The next phase in Aotearoa
New Zealand’s COVID-19 response:
tight suppression may be optimal for health, equity and wellbeing in the months ahead

Access to primary care services using public transport in Ōtautahi Christchurch

Diabetic myonecrosis presenting as unilateral thigh pain and swelling
Subscription to the New Zealand Medical Journal is free and automatic to NZMA members. Private subscription is available to institutions, to people who are not medical practitioners, and to medical practitioners who live outside New Zealand. Subscription rates are below. All access to the NZMJ is by login and password, but IP access is available to some subscribers. Read our Conditions of access for subscribers for further information.

If you are a member or a subscriber and have not yet received your login and password, or wish to receive email alerts, please email: julie@nzma.org.nz

The NZMA also publishes the NZMJ Digest. This online magazine is sent out to members and subscribers six times a year and contains selected material from the NZMJ, along with all obituaries, summaries of all articles, and other NZMA and health sector news and information.

Subscription rates for 2021

<table>
<thead>
<tr>
<th>New Zealand subscription rates</th>
<th>Overseas subscription rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals*</td>
<td>Individual</td>
</tr>
<tr>
<td>$349</td>
<td>$486</td>
</tr>
<tr>
<td>Institutions</td>
<td>Institutions</td>
</tr>
<tr>
<td>$604</td>
<td>$650</td>
</tr>
<tr>
<td>Individual article</td>
<td>Individual article</td>
</tr>
<tr>
<td>$33</td>
<td>$33</td>
</tr>
</tbody>
</table>

*NZ individual subscribers must not be doctors (access is via NZMA Membership)

New Zealand rates include GST. No GST is included in international rates.

Note, subscription for part of a year is available at pro rata rates.

Please email julie@nzma.org.nz for more information.

Individual articles are available for purchase by emailing nzmj@nzma.org.nz
EDITORIALS

8
The next phase in Aotearoa New Zealand's COVID-19 response: tight suppression may be optimal for health, equity and wellbeing in the months ahead

ARTICLES

17
Navigating the health system during COVID-19: primary care perspectives on delayed patient care
Geraldine Wilson, Zoe Windner, Susan Bidwell, Anthony Dowell, Les Toop, Ruth Savage, Ben Hudson

28
Sensitivity and potential utility of SARS-CoV-2 rapid antigen and nucleic acid amplification tests in the context of an elimination approach
Jenna Beaumont, Mirsaeid Miri Nargesi, Susan Smith, David Harte, Erasmus Smit, James Ussher, Gary McAuliffe

38
Rates of Māori women receiving surgical treatment for urinary incontinence and pelvic organ prolapse in Southern District Health Board
Riki Anderson, Mike Stitely, Robin Willink

47
Barriers and facilitators for Māori in accessing hospital services in Aotearoa New Zealand
Emma Espiner, Sarah-Jane Paine, Maree Weston, Elana Curtis

59
Access to primary care services using public transport in Ōtautahi Christchurch
Molly Hartley, Angela Curl, Rose Crossin, Christina McKerchar

70
Cancellation of elective orthopaedic procedures is not a benign practice and is often preventable
Matthew McCall, Mike Peebles, N Amir Sandiford

79
Setting up the Prostate Cancer Outcomes Registry of New Zealand: reflecting and influencing clinical practice
Stephen Mark, Judith Clarke, Brett Shand, Jeremy Millar, Nathan Papa

89
How electronically available referral guidelines for primary medical practitioners can improve the timeliness of orchidopexy
Erika M Stark, Spencer W Beasley, Alison Campbell

95
Frailty prevalence in Aotearoa New Zealand haemodialysis patients and its association with hospitalisations
Katherine Bloomfield, Zhenqiang Wu, Lai Chan, Janak R de Zoysa

VIEWPOINTS

109
Hidden figures and misnomers: a case for disaggregated Asian health statistics in Aotearoa New Zealand to improve health outcomes
Sherly Parackal, Kirsten Coppell, Carlos Lam Yang, Trudy Sullivan, Rathan M Subramaniam
CLINICAL CORRESPONDENCE

117
Pyroglutamic acidosis: an under-recognised cause of high anion gap metabolic acidosis
Tom Crisp, Peter Sizeland, Stephen Du Toit, Lai Wan Chan

122
Diabetic myonecrosis presenting as unilateral thigh pain and swelling
Ha Eun (Grace) Kim, Rahul Gandhi, George Waterworth, Yesim Morice

LETTERS

125
St John Ambulance has and will continue to treat and transport all patients throughout the COVID-19 outbreaks in New Zealand
Kris Gagliardi

OBITUARIES

133
Mark Davis
1952–2021

100 YEARS AGO

136
Notes on the Treatment of Acute Oedema of the Lung
1921
Navigating the health system during COVID-19: primary care perspectives on delayed patient care
Geraldine Wilson, Zoe Windner, Susan Bidwell, Anthony Dowell, Les Toop, Ruth Savage, Ben Hudson

The study surveyed over 160 New Zealand general practitioners, practice nurses and nurse practitioners over a period of 16 weeks from May last year, examining how they dealt with the pandemic-induced change to healthcare delivery and, for this paper, their perceptions of delayed patient care. We found patients were noted to display different health-seeking behaviors and that there were health system contributors to delayed care, including difficulty referring patients to secondary (hospital-based) care. Certain medical conditions were more commonly impacted, with one general practitioner noting that “Covid did distract us from other diagnosis especially in early days.” These experiences have highlighted a number of ways to minimise future delayed care from pandemic disruption, including reducing barriers to patients seeking care and improving integration and relationships across the health system.

Sensitivity and potential utility of SARS-CoV-2 rapid antigen and nucleic acid amplification tests in the context of an elimination approach
Jenna Beaumont, Mirsaed Miri Nargesi, Susan Smith, David Harte, Erasmus Smit, James Ussher, Gary McAuliffe

PCR is the current gold standard for detecting the COVID-19 virus. It is a type of nucleic acid amplification test (NAAT), which is a diagnostic technique that works by identifying the genetic material of the virus. Other testing methods include isothermal NAATs, which are similar to PCR tests but use a slightly different technology to identify the genetic material, and rapid antigen tests (RATs), which work by looking for proteins on the surface of the virus. RATs are less expensive than NAATs and operate in a manner similar to that of a home pregnancy test. Standard PCR tests within the laboratory take a number of hours to provide a result. Our study looked at the performance of three rapid NAATs (one rapid PCR and two rapid isothermal NAATs) and five brands of RAT, all of which can provide a result in less than an hour. We found that the rapid PCR test (the Cobas Liat) was just as sensitive at detecting the virus as our standard PCR tests. The rapid isothermal NAATs and the RATs were less sensitive than our standard PCR tests, limiting their utility.

Barriers and facilitators for Māori in accessing hospital services in Aotearoa New Zealand
Emma Espiner, Sarah-Jane Paine, Maree Weston, Elana Curtis

This paper reports the findings of a literature review to answer the research question, “What are the barriers and facilitators of access to hospital services for Māori?” Our review confirms existing knowledge about practical barriers and facilitators to healthcare access for Māori and contributes to an emerging body of evidence about the impact of racism and culturally unsafe services in preventing Māori from accessing healthcare services. The facilitators identified provide a potential roadmap for the redesign of services, so they are accessible and effective for Māori. Improving services in this way would support district health boards, the Ministry of Health and professional organisations to comply with their commitments to providing culturally safe services and health professionals.
Access to primary care services using public transport in Ōtautahi Christchurch

Molly Hartley, Angela Curl, Rose Crossin, Christina McKerchar

Public transport plays a vital role in improving access to healthcare, particularly for people who do not have access to a car. We mapped and analysed access to primary healthcare (general practitioners) using public transport in Greater Ōtautahi (Christchurch) and examined whether access varies across neighbourhoods and different population groups. Overall, public transport accessibility to primary healthcare across the city is poor, with almost 30% of the population in Greater Ōtautahi being more than 30 minutes from their nearest GP by public transport. In addition, the overall frequency of services was low, which is particularly problematic for those living in the most deprived deciles, who might be more likely to rely on public transport due to lower rates of household car ownership. Improving public transport access to primary healthcare may help meet health equity and sustainability objectives.

Cancellation of elective orthopaedic procedures is not a benign practice and is often preventable

Matthew McCall, Mike Peebles, N Amir Sandiford

Total joint arthroplasty, in particular hip and knee arthroplasty, are cost-effective procedures that significantly improve patients’ mobility, independence and quality of life. These operations are being cancelled for largely avoidable reasons, the majority of which are institutional (hospital related). Patients awaiting elective joint replacement, particularly hip replacements, are waiting significantly longer than other operations. The impact of these cancellations and subsequent delays in eventual surgery on patients has not been published in the literature. While awaiting surgery, these patients are at risk of having progression of symptoms and re-presenting to healthcare services with sequelae of their condition, for example pain falls or over-use of opioid analgesia, not to mention the consequences for the mental health of patients and their families.

Setting up the Prostate Cancer Outcomes Registry of New Zealand: reflecting and influencing clinical practice

Stephen Mark, Judith Clarke, Brett Shand, Jeremy Millar, Nathan Papa

The Prostate Cancer Outcomes Registry of Australia and New Zealand will collect relevant patient information on men with prostate cancer, allowing us to improve patient care and outcomes. We can compare our New Zealand care to those men in Australia with similar conditions, with a goal to deliver better care in Aotearoa New Zealand.

How electronically available referral guidelines for primary medical practitioners can improve the timeliness of orchidopexy

Erika M Stark, Spencer W Beasley, Alison Campbell

This paper demonstrates a trend towards earlier referral and surgery for undescended testes that correlates with the introduction of Community HealthPathways website guidelines. Community HealthPathways appears to have led to substantial improvement in the quality of our regional child health services. A similar resource made available in other regions or countries also might be expected to reduce the age of referral for this condition, enabling orchidopexy to be performed more often at the optimal age for the procedure and allow the best long-term outcomes to be obtained.
Frailty prevalence in Aotearoa New Zealand haemodialysis patients and its association with hospitalisations

Katherine Bloomfield, Zhenqiang Wu, Lai Chan, Janak R de Zoysa

Identification of frailty allows health professionals to focus clinical attention on those people at greater risk of health decline. This is the first Aotearoa New Zealand study of the prevalence of frailty in the haemodialysis population and illustrates that almost 40% of such patients screen positive for frailty. Results show that several factors are associated with the risk of being frail, many of which are unsurprising, such as increasing age. However, we also found that Pacific people had increased association with screening positive for frailty by one of the tools studied. Further larger studies are needed to assess the needs and experiences of people living with frailty in those with renal disease in Aotearoa New Zealand.
The next phase in Aotearoa New Zealand’s COVID-19 response: a tight suppression strategy may be the best option


In this editorial, we consider the implications of the New Zealand Government’s shift away from a national COVID-19 elimination strategy. This is a critical stage in managing the pandemic, with major uncertainties and difficult trade-offs. We argue that the response should continue to be shaped by key principles: notably, science-informed strategic leadership; a Tiriti and equity focus; use of the precautionary principle; and the need to create legacy benefits for our healthcare and public health systems. These principles support critical actions to get Aotearoa New Zealand through the next phase of the pandemic in the best possible shape from a combined health, equity, wellbeing and economic perspective. These actions include applying a “tight suppression” strategy; rapidly closing the remaining immunity gaps; strengthening public health and social measures, including contact tracing, border management and mask use; and adapting the primary care and hospital system to safely manage large numbers of people presenting with illness from COVID-19.

The elimination phase

The first COVID-19 case was identified in New Zealand in late February 2020, and case numbers rose rapidly in the following month (Figure 1). New Zealand initially followed the mitigation strategy that was core to its influenza pandemic plan.1 A major departure was rapidly switching to an elimination strategy in late March 2020 (Figure 2). Elimination included much stronger border management (quarantine and testing) to prevent importation of cases; testing and contact tracing, so cases could be isolated and contacts quarantined; and an alert level system to guide measures to eliminate community transmission.2,3 The initial, national COVID-19 wave was successfully eliminated by May 2020.4,5 Subsequent outbreaks in Auckland were managed in a similar way, sometimes using rapid, intense circuit-breaker lockdowns to regain elimination.

Accumulating evidence suggests that elimination is probably the optimal initial response to an emerging pandemic disease of moderate or greater severity, at least until vaccines and disease-modifying agents are available.6 The elimination strategy has performed exceptionally well for New Zealand, giving us the lowest COVID-19 mortality in the OECD, a significant increase in life expectancy,7 a relatively high degree of personal freedom for much of the pandemic period and relatively good economic performance.8

The first major upgrade of the elimination strategy was the Reconnecting New Zealanders to the World strategy released on 12 August 2021,9 which proposed a carefully managed increase in inbound travel to New Zealand while continuing with elimination. It implied a more comprehensive revision of the pandemic strategy in early 2022.

In this editorial, we consider the implications of the New Zealand Government’s shift away from a national COVID-19 elimination strategy. This is a critical stage in managing the pandemic, with major uncertainties and difficult trade-offs. We argue that the response should continue to be shaped by key principles: notably, science-informed strategic leadership; a Tiriti and equity focus; use of the precautionary principle; and the need to create legacy benefits for our healthcare and public health systems. These principles support critical actions to get Aotearoa New Zealand through the next phase of the pandemic in the best possible shape from a combined health, equity, wellbeing and economic perspective. These actions include applying a “tight suppression” strategy; rapidly closing the remaining immunity gaps; strengthening public health and social measures, including contact tracing, border management and mask use; and adapting the primary care and hospital system to safely manage large numbers of people presenting with illness from COVID-19.

The elimination phase

The first COVID-19 case was identified in New Zealand in late February 2020, and case numbers rose rapidly in the following month (Figure 1). New Zealand initially followed the mitigation strategy that was core to its influenza pandemic plan.1 A major departure was rapidly switching to an elimination strategy in late March 2020 (Figure 2). Elimination included much stronger border management (quarantine and testing) to prevent importation of cases; testing and contact tracing, so cases could be isolated and contacts quarantined; and an alert level system to guide measures to eliminate community transmission.2,3 The initial, national COVID-19 wave was successfully eliminated by May 2020.4,5 Subsequent outbreaks in Auckland were managed in a similar way, sometimes using rapid, intense circuit-breaker lockdowns to regain elimination.

Accumulating evidence suggests that elimination is probably the optimal initial response to an emerging pandemic disease of moderate or greater severity, at least until vaccines and disease-modifying agents are available.6 The elimination strategy has performed exceptionally well for New Zealand, giving us the lowest COVID-19 mortality in the OECD, a significant increase in life expectancy,7 a relatively high degree of personal freedom for much of the pandemic period and relatively good economic performance.8

The first major upgrade of the elimination strategy was the Reconnecting New Zealanders to the World strategy released on 12 August 2021,9 which proposed a carefully managed increase in inbound travel to New Zealand while continuing with elimination. It implied a more comprehensive revision of the pandemic strategy in early 2022.
Figure 1: Epidemic curve for diagnosed COVID-19 cases in New Zealand, distinguishing cases infected overseas (blue = history of recent overseas travel) from locally acquired cases (red).
The apparent shift to a suppression strategy

On 4 October 2021, the Prime Minister for the first time indicated New Zealand would transition away from the elimination strategy. The new approach was not formally announced or defined but could be classified as a suppression strategy (Figure 2). This change was precipitated by a Delta-variant outbreak first detected on 17 August 2021 in Auckland (Figure 1). This outbreak proved too difficult to stamp out using the methods that effectively eliminated previous outbreaks arising from border control failures.10

It appears the goal of the new policy settings is to control rather than eliminate SARS-CoV-2 (Figure 2). A positive feature of these settings is that they suggest a “tight suppression” approach, as opposed to loose suppression or mitigation policies used by countries like the United Kingdom and Sweden. Another positive feature is the continuation of many public health and social measures, including restrictions on New Zealand’s external borders and active contact tracing to keep case numbers low. However, there has been little promotion of masks and improvements to indoor ventilation in public spaces, despite the strong evidence base for these measures.11 New Zealand also introduced a range of vaccine mandates for occupational groups and will soon introduce a mandate preventing unvaccinated people from entering a wide range of indoor social settings, such as gyms, restaurants and hairdressers (the COVID-19 Protection Framework, or “traffic light system”).12

At the time of writing, New Zealand is typically experiencing around 150 to 200 new COVID-19 cases a day, mainly in Auckland. Spread from Auckland to other regions has been occurring but at a low level. Consequently, some of us have argued for continuing with suppression in Auckland while maintaining an elimination strategy for the rest New Zealand, which would require maintaining strong boundary controls around Auckland.13

Principles to guide the ongoing pandemic response

There is a series of key principles that can help inform Aotearoa New Zealand’s pandemic response, some of which have been articulated in government plans.14

Science-informed strategic leadership

One of the strongest lessons from the pandemic response comes from the demonstrated benefits of combining effective

Figure 2: Major strategic choices for managing a pandemic (albeit not including the exclusion strategy successfully used by some Pacific Island nations).
political and scientific leadership. This success was shown when New Zealand switched its response from the established pandemic mitigation approach to an elimination strategy. Given the ongoing need to meet new challenges in the pandemic response, it would be timely to institutionalise an improved set of processes for decision-making that foster use of evidence, innovation, consensus decision-making, continuous quality improvement and transparency.\textsuperscript{15,16} These processes could include: convening a cross-party parliamentary group along the lines of the Epidemic Response Committee;\textsuperscript{17} forming a high-level science strategy rōpū (council) to provide the multidisciplinary expertise needed for complex emergencies; and developing a well-resourced COVID-19 research and development strategy.

**Having a Tiriti and equity focus**

A major lesson from the pandemic response is the overwhelming importance of health equity. There is a long history of infectious diseases\textsuperscript{18} and pandemics\textsuperscript{19} being patterned by inequalities in Aotearoa New Zealand. COVID-19 is unfortunately no exception. Most COVID-19 cases are in Māori and Pacific peoples (71% in the Delta-variant outbreak at the time of writing).\textsuperscript{20} The markedly lower rates of vaccination in Māori illustrate what happens when Māori input is not adequately sought or ignored, and how long-standing inequities in social determinants drive health outcomes. The lack of engagement with the appropriate people, especially in Auckland, ultimately derailed control efforts and contributed to the current outbreak not being eliminated.\textsuperscript{21} Key responses need to align with the principles of equity, tino rangatiratanga, partnership and active protection. More fundamentally, there is a need to identify opportunities to strengthen and resource Māori and Pacific leadership of the pandemic response. Creation of the Māori Health Authority will provide a pathway to institutionalise this goal—but this is in the longer term.

**Application of the precautionary principle**

The precautionary principle expresses the need to take a cautious approach in situations of high uncertainty where decisions have significant impacts,\textsuperscript{22} such as when infectious diseases like COVID-19 emerge. It is important to recognise and be explicit about these unknowns. We do not know the impact of endemic SARS-CoV-2 infection on morbidity and mortality, even in a highly vaccinated population. An underlying assumption by some appears to be that SARS-CoV-2 infection will inevitably become endemic, and that this infection will be relatively benign once population immunity is widespread, as was eventually seen following the 1918 H1N1 influenza pandemic.\textsuperscript{23} There is evidence that this assumption may be overly optimistic. The post-acute effects of SARS-CoV-2 infection (so called “long-COVID") appear to be far more common and severe than for influenza.\textsuperscript{24} For example, there is the possibility of life-course impacts in the child population through effects on the developing brain.\textsuperscript{25} If that is found to be the case, then this pathogen may belong in the same category as measles and polio, which create such a burden of illness that they justify efforts for progressive elimination.\textsuperscript{26 27}

One of the biggest unknowns is about the future evolution of SARS-CoV-2 “variants of concern,” which may be more vaccine resistant, more infectious and even more lethal.\textsuperscript{28} The best way to stem SARS-CoV-2 evolution is to rapidly suppress transmission of this virus to very low levels across the globe, which is technically feasible but difficult to implement given inequities with vaccine supply, public health infrastructure and coordination.

On the positive side, improved vaccines (and vaccine schedules) and disease-modifying treatments are providing tools to reduce both the frequency and consequence of infection. They may even provide the ability to entirely interrupt transmission or make this a trivial infection, or both.

Given this changing landscape, it will be essential to periodically review our strategic direction and policy settings to ensure our response is optimal. It would be unwise to take any option off the table. For example, there may be circumstances in the future where a nationwide return to the elimination strategy, and even global eradication, might become optimal.\textsuperscript{29} (end)
Creating legacy benefits from investment in the response

It is imperative that we gain as many legacy benefits as we can from our huge investment in the pandemic response. We are now almost two years into the pandemic, and it is time to move beyond the crisis phase and establish more mature systems that can undertake robust risk assessment and react swiftly to emerging population health threats. One test is whether the decision-making processes and infrastructure we have developed for this response are sufficiently versatile for future threats, including evolution of the current pandemic and multiple emerging infectious disease threats that require a similarly vigorous response.30,31 The proposed measures in the COVID-19 Protection Framework are not flexible enough to protect New Zealanders against outbreaks of non-COVID infectious diseases (eg, influenza or meningococcal disease) that are likely to occur once border restrictions are loosened and may have atypical epidemiology and severity.31 The time to begin planning and rehearsing for the next pandemic is now.32

The reforms proposed by the new Pae Ora (Healthy Futures) Bill provide an overdue opportunity to create a national public health service that is fit for purpose. Establishing a dedicated national public health agency could consolidate New Zealand's capacity to deliver a consistently high-quality and sustainable pandemic response, along with other disease prevention and control services across the country and for all its citizens. Such an agency would have an additional valuable role in supporting the pandemic response in the Pacific region. Finally, in the ongoing resource-constrained environment, there has never been a better time to Choose Wisely33 for rational and equitable34 healthcare resource stewardship.

Key actions that need to be taken now

Applying these principles supports a number of immediate actions as part of the pandemic response, all of which are underway to varying degrees.

Adopt a tight suppression strategy

We argue that the uncertain public health impacts of the pandemic necessitate a relatively cautious, tight suppression strategy. Tight suppression could extend to elimination outside of Auckland until at least the end of January 2022. This mixed regional approach would increase the time available for the next key action: closing the remaining immunity gaps. A critical decision that will also increase the time available to raise vaccine coverage is careful management of the regional border around Auckland when it "opens" on 15 December, allowing Aucklanders to travel widely across New Zealand. The currently proposed controls will miss many infected people, as they only require vaccination or testing.35 By comparison, even the reduced requirements for travel into New Zealand from overseas that will start in January 2022 still require far more controls (vaccination, pre-travel test, test on arrival, one-week self-isolation, post-isolation test) for a traveller who may have a similar or lower level of risk compared with a traveller from Auckland.36 To maintain even some consistency in risk management, the government needs to set the requirement for travel out of Auckland at a much higher level (a minimum would be full vaccination for those who are eligible plus fully tested for all, including children down to two years of age).

Rapidly close remaining immunity gaps

Disease modelling and international experience indicate that creating and maintaining uniformly high COVID-19 immunity is the most important requirement for minimising the population health impact of COVID-19 with a suppression strategy. New Zealand has extremely low rates of "natural immunity" compared with other countries, so we are very reliant on vaccine-induced immunity. Firstly, we need to achieve high vaccine coverage—that is, as close to 100% as possible for the total population. This is because the dominant Delta variant is highly infectious and, as with previous coronavirus vaccines, the currently available COVID-19 vaccines are not able to create "sterilising immunity" (where people are highly protected from becoming infected and infecting others, as is the case with measles vaccine). Secondly, this coverage needs to be high across all population groups, and protecting those who have a higher risk of infection or adverse outcomes must be a focus. This is not presently the case in New Zealand, where coverage is
around 20% lower for Māori (albeit this gap is declining). Thirdly, we need to extend coverage to young children. Currently in New Zealand, vaccination is limited to children 12 years of age and older, but several international jurisdictions, including the United States, Canada and Israel, are now vaccinating the 5–11-year age group, with over three million first doses administered. Finally, we need to address waning vaccine immunity over time by providing “booster” doses six months after the first two doses (which may in fact be just part of the primary vaccine course), and also in future years. These COVID-19 booster doses could potentially be combined with seasonal influenza vaccination.

**Strengthen public health and social measures**

Although vaccination will certainly reduce case numbers and severity of illness, it is insufficient to prevent all COVID-19 illness. To limit SARS-CoV-2 transmission, we need to continue upgrading our public health and social measures. Many of these measures are familiar from the elimination strategy. However, activation of lockdowns (stay-at-home orders) is less likely with a suppression strategy, where there is a greater tolerance for transmission than there is with elimination. We may need to retain localised lockdowns for situations where cases threaten to overwhelm healthcare services, or if new, more-virulent variants emerge. Effective prevention of transmission in schools requires high uptake of masks and optimising indoor ventilation to prevent spread by inhalation. It would be useful to develop a nationwide mask strategy to ensure high use of appropriate masks in all settings where this would reduce the risk of SARS-CoV-2 transmission.

**Strengthen and adapt contact tracing**

Testing, contact tracing, case isolation and quarantine of contacts are all essential components of COVID-19 suppression. These measures need to be strengthened so they can manage the potentially large numbers of cases that may arise following the switch from elimination to suppression. The government has recently announcement a new national testing strategy to provide better protection for high-risk groups as New Zealand transitions to the COVID-19 Protection Framework. This strategy will include a new telehealth case investigation service, increased PCR testing capacity and wider use of rapid antigen testing and saliva-based PCR testing.

**Retain border entry controls**

Border management is less critical with a suppression strategy in comparison to elimination, and re-designing border controls is now necessary to free-up rooms in MIQ facilities for isolating cases who can’t isolate at home. Nevertheless, border controls will still help reduce the overall case load, especially in regions outside of Auckland. Even the reduced requirements for travel into New Zealand from overseas that will start in January 2022 still require a minimum of full vaccination, multiple tests and one-week self-isolation. Tight border management may also need to be reinstated in the future to prevent importation of more virulent SARS-CoV-2 variants.

**Strengthen primary healthcare services and support for cases in the community**

The primary healthcare system and community support services need to increase their capacity to manage large numbers of people with mild to moderate COVID-19 infection safely in the community.

**Strengthen hospital services**

The need to assess and manage more seriously ill COVID-19 patients in hospital emergency departments, wards and ICUs will increase. This is a concern, as the healthcare system had limited surge capacity prior to the pandemic, due to heavy demands, resource and workforce constraints. Ultimately, the current healthcare system reform, as outlined in the new Pae Ora (Healthy Futures) Bill, aims to strengthen the capacity and performance of the healthcare system in total.

**Ensure effective public communication**

The highly effective communication of the elimination strategy was critical to its successful implementation. Since the transition away from elimination was announced on 4 October, and the
Proposal of the “steps system” and the following “traffic light system,” there has been less clarity and consistency around the pandemic strategy and how it will be achieved. It would be useful to consider ways to ensure clear communication about the current aims of the pandemic strategy and their rationale. Such communication is particularly important for communities where English is a second language, notably some Pacific peoples.

Conclusion

New Zealand’s COVID-19 elimination strategy was highly successful, having maintained positive public health, equity, wellbeing and economic outcomes through the initial phase of the pandemic. The transition away from elimination will be challenging. Outcomes are likely to be optimised by taking a tight suppression approach, minimising immunity gaps and using public health and social measures to protect populations that are more vulnerable to infection and adverse outcomes of infection. All investments in the response should be assessed according to their legacy benefit as well as their immediate value. In this new phase of the response, science-informed strategic leadership and a commitment to equity are more important than ever.

Competing interests:

Nil.

Acknowledgements:

This work was based in the Covid-19 Research Group (CoSearch) at the University of Otago, Wellington which receives funding support from the Health Research Council of NZ (20/1066). The epidemic curve was produced by Andy Anglemyer, Senior Research Fellow, Department of Preventive and Social Medicine, University of Otago, Dunedin.

Author information:

Michael Baker: Professor of Public Health, Director of CoSearch, Department of Public Health, University of Otago, Wellington.
Amanda Kvalsvig: Senior Research Fellow, Co-Director of CoSearch, Department of Public Health, University of Otago Wellington.
Sue Crengle: Professor in Māori Health, Department of Preventive and Social Medicine, University of Otago, Dunedin; Specialist General Practitioner, Invercargill
Matire Harwood: Associate Professor, Department of General Practice and Primary Care, University of Auckland; Specialist General Practitioner, Papakura Marae Health Clinic, Auckland
Collin Tukuitonga: Associate Dean (Pacific) and Associate Professor of Public Health, Faculty of Medical and Health Sciences, University of Auckland
Bryan Betty: Medical Director of the Royal New Zealand College of General Practitioners; Specialist General Practitioner, Cannons Creek, East Porirua
John Bonning: FACEM, Emergency Physician Waikato Hospital; Chair of the Council of Medical Colleges of Aotearoa NZ; Immediate Past president ACEM.
Nick Wilson: Professor of Public Health, BODE3 Programme, Department of Public Health, University of Otago, Wellington

Corresponding author:

Professor Michael Baker, Department of Public Health, University of Otago, Box 7343, Wellington 6242, New Zealand; 0064 (0)21 355 056 michael.baker@otago.ac.nz

URL:


REFERENCES


Navigating the health system during COVID-19: primary care perspectives on delayed patient care

Geraldine Wilson, Zoe Windner, Susan Bidwell, Anthony Dowell, Les Toop, Ruth Savage, Ben Hudson

ABSTRACT

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

METHOD: We qualitatively analysed a subtheme of delayed patient care of the General Practice Pandemic Experience New Zealand study, where general practice team members nationwide were invited to participate in five surveys between May and August 2020.

RESULTS: 164 participants initially enrolled in the study, with 78 (48%) completing all surveys. Four delayed-care themes were identified: patient contributors, health system contributors, impacts and opportunities for minimisation. Respondents noted that patients avoided healthcare, downplayed symptoms and feared going out. Non-essential care was put on hold, allied services were reduced and access to secondary care was variable. Certain diseases and screening were commonly impacted. As lockdown lifted a backlog of work resulted. Flexible review periods, outreach care, self-screening, cross-sector collaboration and improved public awareness were strategies for timely healthcare.

CONCLUSION: Reducing barriers to patients seeking care and improving integration and relationships across the health system would minimise future pandemic disruption and delayed patient healthcare.

The coronavirus disease 2019 (COVID-19) pandemic brought about sudden changes in the delivery of healthcare throughout Aotearoa New Zealand. In response to level 4 “lockdown” from 25th March 2020, all areas of the health sector made changes to prepare for a potential influx of unwell COVID-19 patients, as had been seen overseas.

In primary care, non-urgent healthcare (such as screening) was discouraged, tele-health consultations were encouraged and patients were screened and streamed for respiratory illnesses. In secondary (hospital-based) healthcare, the National Hospital Response Framework was implemented, with routine outpatient appointments cancelled or moved to telehealth where possible. Elective surgery was cancelled, and in some districts, non-urgent referrals were declined or discouraged. Some New Zealand research is emerging on the impact of these changes on timely patient care. A New Zealand patient experience study over the early pandemic lockdown period found a majority had delayed seeking healthcare during this time. Many non-urgent problems were dealt with by observation and self-care.

New Zealand Ministry of Health data show a reduction in both planned and unplanned care at primary and secondary levels. Hospital inpatient treatment reduced the most, by 63.8% in April 2020 when compared with April 2019. Research in both Australia and New Zealand suggests that delays in diagnosis and management contributed to this decrease in primary and secondary healthcare activity. However, conversely, decreases in overall healthcare activity, particularly in primary care, may also result in delayed diagnosis and
management. People living more sedentary lifestyles because of lockdown may have also contributed to the way symptoms were experienced for some heart conditions.\textsuperscript{9} In New Zealand, ambulance services reported lower acuity calls and increasing mental health issues, suggesting there was a reduction in access to primary care.\textsuperscript{11}

Internationally, there has been growing concern over “collateral consequences” of COVID-19 lockdowns diverting attention away from management of long-term conditions.\textsuperscript{12} A UK study in a large, deprived population has retrospectively shown a reduction of 40–50\% in first diagnosis of common primary care conditions from March to May 2020, with concern that some of this represents undiagnosed conditions.\textsuperscript{13} With reduced screening and non-urgent diagnostic services in the UK’s relatively prolonged lockdown, modelling has predicted a large increase in avoidable cancer deaths.\textsuperscript{14}

As a patient navigates the health system, multiple factors can contribute to delaying their care. These have been modelled in pre-pandemic settings as patient, provider/system and disease factors.\textsuperscript{15}

We present the first qualitative analysis of the experience of a large group of New Zealand primary healthcare professionals on their perception of delayed patient care during the early COVID-19 pandemic.

**Methods**

This paper is part of the previously described General Practice Pandemic Experience New Zealand (GPPENZ) study, which followed the same group of primary care healthcare team members through a series of five online surveys over a 16-week period from 8 May 2020.\textsuperscript{16} The participants included general practitioners (GP), nurse practitioners (NP), practice nurses (N) and practice managers (P), with a small number of dual-role practice managers and nurses (PMN). Invitations were distributed widely through national medical and nursing organisations, local and regional networks and social media. Specific platforms for Māori, Pasifika and high-health-needs groups. Further secondary analysis was performed where delayed care was coded in more general survey questions (eg, from survey one: “What challenges have you experienced over this time?”). A thematic content analysis was conducted drawing from relevant codes, within a framework developed by SB, GW and ZW, and then circulated for review by all authors.

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

**Results**

The threat of COVID-19 infection, combined with patient and health system factors, were raised as elements that contributed to delayed patient care in the early pandemic period covered by the surveys. Further themes emerged on the impact of delayed care and opportunities for the future to avoid delayed care.

**Patient contributors to delayed care**

There was widespread concern from respondents that their usual patient group was not seeking care in the normal way. Some reported a dramatic decline in
workload, attributed to patients mistakenly believing that medical services were over-whelmed and avoiding adding to the load. Respondents commented that patients appeared to be minimising or tolerating their symptoms, considering them too minor to justify seeking care in this period:

“Impression is that patients are likely delaying seeing the GP for health matters as not wanting to bother the doctor or not seeing their needs as important.” – GP86

“Rightly (in some situations) or wrongly (in other situations), assumed their questions were insignificant.” – N7

Respondents reported that many patients combined this with a fear of being unsafe if they ventured out, and that patients were reluctant to expose themselves to infection risk, for example in a practice waiting room:

“Not coming in for medication as they didn’t want to be exposed to others in the waiting room.” – N20

“Pacific community scared to leave home and get meds, literally taken lockdown message to heart.” – GP41

It was noted that public messages emphasising the vulnerability of older people and urging them to stay home for their own protection seemed to have had the unintended effect of discouraging some from obtaining healthcare when they needed it. Moreover, some interventions aiming to protect older people may have reinforced the impression that they were not allowed to go out for healthcare:

“Elderly particularly had great fear, especially with security guards on the gates of villages, felt it was too dangerous or they weren’t allowed to leave the village even for essential health.” – PMN2

High-needs patients, including those with limited English and older people, were also said to find telehealth less suitable. Many had no internet connection, were not confident they could hear well on the phone or believed they would not be assessed properly:

“Many patients who were not keen to talk on the phone or were not technology savvy just sat on their medical problems and left chronic conditions untreated.” – GP76

Financial concerns also appeared to play a role in keeping people away, with loss of employment due to the lockdown:

“Many patients have been made redundant or pay/hours have been reduced. It is very tricky for patients to pay their bills and no doubt this would make them reluctant to seek healthcare.” – GP76

“With high unemployment, patients are expecting a reduction in fees, therefore delaying treatment options if they cannot afford them.” – N12

Fully subsidised COVID-19 consults were noted to have offset this slightly, and one respondent reported that the “mid-severely anxious had more time and tended to ring for more appointments” (GP80).

Health system contributors to delayed care

Health system COVID-19 related arrangements also appeared to contribute to delays in care. Respondents acknowledged that certain areas of care had been put on hold because of the pandemic, with screening and routine follow-ups the most affected:

“Things needing immediate attention were dealt with in level 3 and 4 but everything else was put on hold.” – N2

“As a practice we had to prioritise the services we offered with all non-essential services being put on hold. This undoubtedly will impact on our chronic disease patients who have routine appointments for things like asthma and diabetes management put off indefinitely.” – NP8

Practices also introduced new procedures required for consultation, such as tele-health and phone triage before being seen in-person by a doctor. Respondents also noted that the triage of minor respiratory infections (which pre-pandemic patients would have self-managed at home) took time away from other patient care:

“Lots of time taken up with triaging. Finding the process quite laborious as we are assessing patients who would normally be at home managing themselves, which is just taking up
Table 1: Participants in General Practice Pandemic Experience New Zealand study.16

<table>
<thead>
<tr>
<th></th>
<th>Total (%)</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**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>50</td>
</tr>
<tr>
<td>Female</td>
<td>125 (76.2%)</td>
</tr>
</tbody>
</table>

**Ethnicity** (total count*)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>144 (87.8%)</td>
</tr>
<tr>
<td>Māori</td>
<td>9 (5.5%)</td>
</tr>
<tr>
<td>Pacific Peoples</td>
<td>5 (3.0%)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (8.5%)</td>
</tr>
</tbody>
</table>

**Occupation**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>General practitioner (GP)</td>
<td>93 (56.7%)</td>
</tr>
<tr>
<td>Practice nurse (N)</td>
<td>38 (23.2%)</td>
</tr>
<tr>
<td>Nurse practitioner (NP)</td>
<td>11 (6.7%)</td>
</tr>
<tr>
<td>Practice manager (P)</td>
<td>18 (11%)</td>
</tr>
<tr>
<td>Practice manager and nurse, dual role (PMN)</td>
<td>4 (2.4%)</td>
</tr>
</tbody>
</table>

**Type of practice**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusively urban practice</td>
<td>115 (70.1%)</td>
</tr>
</tbody>
</table>

* Total count of ethnicities will be greater than the number of respondents because one person can identify as belonging to multiple ethnicities.
Delays were not limited to GP appointments but affected other services too, including nursing, community services such as palliative care and diagnostic tests, compounding the effect:

“Our access to laboratory service was reduced to three days per week and still is so it was more difficult to do routine disease management.” – GP20

“We have a marae-based clinic that was closed during the pandemic. We used a community-based nurse during lockdown but overall, I think our service to Māori in particular was poorer than it usually is and more reactive with less chronic care.” – GP31

Respondents noted that, during the lockdown period, secondary care reduced services in anticipation of potential high rates of unwell COVID-19 patients. However, acute care remained almost as normal, with respondents reporting it was “good” and “well accessible,” and that there was “no problem referring acutely.” Experience with less-urgent care, which required hospital admission or specialist assessment and intervention, was more variable. Some services and specialties provided consultation or advice remotely, especially for high-risk patients. In some cases, there was improved contact with specialists who were more directly accessible for telephone advice:

“It was easy to get good advice during lockdown from the hospital—they were happy to support us doctors in the community, as we were keeping patients out of hospital.” – GP 28

“Patients have had access to secondary care by way of telephone consults with their specialists, and this seems to have worked quite well on the whole.” – N7

Moreover, although there were barriers in getting patients admitted to hospital, respondents reported that patients were seen quickly and that their care was well managed once they were admitted:

“One thing that was good was that anyone who did need to be seen during the lockdown was seen and dealt with very quickly by secondary care.” – GP74

A number of respondents commented that many referrals to secondary care and procedures for their patients were postponed or cancelled during the early pandemic lockdown period. Some patients on waiting lists were sent back to their primary care practice with a request to re-refer when “normal” services resumed. This was a source of frustration and generated a number of emotional responses to the survey. Apart from the extra work involved, it was felt by respondents that these patients had been referred because they needed specialist services that primary care could not provide. Moreover, there was a perception among respondents that secondary care was not particularly busy. This was a further source of frustration for some, who felt patient care was delayed unnecessarily, which left primary care providers responsible for issues usually managed in secondary care:

“Several patients have been ‘returned to primary care’ who were previously sitting on a waiting list for some kind of interventions—almost all from surgical disciplines. Frustrating and unnecessary as if they were on a waiting list for an intervention it is clear this cannot be provided in primary care.” – GP47

“Felt many patients needs were compromised by keeping hospitals ‘ready’. Therefore, patients requiring admission were discharged asap then returning to us to either re-admit or administer delayed treatment that should have occurred in hospital.” – PMN2

“Mental health just sent back outpatient referral with decline—’send this again when everything back to normal’!!! I sent it at each lockdown stage to determine what ‘normal’ (!!!) might be.” – GP80

Impact of delayed care

A range of serious conditions were reported to have been affected by the delay in being seen: for example, skin, breast...
and colorectal cancers, and a considerable number of cardiovascular events where patients had either presented late or had refused emergency admission to hospital in fear of being exposed to COVID-19:

“Multiple people with chest pain, joint problems, skin cancers come to mind.” – GP25

“Had a lady present with disseminated malignancy much later than she should due to lockdown as she had nobody to bring her in and language barrier (Tongan).” – GP58

There were also reports of septic shock, thyrotoxicosis and pancreatitis, and cases where other presentations, for example shortness of breath, were possibly misdiagnosed due to the emphasis on identifying COVID-19:

“Covid did distract us from other diagnosis especially in early days.” – GP58

Several respondents noted that remote consultation delayed reaching the correct diagnosis when it would have been obvious in an in-person consultation. There were reports of skin infections and abscesses that deteriorated because patients had waited to seek care. Specialist mental health services were also highlighted by many respondents as having been affected by delay, even after lockdown restrictions were lifted in survey five:

“There is a five-month waiting list for suicidal teenagers in the community mental health teen service in Auckland. Teens are really struggling with altered schooling and a very uncertain world... DHBs seem very quick to... get their surgical waiting lists down but don't appear to have even considered it for our very high-risk mental health patients.” – GP9

Specific areas of screening noted by respondents to be affected by delays were cervical screening and bowel screening. Fewer in-person consultations also reduced their usual ability to provide opportunistic screening:

“We are also not doing screening, so I am concerned about missing cancers etc [and] late diagnosis.” – GP86

“Much of the care we provide is ‘opportunistic’. Patients would stop in for a cup of coffee and we would then catch them for the blood test they haven’t completed, or the smear they've been putting off. Without patients dropping-in, these opportunities have been missed.” – P13

Of note, in the responses was the presence of healthcare worker distress at what was happening to patients, and their inability to provide healthcare in the usual way. Often noted was a “concern that patients might be getting delayed diagnoses” (GP20) and a “fear about missing serious illness” (GP15).

As the threat of an overwhelming pandemic receded, restrictions eased, and respondents reported that patients felt more comfortable seeking in-person care. Non-urgent work, screening and reviews requiring in-person appointments had built up and workloads rapidly increased to cope with the “backlog of things that need to be seen face-to-face” (GP83):

“Workload has increased as people come out of woodwork, and we need to catch back up with routine screening and services that we did not do during lockdown.” – GP29

“We have worked so hard to talk about preventative care and reviews. So, we will be going up a hill to try get back to our cervical smears, annual diabetic reviews, cardiovascular, etc. We have a 90% high need population, so we end up doing much more to try get our patients in, statistics for Māori or Pacific supports this.” – N8

Practices became much busier with patients who had “saved up” their concerns:

“Patients have stored up their health concerns and are now coming in with long complex lists they are expecting us to deal with in a single consult as they can only afford to pay for a single consult.” – GP4

Opportunities for the future to minimise delayed care

Despite the difficulties that the restrictions from the pandemic had caused, respondents pointed to opportunities for change and renewal. One example was flexibility in routine review periods, with reduced
appointment frequency for stable, long-term conditions:

“Apply clinical judgement to reviews rather than blanket policy of needing three-monthly review and six-monthly in-person review.” – GP15

“I wondered if long term conditions are being neglected, or did we not really have to see as many of our patients as we used to.” – GP6

Opportunities had also been demonstrated for developing areas of primary care to cope with future disruption, whether pandemic-related or otherwise. Proactive outreach services were highlighted as useful in reducing some of the barriers to vulnerable groups seeking care. Taking services to patients instead of waiting for them to come into a practice was likely to have offset potential harm from the neglect of chronic conditions:

“We continued throughout to deploy our ‘mobile’ nurse who links in with the high-needs groups to make contact with patients who have [for example] diabetes. And we continued to run our practice based diabetic clinic run with the DHB diabetes clinic staff.” – GP81

“Much lower workload has allowed our nurses to reach out by phone to our vulnerable patients—many have mental health challenges even in normal times, and many live precariously in boarding houses. These calls have been valued by the patients, and by our team for building relationships.” – GP53

Likewise, new self-administered screening methods were recommended by a respondent to avoid delays from pandemic disruption:

“It would be my recommendation to expedite the self-swabbing for cervical screening—in this way the programme could be managed in a similar way to bowel screening.” – N12

Beyond the issues of direct patient care, other reflections from respondents concerned developing more responsive and integrated care across the whole health system during the pandemic. One suggestion was to enable the redeployment of health professionals to where they were most needed:

“I believe more thought should be done to reallocating staff who were not needed, like casual nurses in hospitals to primary healthcare at no cost to GP services. We got slammed in our first three weeks and while there was much preparation in the hospitals.” – N8

Others highlighted that some funding models were more conducive to workforce flexibility and allowed for time implementing community initiatives:

“We are a kaupapa Māori practice, so it’s more that we knew the COVID-19 crisis would impact our patient population more, so were extra invested in mitigating this as we could. Our model of funding (eg, all staff salaried, operated by DHB), meant we were really flexible with our team-roles, and freed up our lead GP to dedicate a lot of time working with the local rūnanga who was implementing a community safe zone. This entailed many hours of huis, but we felt this was vital to supporting the community. We also proactively rang all the patients 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

It was also clear that many respondents believed improved communication at local, regional and national levels was needed. To care for patients effectively, primary care professionals needed to have a voice in the decisions made and ensure that these decisions were communicated directly and clearly through official channels as opposed to mainstream media. A considerable number of comments were received about the confusion caused by communication gaps between different parts of the health system and the need for collaboration and consistency across primary and secondary care:

“[Ministry of Health] to improve communication with primary care—properly sourcing primary
care opinions and advising about upcoming updates to things like case definitions before they happen rather than letting us learn about them through the media. Health... needs to work closely with GP colleagues as we are the ones to are at the frontline and dealing with patients' issues—high anxiety and fear, anxiety around testing and covid illness, reduced presentation to hospital and leading to them becoming unwell." – GP69

Above all, respondents said it was important for clear messages to be widely disseminated in any future COVID-19 lockdowns to assure the public that primary healthcare services remain open and that they should not delay seeking care for issues that concerned them:

“Educate the public more about not delaying seeking medical care regardless of the alert level to reduce harm from delayed diagnoses.” – GP9

Discussion

This paper describes aspects of potential causes of delayed healthcare due to pandemic disruption and possible solutions from the perspective of a nationwide sample of New Zealand general practice teams.

Respondents noted that patients displayed different health-seeking behaviours over this time. Patients often minimised symptoms and avoided contact due to fear of being exposed to COVID-19 and a concern that healthcare services were too busy. These findings echoed two New Zealand patient-experience surveys over the same time frame. New procedures adopted by practices before in-person consultation, such as telehealth and phone triage and streaming for respiratory illnesses, may have added to the impression that medical practices were too busy to see patients unless they were very ill, or that there were too many barriers to getting an appointment. As had been recommended, at higher alert levels many practices prioritised acute or urgent care, and triage and testing of potential COVID-19 infections, over non-essential services such as screening and chronic disease management. Positively, these clinical priorities were refined and adapted throughout 2020 in order to minimise disruption and delayed care.

Importantly, in order to support patients to access care when they need it, we need sustained public health messaging that “GPs remain open for business.”

Commendably, initiatives such as outreach care provided by primary care practices were a positive response to the need to alter healthcare during lockdown. Other positive long-term changes that may persist after the pandemic include reconsidering review intervals for chronic disease management (largely determined by three monthly prescription limits) and different ways of using technology in healthcare.

Respondents’ experience of the interface between primary and secondary care when referring or seeking advice on patients varied significantly. Some reported a positive experience with improved access to phone advice. Others expressed frustration when patients were declined access to non-urgent care in readiness for keeping hospitals “prepared” for potential COVID-19 patients. From the primary healthcare team member perspective, our results suggest that altering the usual healthcare provided by secondary care (eg, cancelling elective surgery, declining non-urgent referrals, or deferring work back onto primary care) has impacts and flow-on effects to other providers who are not necessarily equipped for this, and ultimately contributes to delayed patient care. Although there was clearly a rationale for the immediate secondary care response when significant COVID-19 community transmission seemed likely, as the threat receded there was little evidence of secondary care being proactive in helping general practices to address potential delayed care issues.

This study highlights the importance of integration and relationships across our healthcare sector and communities in providing timely care for patients. Respondents valued improved interpersonal communication with secondary care colleagues where this occurred. A kaupapa Māori practice worked with local rūnanga with the aim to protect patients from COVID-19. In contrast, communication gaps caused stress in the system, and respondents wanted primary care input into writing case-definitions and guidelines and for messages to come through official
channels rather than media. The importance of primary care involvement in pandemic planning and response, and support for dealing with higher acuity illness in the community, has been highlighted also in a Canadian review article. Improved integration could see redeployment of resources, such as staff moved to the area of greatest need. Rural generalists have been used as an example of flexibility between primary and secondary care roles in response to the pandemic. Also, flexible funding models were demonstrated to be effective in allowing health staff to adapt working practices with the community.

A major strength of our study is the unique real-time surveys that allowed us to capture the experience of healthcare professionals as they occurred during the early pandemic period. We also reported from a large, diverse group of primary care team members from throughout Aotearoa New Zealand. Our responses were limited to free-text responses by survey only. However, as this study commenced during the COVID-19 pandemic lockdown, this was deemed the most feasible means to assess the experience of busy healthcare teams.

Once lockdown restrictions eased, this study, and others internationally, identified a potential backlog of untreated patients’ “routine” issues usually diagnosed or managed by primary care. It was evident from respondents that practice teams worked hard to keep going under stressful situations, quickly reinstated business as usual and tried to mitigate effects of delayed care where possible. The concerns raised by our group warrant careful monitoring of disease incidence, morbidity and mortality data. As these become available, the true impact of these delays must be determined, with learning embedded into practice. However, it is critical that remedial work starts now, with primary care targeting those vulnerable to delay and secondary care streamlining the referral process.

Compared to other countries, New Zealand had a relatively short period of lockdown and very low incidence of COVID-19, but nonetheless the provision of healthcare was disrupted, and together with uncertainty, the period was stressful for healthcare workers. It is widely acknowledged that New Zealand’s health system has been under-funded for two decades and, even before the COVID-19 pandemic, increasing concerns have been raised about unmet need and delayed care. Had New Zealand been tested more severely with a larger number of unwell COVID-19 patients or a longer period of lockdown, the years of under investment in our health system could have meant that our ability to provide adequate clinical care would have been more severely compromised.

Careful attention to policy choices along with nimble planning and funding changes are needed to reduce the barriers for patients seeking care and improve integration and relationships across the health system. This would minimise future pandemic disruption and delayed patient healthcare.
Competing interests:
Nil.

Acknowledgements:
We thank Pegasus Health (Charitable) Ltd. for providing statistical and quantitative analysis and providing consultation with the Director of Hauora Māori and Equity, Irihāpeti Mahuika. 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.

Author information:
Geraldine Wilson: General Practitioner, Senior Research Fellow, Department of General Practice, University of Otago, Christchurch.
Zoe Windner: Medical Student, University of Otago, Christchurch; Susan Bidwell, Senior Research Fellow, Department of General Practice, University of Otago, Christchurch.
Anthony Dowell: Professor of Primary Health Care and General Practice, University of Otago, Wellington.
Les Toop: Professor of General Practice, Department of General Practice, University of Otago, Christchurch.
Ruth Savage: Senior Lecturer, Department of General Practice, University of Otago, Christchurch.
Ben Hudson; Senior Lecturer Department of General Practice, University of Otago, Christchurch.

Corresponding author:
Dr Geraldine Wilson, Department of General Practice, University of Otago, Christchurch, PO Box 4345, Christchurch 8140, phone 03 364 3613 geraldine.wilson@otago.ac.nz

URL:

REFERENCES


ABSTRACT

AIM: To assess the sensitivity and potential utility of five RATs and the IDNow, Liat and Oxsed nucleic acid amplification tests (NAATs) in our population.

METHOD: 39 retrospective and contrived SARS-CoV-2 positive samples were tested in parallel by standard RT-PCR and RAT. A second group of 44 samples was tested by standard RT-PCR, rapid RT-PCR and two isothermal NAAT assays. Limit of detection was compared at RT-PCR cycle thresholds for all assays.

RESULTS: We found that the Cobas Liat RT-PCR had 100% concordance with conventional RT-PCR, whereas the sensitivity of other rapid NAAT assays was less at lower viral loads indicated by Cts >30 (p=0.042) and the RATs at Cts >25 (p <0.001). When applied to New Zealand testing scenarios, IDNow or Oxsed NAAT could miss up to 12% and RATs up to 44.3% of COVID-19 cases compared with the RT-PCR currently used at our laboratory.

CONCLUSION: We found that the POC Cobas Liat, a platform that delivers a sample answer in 20 minutes, demonstrated equivalent performance to standard RT-PCR. However, the RATs and isothermal NAAT assays demonstrated reduced sensitivity, limiting their utility in New Zealand’s currently very low prevalence setting.

In New Zealand, as in the rest of the world, COVID-19 is diagnosed by SARS-CoV-2-specific nucleic acid amplification tests (NAAT), and past infection is determined by serological assays. Typically, high-volume NAAT testing is performed in batches and results may take several hours. However, a rapid turnaround time of a test, from arrival in the laboratory to provision of results, is critical to the success of public health interventions, as well as for individual patient management.

New Zealand currently has a very low prevalence of COVID-19, and laboratories are generally operating well within existing capacity, although, even with our current prevalence, increased levels of testing around suspected or actual community cases can strain local laboratory resources. Nevertheless, there is a need to consider what rapid-testing alternatives are available should current epidemiology change, and how these options could fit with SARS-CoV-2 diagnostic testing in the New Zealand setting.

Rapid SARS-CoV-2 antigen tests (RATs) were developed by many manufacturers by mid-2020. RATs promised low cost and scalable diagnostics that can be performed outside of a laboratory. Subsequently, these tests have been assessed and used in high-prevalence settings globally and are...
recommended in low income settings by the World Health Organization (WHO). In New Zealand, due to concerns around the quality of manufacturing and accuracy, importation of RATs has been restricted since April 2020; these restrictions have recently widened to include molecular point-of-care tests.

Early in the pandemic, several commercial molecular assays utilising reverse-transcriptase PCR (RT-PCR) became available with time to results of <1 hour, such as the GeneXpert (Cepheid, USA) and FilmArray (Biomerieux, France), which were integrated into diagnostic workflows in New Zealand. These rapid molecular tests are generally regarded as point-of-care tests (POCTs), although in New Zealand use of the GeneXpert and FilmArray is currently confined to laboratory settings. Later in 2020, ID NOW (Abbott, US) and Cobas Liat (Roche, Germany), molecular assays able to provide results in 20 minutes, also became available to New Zealand laboratories. These platforms are generally able to process one sample at a time, whereas some NAAT tests, such as the Oxsed RaVid Direct (Oxford, UK) reverse-transcription loop-mediated isothermal amplification (RT-LAMP) assay, potentially offer rapid and scalable results.

The aim of this study was to assess the sensitivity and potential utility of five rapid antigen tests and three rapid NAAT tests in our population.

**Methods**

**Rapid antigen tests**

Five RAT kits were evaluated:

- Panbio COVID-19 Ag Rapid Test Device (Abbott, US)
- CareStart COVID-19 Ag Rapid Test (AccessBio, US)
- Clinitest Rapid COVID-19 Ag Test (Siemens, Germany)
- Innova SARS-CoV-2 Ag Rapid Test (Innova, US)
- Roche SARS-CoV-2 Rapid Ag Test (Roche, Germany)

These brands were selected because of their widespread use, post-marketing performance data and emergency use authorisations in either the USA or Australia. Specimen types recommended by the manufacturers for the Abbott, CareStart and Clinitest kits are nasopharyngeal swabs or nasal swabs. The Roche kit is nasopharyngeal swabs only. The Innova kit is nasal swabs or throat swabs.

Thirty-three SARS-CoV-2 NAAT-positive, frozen, stored patient samples in viral transport media (VTM) were retrieved. Each sample was thawed at room temperature, vortexed for 10 seconds and then prepared as follows:

- For rapid antigen testing, 200uL of the sample was aliquoted into the manufacturer’s extraction vessel and further testing proceeded as per the manufacturer’s instruction.
- For routine RT-PCR comparison, 200uL of each sample was extracted using the MagNA Pure 96 (Roche) system followed by amplification using the A*STAR Fortitude Kit 2.1 (Mirxes, Singapore) on a Lightcycler 480 (Roche, Germany). The A*STAR Fortitude Kit 2.1 detects two different proprietary regions of the orf1ab gene.

One positive sample (with an initial Ct value of 16.1) was diluted tenfold out to $10^{-6}$ in universal transport media (UTM). The original sample and resulting dilution series were tested by RT-PCR and by each of the five RAT kits.

**Rapid NAAT testing**

For the rapid NAAT tests, 50 additional SARS-CoV-2 NAAT-positive, frozen, stored nasopharyngeal samples were prepared as above.

Cobas Liat testing was performed using 200uL of sample, according to the manufacturer’s instructions. The same volume of sample was used for the ID NOW, as direct dry patient swabs were unavailable, although the manufacturer’s recommendation for this assay is that it be used for testing nasal, throat or nasopharyngeal swabs directly without elution in VTM.

For routine RT-PCR comparison, 200uL of each sample was extracted on the Kingfisher Flex system (Thermofisher, US), as per the manufacturer’s recommendation for extraction for the Oxsed RT-LAMP, using Machery Nagel (Machery-Nagel, Germany) kits followed by amplification using A*STAR Fortitude Kit 2.1 on a Lightcycler 480.
For Oxsed RT-LAMP, an aliquot of the above extracted RNA was prepared according to manufacturer’s instructions; reaction tubes were incubated in a heat block at 65°C for 30 minutes and colour changes determined in conjunction with “before and after” photographs.

Analysis
RAT (Figure 1) and rapid NAAT results (Figure 2) results were interpreted according to the manufacturers’ instructions by two independent operators. When these operators disagreed, a third operator determined the result.

Sensitivity of all the evaluated kits was compared with the qualitative result of the orf1ab region 1 target (FAM channel) of the A*STAR Fortitude Kit 2.1 RT-PCR using Chi square tests; Ct was used as a surrogate of viral load. Where samples tested negative using the A*STAR kit on retrieval from storage, they were excluded from analysis.

Results
Rapid antigen tests
For the 39 samples tested using RAT, the overall average sensitivity compared with RT-PCR was 39.0% (95% CI 30.3–43.9%, p=0.01), with individual results as shown in Table 1. All RAT kits showed a sensitivity of 100% where the RT-PCR Ct value was <25 (n=9), but RAT sensitivity dropped for all kits where samples had a Ct value of ≥25.0 (p<0.001). Clinitest had the highest sensitivity overall. However, there was no significant difference between the sensitivity of the tests (p=0.178). None of the kits detected SARS-CoV-2 in any of the samples with a Ct value ≥35.0.

Rapid NAAT testing
For the 50 stored positive samples tested using rapid NAAT,six samples tested negative on repeat by the A*STAR Fortitude Kit 2.1 assay and were excluded from further analysis.

The overall sensitivity compared with RT-PCR was 92% (95% CI 86.6–95.8, p=0.07), with individual performance presented in Table 2.

All three tests showed a sensitivity of 100% where the RT-PCR Ct value was <29 (n=29), but sensitivity dropped for the ID NOW and Oxsed assays for samples with a Ct value of ≥30.0 (p=0.042). In contrast, the Cobas Liat detected all 44 (100%) samples.

Discussion
We evaluated the sensitivity of rapid antigen tests and rapid molecular assays in order to determine potential utility in the New Zealand setting. Specificity was not assessed for this evaluation, as limited kits were available; internationally, this has been found to be high across a range of devices, though the positive predictive value would be highly variable dependent on prevalence of infection in the setting in which the tests were used in New Zealand.10

We found that the Cobas Liat, which provides results in 20 minutes and uses RT-PCR technology, had equivalent sensitivity to our standard high-throughput RT-PCR assay. This has been demonstrated elsewhere and, notably, several authors have demonstrated concordance with the GeneXpert, a RT-PCR system that provides results in 40 minutes and is already in use in our laboratory.11,12 The major limitation of the Liat is that only one sample can be tested at a time, which considerably limits throughput, although the Liat also has significant advantages: the simplicity, speed and portability would suit remote settings (eg, rural hospitals without molecular laboratories) when rapid results are needed. However, at >$10K per machine, financial considerations could impede scalability.

Otherwise, all evaluated assays were less sensitive than the standard RT-PCR used in our laboratory, which is evident at lower viral loads. RATs demonstrated a higher limit of detection compared with the ID NOW and Oxsed RaVid assays. Overall our results are consistent with many other reports that demonstrate sensitivity is related to viral load proxies such as Ct value in a laboratory or a field setting for these assays and others,6,10,13–17 though comparative data for the Oxsed RaVid RT-LAMP assay against RT-PCR are limited.18 Therefore, although we tested a narrow range of assays, we believe our findings and conclusions are more generalisable.

One note of caution: there is a high degree of variability in performance across RAT brands and some will perform worse than those we have presented.7,10
There are technical limitations to our study. A limited range of kits were available for the evaluation, which resulted in small numbers and consequent statistical challenges. Furthermore, limited residual sample volume precluded direct comparison of RATs and rapid NAATs. Importantly, for the RATs and rapid NAAT assays, we were constrained to using samples in VTM at a standard volume of 200µL (the average volume of fluid absorbed by a flocculated swab), as all swabs received at our laboratories are inoculated into VTM to optimise detection of SARS-CoV-2 using existing platforms and dry swabs were unavailable. The RAT or ID NOW manufacturers do not recommend the use of VTM, as there is a dilution effect when additional kit buffer is added to this volume. Accordingly, in theory, the sensitivity of the RATs and ID NOW kits may differ from that obtained by the manufacturers’ recommended methods; however, in practice our findings are consistent with those reported elsewhere for the RATs and for ID NOW using either dry swabs (the manufacturer’s recommended method) or VTM.6,10,13–17

Conversely, we were unable to evaluate the manufacturer’s alternate “extraction-free” Oxsed method, as VTM affects assessment of the end point colour and our results obtained using RNA extraction likely demonstrate higher sensitivity than we would have obtained using the faster method; further evaluation without extraction would be needed if this technique were under further consideration.

Our results highlight the importance of assessing the performance of RATs or rapid NAATs in the intended setting because epidemiology and public health approaches differ globally. In New Zealand, which is currently pursuing an elimination strategy, detection of any COVID-19 case is of paramount public health importance as it may indicate the presence of unknown transmission links. After applying our findings into three New Zealand scenarios with data from our laboratory, we found that the average clinical sensitivity of the RATs/NAATs (with the exclusion of the Cobas Liat) for detecting SARS-CoV-2 infections identified by RT-PCR would be 74.1%/93.9% in the initial outbreak of March–June 2020, 58.3%/92% in the Auckland outbreak in August 2020 and 55.7%/88% in individuals testing positive in managed isolation facilities between December 2020–January 2021.

Since August 2021, the Abbott, CareStart and Roche RATs have been included in the Australian Register of Therapeutic Goods (ARTG) for legal supply in Australia,19 while the CareStart RAT has been authorised for emergency use by the US Food and Drug Administration (FDA).20 In New Zealand, all RATs have been prohibited for import since April 2020 due to concerns around their performance in our low-prevalence setting.6 This has recently been widened to include molecular point-of-care devices (outside diagnostic laboratories).9 Our local data support these restrictions for RATs; we found an overall sensitivity of 39% for the samples we tested; none of the kits would meet the WHO interim guidance for rapid antigen device (RAD) diagnosis of SARS-CoV-2 infection (≥80% sensitivity and >97% specificity),7 and they are not suitable for use as a standalone test.

RATs do offer potential advantages as diagnostic tests for SARS-CoV-2 infection in both high-disease-prevalence and low-technology settings—they provide rapid results, are relatively inexpensive compared to nucleic acid testing and can be used outside of the laboratory,13 and multiple RATs can be performed simultaneously.7 Consideration could be given to their use as an adjunct to RT-PCR in the event of a widespread outbreak in New Zealand where laboratories are unable to provide RT-PCR results in a timely fashion.1,10,21 However, their results will have to be confirmed with RT-PCR testing even in this setting if an elimination strategy is being pursued, given performance characteristics and likely prevalence.10,21 In our current setting, RATs could have a role in parallel with confirmatory RT-PCR in specific scenarios, such as within a relatively isolated group of individuals with acute respiratory symptoms where rapid RT-PCR tests are not readily available (eg, on a fishing boat or in a remote community), in which case a positive SARS-CoV-2 result would allow rapid escalation of interventions while awaiting definitive results.22 There has been recent interest in the potential use of RATs at points of entry to New Zealand (eg, in screening incoming passengers), and there may be value in...
Figure 1: Clinitest rapid antigen test: dilution series.

Table 1: Performance of RATs compared with reference RT-PCR.

<table>
<thead>
<tr>
<th>A*orf1ab region 1 Ct value</th>
<th>Rapid antigen tests</th>
<th>Number tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abbott</td>
<td>CareStart</td>
</tr>
<tr>
<td>15–19</td>
<td>4 (100)</td>
<td>4 (100)</td>
</tr>
<tr>
<td>20–24</td>
<td>5 (100)</td>
<td>5 (100)</td>
</tr>
<tr>
<td>25–29</td>
<td>5 (71.4)</td>
<td>4 (57.1)</td>
</tr>
<tr>
<td>30–34</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>≥35</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>All</td>
<td>14 (35.9)</td>
<td>13 (33.3)</td>
</tr>
</tbody>
</table>

Lines at C + T = positive, line at C only = negative. Neat Ct value = 16.1. \([x1] = 10^{-1}\) dilution, \([x2] = 10^{-2}\) dilution, etc.
Table 2: Comparison of Cobas Liat, ID NOW and Oxsed assays with reference RT-PCR.

<table>
<thead>
<tr>
<th>A*orf1ab region 1 Ct</th>
<th>NAAT</th>
<th>Number tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RT-PCR</td>
<td>Isothermal NAAT</td>
</tr>
<tr>
<td></td>
<td>Liat</td>
<td>ID NOW</td>
</tr>
<tr>
<td>15–19</td>
<td>1 (100)</td>
<td>1 (100)</td>
</tr>
<tr>
<td>20–24</td>
<td>15 (100)</td>
<td>15 (100)</td>
</tr>
<tr>
<td>25–29</td>
<td>13 (100)</td>
<td>13 (100)</td>
</tr>
<tr>
<td>30–34</td>
<td>8 (100)</td>
<td>6 (75)</td>
</tr>
<tr>
<td>≥35</td>
<td>7 (100)</td>
<td>4 (60)</td>
</tr>
<tr>
<td>All</td>
<td>44 (100)</td>
<td>39 (89)</td>
</tr>
</tbody>
</table>

Figure 2: Oxsed RT-LAMP results.

Colorimetric result of Oxsed RT-LAMP. Yellow = positive, pink = negative.
testing individuals from very high-risk countries in parallel with confirmatory RT-PCR, to determine their disposition. However, testing all arrivals indiscriminately is not advisable due to the low positive and negative predictive value of this approach and the associated operational and logistical challenges.

It is likely these technologies will have wider utility as the public health strategy changes and COVID-19 becomes more prevalent in our population; this is because sensitivity will be less critical for diagnostic tests, positive predictive value will improve and the advantages of near-patient care may outweigh the risks associated with their use. At that stage, there may be a role for the use of RATs for single tests for mass screening, such as at large public events, and as part of a diagnostic algorithm in healthcare settings. Under these circumstances, regular and frequent testing for healthcare workers or in residential care facilities may also be appropriate to reduce the risk of transmission to patients in hospitals or nursing homes, as in higher-prevalence settings frequency of testing has been shown to increase sensitivity. However, in New Zealand’s current low-prevalence state, trying to offset the decrease in sensitivity by increasing the testing frequency of the same individual would likely give a false sense of security.

The ID NOW and Oxsed, which are both rapid isothermal NAAT assays, performed better than RAT and could be considered if increased national testing capacity were to be required and limited reagents and instruments were available for RT-PCR. However, each test is suited to a different setting: The ID NOW provides results within 20 minutes but, similarly to the Liat, only allows single sample testing. The Oxsed assay is scalable if performed directly without extraction and would take approximately 40 minutes to results, but this assay is not an integrated sample-to-answer machine like the ID NOW or Liat, so it requires considerable scientific skill and resource to run, similarly to a batched RT-PCR test.

In summary, we found that the Cobas Liat, a RT-PCR POC platform that delivers a result in 20 minutes, performed equivalently to our standard RT-PCR, whereas the RATs and rapid isothermal NAAT assays demonstrated reduced sensitivity, which limits their utility in New Zealand’s currently very low prevalence setting. RATs and rapid isothermal NAAT assays may be useful in the event of a widespread outbreak in New Zealand, when laboratories may be overwhelmed and unable to provide prompt results with existing resources. With time, changes in public health strategy and disease prevalence may also widen the utility of these tests.

Addendum

This study was written prior to New Zealand’s August 2021 COVID-19 outbreak. Since then, the prevalence of COVID-19 has risen in Auckland, and while other regions are still pursuing an elimination strategy, it is expected that outbreaks will occur across the other regions in short order. It is apparent that rapid antigen testing will be an integral part of testing strategy in regions with a high prevalence of infection over the coming months to supplement PCR testing, particularly for asymptomatic surveillance testing in health care and other settings.
Competing interests:
Dr Harte reports non-financial support from Abbott Rapid Diagnostics Pty Ltd, Siemens Australia and Rapid Test & Track, Sydney (supply of RAT devices for the trial evaluation).

Acknowledgements:
The manufacturers for supplying the rapid antigen test kits and rapid NAAT assays at no cost for our evaluation.

Author information:
Jenna Beaumont: Virology and Immunology Department, LabPLUS, Auckland City Hospital, Auckland, New Zealand.
Mirsaeed Miri Narges: Virology and Immunology Department, LabPLUS, Auckland City Hospital, Auckland, New Zealand.
Susan Smith: Labtests, Auckland, New Zealand.
David Harte: Institute of Environmental Science and Research Ltd, Kenepuru Science Centre, Porirua, New Zealand.
Erasmus Smit: Institute of Environmental Science and Research Ltd, Kenepuru Science Centre, Porirua, New Zealand.
James Ussher: Southern Community Laboratories, Dunedin, New Zealand.
Gary McAuliffe: Virology and Immunology Department, LabPLUS, Auckland City Hospital, Auckland, New Zealand.

Corresponding author:
Gary McAuliffe: Virology and Immunology Department, LabPLUS, Auckland City Hospital, Auckland, New Zealand.
gmcauliffe@adhb.govt.nz

URL:

REFERENCES


Rates of Māori women receiving surgical treatment for urinary incontinence and pelvic organ prolapse in Southern District Health Board

Riki Anderson, Mike Stitely, Robin Willink

ABSTRACT

AIMS: Pelvic organ prolapse (POP) and urinary incontinence (UI) are common gynaecological conditions that are amenable to surgical management. The prevalence of these conditions has not been well studied in the New Zealand population, but limited evidence suggests that Māori women are likely to have a higher prevalence of POP and UI than non-Māori women. The aim of this study was to formally document the rate of access to these surgical procedures for Māori and non-Māori women in the area served by Southern District Health Board (SDHB).

METHODS: A retrospective descriptive study of women who underwent surgical management for POP and/or UI at SDHB facilities between 2015 and 2019 was performed.

RESULTS: Unadjusted results suggested that there was a difference in the accessibility of operations for Māori and non-Māori. However, standardisation for the difference in the age structures of the two populations showed that Māori and non-Māori women access gynaecological surgery for POP and UI at very similar rates.

CONCLUSIONS: We have documented that the standardised rates for Māori and non-Māori women accessing POP and UI surgery are similar in SDHB. Owing to the likely greater prevalence of these conditions in Māori women, the near equality of standardised rates of surgical intervention is likely to represent an inequity of access for Māori women.
and neurogenic disease.\textsuperscript{5,7,8} Given that, in comparison with other women in New Zealand, Māori women have higher fertility rates (Māori total female fertility rate was 2.34 in 2014, compared with 1.92 for New Zealand women overall),\textsuperscript{9} have higher rates of cigarette smoking\textsuperscript{10} and are more likely to be overweight/obese,\textsuperscript{11} it should be expected that they experience a higher prevalence of POP and UI.

The limited data available describing the prevalence of POP and UI by ethnicity in New Zealand women support this suggestion. Only one study in New Zealand has assessed the prevalence of UI in Māori, Pacific Island and European women aged 18 years and over.\textsuperscript{11} That study found the prevalence of UI to be significantly greater for Māori women (46.8\%) than either Pasifika (29.2\%) or European women (31.2\%).

In the United States, the lifetime risk of undergoing surgery for POP is estimated to be 13\% by the age of 80 years.\textsuperscript{6} A study undertaken in Western Australia estimated a similar lifetime probability of undergoing surgery for POP of 19\%. In the general female population,\textsuperscript{12} rates of stress urinary incontinence surgery in the United States were 246.1 per 100,000 person years.\textsuperscript{13}

In 2019, Stitely et al reviewed a cohort of women scheduled for gynaecological surgery at Dunedin Public Hospital, Southern District Health Board (SDHB), Aotearoa New Zealand, where cystoscopy was a planned component of the procedure.\textsuperscript{15} The majority of surgeries were performed to manage POP and/or UI. The ethnicities of the women who participated were collected. Only 3\% of women in the cohort identified their ethnicity as “Māori,” compared to 92.4\% who identified as “European.”\textsuperscript{15} Given the apparent under-representation of Māori women in this cohort and the recognition that risk factors for POP and UI are more common in Māori, there was concern that Māori women did not have appropriate access to surgical intervention for POP and UI in SDHB.

**Aims**

The aim of this study is to document the surgical access rates for Māori and non-Māori women for treatment for POP and UI in the catchment area served by SDHB in Aotearoa New Zealand between 2015 and 2019.

**Methods**

An application was made to the Ethics Committee at The University of Otago, Dunedin, under the Minimal Risk Research Audit Proposal and was approved (Ethics Committee reference number: HD20/018). In addition, local authorisation was sought and granted from SDHB, and research consultation was undertaken with Māori via the Ngāi Tahu Research Consultation Committee.

A retrospective descriptive study was undertaken, which included women undergoing surgical management for POP and/or UI at SDHB facilities between 2015 and 2019. Line-by-line data for women, including their stated National Health Index (NHI) ethnicities, were obtained from the Hospital Surgical Activity Database for SDHB using the Australian Classification of Health Interventions (ACHI) coding system. Stats NZ population projections for the SDHB population derived from New Zealand census data were used as the denominator to calculate ethnicity-specific rates for the procedures. On every admission for surgery, women had been asked to self-identify their ethnicity, with the option to record up to three ethnicities per woman.

Women can identify with more than one ethnic group, hence a prioritisation process related to ethnicity is used by SDHB, which was developed by Stats NZ for situations where people need to be counted only once. Ethnicity is prioritised in the following order: New Zealand Māori > Pasifika > Asian > Middle Eastern, Latin American, African (MELAA) > Other > European > Residual Categories. Because we were interested in understanding inequities for Māori, our study divided ethnicity into two sub-groups: (1) women identifying as New Zealand Māori and (2) all others (including women identifying as Pasifika, Asian, MELAA, European or another ethnic group).

This study aimed to assess the level of access to gynaecological POP and/or UI procedures, rather than the level of provision of the procedures. Therefore, in instances when there was more than one date of surgery for a given patient, only the procedure performed on the earliest date...
was included (ie, when a woman underwent multiple surgeries on different dates, only her first date of surgery was counted). Raw data were obtained for Māori and non-Māori women who received service from SDHB, and raw overall rates and age-specific rates were calculated. Subsequently, direct standardisation to the combined population of Māori and non-Māori women was used to obtain adjusted (ie, standardised, overall rates). This accounts for the difference in the age distributions of the two populations.

### Results

The estimated female resident population for SDHB in 2015–2019 is shown in Table 1. For example, it was estimated that, in 2019, 10.4% of the female population was Māori and 89.6% was non-Māori.

The numbers of surgical procedures were analysed by age and ethnicity. The unstandardised overall rate of receiving operations for Māori women, \( r \), was lower than for non-Māori, \( r^o \), (Figure 1 and Figure 2). The contributions from the upper age groups were much smaller for Māori (Figure 1). The overall rates, \( r \) and \( r^o \), can be found by combining the rates for women in the individual age groups, \( r_j \) and \( r^o_j \) (Figure 2), with the sizes of the age groups, \( n_j \) and \( n^o_j \) (Figure 3). They are

\[
    r = \frac{\sum n_j r_j}{\sum n_j} = 0.17% 
\]

and

\[
    r^o = \frac{\sum n_j^o r^o_j}{\sum n_j^o} = 0.25%. 
\]

Although the rates for Māori and non-Māori in the individual age groups are similar (Figure 2), the overall rate is lower for Māori. Taken in isolation, this would suggest that there is a difference in the rates of access to operations for Māori and non-Māori. However, the age structures of the populations of Māori and non-Māori women differ considerably (Figure 3). Direct standardisation was undertaken. The combined female population was used as this is a real population, each individual contributes equally and the results are unaffected by factors outside the populations being compared. Standardising the rates to the age structure of the combined female population gives standardised rates for Māori and non-Māori (Figure 4) of

\[
    r_{st} = \frac{\sum (n_j + n^o_j) r_j}{\sum (n_j + n^o_j)} = 0.24% 
\]

and

\[
    r^o_{st} = \frac{\sum (n_j + n^o_j) r^o_j}{\sum (n_j + n^o_j)} = 0.24% 
\]

per year, which means that the standardised rate-ratio is very close to 1. The estimates are identical to two significant figures. It

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Māori</td>
<td>15,810</td>
<td>9.9</td>
<td>16,530</td>
<td>10.1</td>
<td>17,110</td>
</tr>
<tr>
<td>Pacific</td>
<td>2,900</td>
<td>1.8</td>
<td>3,060</td>
<td>1.9</td>
<td>3,230</td>
</tr>
<tr>
<td>Asian</td>
<td>8,940</td>
<td>5.6</td>
<td>9,710</td>
<td>5.9</td>
<td>10,460</td>
</tr>
<tr>
<td>NZ European/Other</td>
<td>132,760</td>
<td>82.8</td>
<td>134,210</td>
<td>82.1</td>
<td>135,650</td>
</tr>
<tr>
<td>Grand total</td>
<td>160,410</td>
<td>100</td>
<td>163,510</td>
<td>100</td>
<td>166,450</td>
</tr>
</tbody>
</table>

Source: Projections produced by Stats NZ according to assumptions agreed to by the Ministry of Health 2019.
Figure 1: Unstandardised rates of undergoing operations.

(i) Percentage of female population per year

- To measure access, rather than provision, only the first operation for each woman is counted.

Figure 2: Unstandardised rates of undergoing operations.

(ii) Percentage of female age group per year

- To measure access, rather than provision, only the first operation for each woman is counted.
Figure 3: Size of age groups of female populations.

Figure 4: Standardised rates of undergoing operations.

*To measure access, rather than provision, only the first operation for each woman is counted.
is evident from this result that we cannot conclude from the data that either Māori or non-Māori access gynaecological surgery for POP/UI more than the other. Rather, it appears that, in the area covered by SDHB, Māori and non-Māori access these surgeries at similar rates.

Discussion

This study aimed to document the rates of access for Māori and non-Māori women to gynaecological procedures for POP and/or UI in the region serviced by SDHB.

Unadjusted/unstandardised analysis suggested that the proportion of Māori women undergoing these procedures is low compared to the proportion of non-Māori women undergoing these procedures. However, after standardisation of the data to allow for differences in the age structures of the Māori and non-Māori female populations, and with the combined population of women in SDHB being the reference, this difference disappears. The analysis shows that overall rates of gynaecological procedures for Māori and non-Māori women in the SDHB population both sit at approximately 1/4% of the given reference population per year.

There is some evidence that different ethnic groups have different rates of POP and UI. Overseas studies have shown different rates of prevalence in women of different ethnicities.16–20 In a prospective observation study in 2019, Cheung et al18 assessed prolapse symptoms and assessed prolapse stage using the Pelvic Organ Prolapse Score Quantification System (POP-Q) and transperineal ultrasound. Ethnicity was a significant predictor of type of prolapse. Rates of apical compartment prolapse were found to be higher in East Asian women than in Caucasian women; however, rates of posterior compartment prolapse were less common in South East Asian women.

Cheung et al also identified ethnic differences in the anatomical position of structures such the uterus and the rectal ampulla on Valsalva manoeuvre. These findings raised the question: Do ethnic differences in anatomy contribute to differences in rates of presentation with POP/UI symptoms and surgical reconstruction? Indeed, studies have been carried out to look for inter-ethnic variation in pelvic floor functional anatomy (eg, levator hiatal distensibility and pelvic organ descent in women with symptomatic organ prolapse).19,20 Abdool et al found this to be the case in their prospective observational study of South African women referred to a tertiary urogynaecological clinic for pelvic organ prolapse assessment and management.20 On the basis of taking a detailed history, performing a clinical examination and undertaking 4D transperineal ultrasound, they found South African Asians had a lower rate of avulsion of levator ani muscles. Black women were found to have a greater degree of genital hiatus distensibility and greater hiatal area than South Asian and Caucasian women, and greater pelvic organ mobility than Caucasian women on ultrasound.20

In 1995 Ford et al reviewed Pelvic Floor Disability Index (PFDI-20) questionnaire scores between women of different ethnicity.21 Their retrospective cohort study of women undergoing pelvic reconstructive surgery found that Caucasian women appeared to be more symptomatic from prolapse and urinary symptoms compared with black women. This was despite the cohort of black women having higher parity and body mass index (BMI), which are known risk factors for both conditions.

No New Zealand data are available to confirm or refute relevant local ethnic differences in pelvic anatomy. It is known that risk factors for these conditions are more prevalent for Māori,9,10,11 so it seems possible that Māori women may have higher prevalence of these conditions, but this needs to be proven through prevalence studies. Therefore, the finding of equal access to surgical procedures for POP and UI may mean that Māori women are not accessing services in proportion to their need.

Māori women are recognised as being underserved for other gynaecological issues. Māori women are recognised as being less likely to access care for cervical screening, post-menopausal bleeding (requiring investigation for endometrial cancer) and vulval lichen sclerosus.22–25 Factors that have been identified as contributing to these differ-
ences in seeking care include: cost, physical discomfort and an inappropriate model of care involving, for example, a lack of recognition of wairua (spiritual wellbeing), hinengaro (psychological wellbeing), tinana (physical wellbeing) or whānau (extended family).23,25

Access to surgery for POP and UI is dependent on women recognising that they have a health issue that is potentially treatable and subsequently seeking care through their primary care provider. There is evidence that women often normalise the symptoms of urinary incontinence.7,23,26 In their assessment of European women, Māori women and women of Pacific Island descent in Wellington, Lara and Nacey found that 50% of incontinent women reported wanting help for their urinary problems but that only one third had sought medical assistance.12 The most common reason why Māori, Pacific Island and European women did not seek help was a belief that incontinence was normal for women (42%, 45% and 38% respectively).12 The second most common reason for Māori and Pacific Island women was embarrassment (27% and 33% respectively), and the second most common reason for European women was their assessment that their incontinence was not severe enough to require help.12

Primary health care providers are the main referrers to secondary providers, who provide gynaecological surgical services in New Zealand. Therefore, any barriers to accessing primary health consultations will also be a barrier to accessing POP/UI surgical care.24,25 In the study by Lara and Nacey, 12% of the women with UI who identified as Māori gave “consultation cost too high” as the reason for not seeking medical help, compared to 7% of European women.12

Further research is needed to understand the prevalence of POP and/or UI by ethnicity. Given the sensitive nature of these conditions, a prevalence study would need to be well designed within a kaupapa Māori framework, to ensure accurate information is collected. Once prevalence has been established, other district health boards can be encouraged to review their access rates for POP and UI by ethnicity in order to understand whether access is appropriate. Further work might demonstrate definitively the existence of a gap between the prevalence of POP/UI and the level of access to treatment. In that case, additional work will be needed to understand the barriers to access, and steps might then be taken to overcome these barriers.

Limitations

This study is retrospective. It also assumes that patients were consistent in their identification of ethnicity when asked on the 2018 New Zealand census and when asked by the hospital. Numerator–denominator mismatch is possible given the different sources of data. However, both the census data from Stats NZ and the hospital data use self-identified ethnicity prioritised in the same way. Protocols followed at SDHB aim to ensure that all patients are asked on each interaction to confirm their ethnicity. As this is self-identified, it is possible that a person’s identified ethnicity can change. In addition, the clinical data are for women accessing provider arm services provided by SDHB, and it is possible that some of the women accessing the services provided by SDHB were not domiciled in the SDHB catchment area and so were not counted in the census projections of population. This could have caused a small mismatch between the numerator and denominator in the rate calculations.
Competing interests:
Nil.

Author information:
Riki Anderson: Obstetric and Gynaecology Registrar Hutt Hospital, Lower Hutt.
Michael L Stitely: Associate Professor, Department of Women’s and Children’s Health, Dunedin School of Medicine. University of Otago, Dunedin.
Robin Willink: Biostatistician, University of Otago Wellington, Wellington.

Corresponding author:
Dr Riki Anderson Obstetrician and Gynaecologist, Honorary Lecturer, Department of Obstetrics and Gynaecology, Wellington School of Medicine, University of Otago
Riki.anderson@gmail.com

URL:

REFERENCES


Barriers and facilitators for Māori in accessing hospital services in Aotearoa New Zealand

Emma Espiner, Sarah-Jane Paine, Maree Weston, Elana Curtis

ABSTRACT

AIM: This paper reports the findings of a literature review to answer the research question, “What are the barriers and facilitators of access to hospital services for Māori?”

METHOD: MEDLINE (Ovid) and PsycINFO were searched using keywords to identify relevant literature published between 2000 and 2020. The data analysis was informed by a Kaupapa Māori positioning and the CONSIDER statement on reporting of health research involving Indigenous peoples.

RESULTS: Twenty-three papers met the inclusion criteria. We identified five themes that captured the barriers for Māori accessing hospital services (practical barriers, poor communication, hostile healthcare environment, primary care barriers and racism) and five facilitatory themes were identified (practical facilitators, whakawhanaungatanga, whānau, manaakitanga and cultural safety).

CONCLUSION: This article confirms existing knowledge about practical barriers and facilitators to healthcare access for Māori and contributes to an emerging body of evidence about the impact of racism and culturally unsafe services in preventing Māori from accessing healthcare services. The facilitators identified provide a potential roadmap for the redesign of services so they are accessible and effective for Māori. Improving services in this way would support district health boards, the Ministry of Health and professional organisations to comply with their commitments to providing culturally safe services and health professionals.

Māori health inequities result from systematic failures in the provision of healthcare by the public health system and historical structural failures that have led to the inequitable distribution of the social determinants of wellbeing for Māori compared to non-Māori. Māori have greater need for health services but experience more barriers to accessing services compared with non-Māori. Māori are less likely to have health practitioners explain medical information in a way that is understood, and health practitioners spend less time with Māori patients compared with non-Māori. Māori are more likely to live in environments with reduced access to healthy food and opportunities for exercise and recreation in the built environment, to live closer to fast food, tobacco and low cost alcohol retailers and to experience barriers to influencing local government and regulatory bodies to modify these social determinants of wellbeing compared with non-Māori.

Non-communicable diseases, suicide and motor vehicle accidents are the leading causes of death for Māori. Each of these can require frequent hospital-based care. Outpatient appointments and hospital service utilisation can either facilitate or provide a barrier to care for acute and chronic conditions. Therefore, the contribution of hospital-based care on Māori health is significant. Cancer care for Māori illustrates disparities in the provision of population-level prevention efforts, as well as reduced access for Māori to timely screening, diagnosis and treatment in the hospital setting compared with non-Māori. Facilitating meaningful action towards health equity for Māori requires all aspects of the health system to be interrogated.
Given this context, it is timely to investigate evidence on the interplay between personal and system factors as key drivers for Māori inequities in hospital services.

**Methods**

This literature review incorporates an Indigenous Kaupapa Māori Research positioning. This included Māori leadership of the research agenda and Māori research supervision (including supervisors with expertise in Kaupapa Māori theory and research experience). This approach specifically rejects cultural deficit or victim-blaming analyses as valid explanations of Māori health inequities.

A literature search was undertaken to identify experiences of whānau Māori in accessing hospital care. The research question asked, “What are the barriers and facilitators of access to hospital services for Māori?” A systematic search strategy of MEDLINE (Ovid) and PsycINFO databases was conducted to identify published peer-reviewed journal articles. Keyword search terms were: Māori; barriers; enablers; facilitators; services; outpatient; experience; attendance. All articles identified from the initial database search were imported into Covidence, a systematic review software for managing the screening and selection process.

Inclusion and exclusion criteria are presented in Table 1. This literature review excluded studies that were solely descriptive (ie, studies that may have documented outcomes such as disparities in access but did not discuss or critically analyse the inequities in Māori access to hospital services). Grey literature was also excluded as it was outside of the scope of the study timeframe and resources.

All included articles were critiqued from a Kaupapa Māori positioning that promotes Māori/non-Māori analyses within research as important for the examination of non-Māori privilege and racism as causal factors for Māori/non-Māori health service inequities. The analysis was broadly guided by the CONSIDER statement and Kaupapa Māori epidemiological principles, including quality of ethnicity data collection, benefit of research to Māori, level of Māori research leadership or control, use of mātauranga Māori and avoidance of deficit/victim-blaming analyses. The literature was examined for statements on researcher positionality as this is acknowledged as an important influence on how researchers interpret Indigenous data. Quantitative studies were reviewed to determine how the analytical approach informed a systems level view of Māori/non-Māori health inequities. All articles were reviewed from a structural determinants approach, which included an acceptance of diverse Māori realities and rejection of cultural essentialism.

**Results**

During the initial search, 391 papers were identified. Duplicate articles were removed (n=50) and the abstracts of the remaining papers were reviewed using inclusion and exclusion criteria, resulting in 23 articles for study inclusion following full article review (Table 2).

Of these, four papers were published prior to 2010 and 19 were published between 2010 and July 2020. Thirteen articles involved Māori participants only. The study settings included acute hospital services, outpatient clinics, community services and primary care. We excluded studies solely looking at the experience of Māori in primary care. However, the majority of articles included findings from Māori in primary and community care.

The Kaupapa Māori analysis found that, although most authors avoided deficit framing and included a social determinants-based analysis of the findings, very few reported on the quality of ethnicity data beyond “self-identified” (n=9) or “not stated” (n=9). Researcher positionality was stated explicitly in just under half of the articles (n=11). Some articles that claimed to use Kaupapa Māori methods did not explicitly state researcher positionality or address governance issues (n=2). Barriers to access (n=22) and facilitators of access (n=20) were discussed similarly across the included articles.

Overall, five themes captured the barriers experienced by whānau Māori:

- Poor communication
- Hostile healthcare environment
- Primary care barriers
Five themes identified facilitators to accessing healthcare services by Māori:

- Practical facilitators
- Whakawhanaungatanga
- Whānau
- Manaakitanga
- Cultural safety

Barriers to accessing hospital services

Poor communication was a feature of Māori participants’ experiences with mainstream hospital and outpatient services. Māori were not given appropriate, or enough, information; information provided was poorly written or illegible; terminology used was obtuse; and healthcare providers were described as “not proactive” in offering information.\textsuperscript{17,19}

Healthcare interactions where Māori felt rushed or where interactions occurred with unfamiliar health professionals who had not properly introduced themselves led to whānau feeling disempowered and misinformed about how to best take care of their wellbeing.\textsuperscript{21,22} Māori feel reluctant to complain and powerless, and as if they are “a nuisance” when asking questions from healthcare practitioners.\textsuperscript{23}

Hostile healthcare environment. The literature demonstrates how Māori experience the healthcare environment as hostile, disempowering and alienating. Māori are aware of previous negative experiences (both personal and vicarious via whānau), including media reporting on racism in health, which diminishes trust in the health system and social services.

Table 1: Literature search inclusion and exclusion criteria.

<table>
<thead>
<tr>
<th>Inclusion</th>
<th>Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language: English language</td>
<td>Language: non-English</td>
</tr>
<tr>
<td>Dates: 2000–2020</td>
<td>Dates: prior to 2000 or published after July 2020, as analysis was undertaken in September 2020</td>
</tr>
<tr>
<td>Population: Māori adults defined as 18 years of age + with or without non-Māori participants, which includes parents accessing care for their children</td>
<td>Population: children and non-Māori adults 18+</td>
</tr>
<tr>
<td>Geographic: Aotearoa New Zealand</td>
<td>Geographic: International</td>
</tr>
<tr>
<td>Setting: hospital and outpatient</td>
<td>Setting: primary and community care</td>
</tr>
<tr>
<td>Study type: peer-reviewed, qualitative and quantitative</td>
<td>Study type: case reports, letters, books, dissertations and editorials</td>
</tr>
<tr>
<td>Intervention: attendance at hospital and outpatient services and factors associated</td>
<td>Intervention: does not review attendance at hospital and outpatient services and factors associated</td>
</tr>
<tr>
<td>Outcome: must not be descriptive only; must have some critical thinking to elucidate drivers of experience</td>
<td>Outcome: descriptive only; no critical thinking to elucidate outcomes</td>
</tr>
<tr>
<td>Lead author, date</td>
<td>Title</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Anderson, A. 2017</td>
<td>Whānau perceptions and experiences of acute rheumatic fever diagnosis for Māori in Northland, New Zealand</td>
</tr>
<tr>
<td>Anderson, A. 2019</td>
<td>Mismatches between health service delivery and community expectations in the provision of secondary prophylaxis for rheumatic fever in New Zealand</td>
</tr>
<tr>
<td>Barker, C. 2016</td>
<td>Pathways to ambulatory sensitive hospitalisations for Māori in the Auckland and Waitemata regions</td>
</tr>
<tr>
<td>Bolitho, S. 2006</td>
<td>Experiences of Māori families accessing health care for their unwell children: a pilot study</td>
</tr>
<tr>
<td>Makowharemahihi, C. 2019</td>
<td>Initiation of maternity care for young Māori women under 20 years of age</td>
</tr>
<tr>
<td>Corbett, S. 2014</td>
<td>Barriers to early initiation of antenatal care in a multi-ethnic sample in South Auckland, New Zealand</td>
</tr>
<tr>
<td>Cram, F. 2003</td>
<td>Mapping the themes of Maori talk about health</td>
</tr>
<tr>
<td>Dew, K. 2015</td>
<td>Dissonant roles: The experience of Māori in cancer care.</td>
</tr>
<tr>
<td>Dhunna, S. 2018</td>
<td>An Affront to Her Mana: Young Māori Mothers’ Experiences of Intimate Partner Violence</td>
</tr>
<tr>
<td>Ellison-Loschmann, L. 2015</td>
<td>Barriers to and delays in accessing breast cancer care among New Zealand women: disparities by ethnicity.</td>
</tr>
<tr>
<td>Frey, R. 2013</td>
<td>“Where do I go from here”? A cultural perspective on challenges to the use of hospice services</td>
</tr>
<tr>
<td>Hutchinson, P. 2015</td>
<td>Factors Influencing Outpatient Cardiac Rehabilitation Attendance</td>
</tr>
<tr>
<td>Lead author, date</td>
<td>Title</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kerr, S. 2010</td>
<td>Kaupapa Maori Action Research to improve heart disease services in Aotearoa, New Zealand</td>
</tr>
<tr>
<td>Lovell, S. 2007</td>
<td>Sociocultural barriers to cervical screening in South Auckland, New Zealand</td>
</tr>
<tr>
<td>Masters-Awatere, B. 2019</td>
<td>Whānau Māori explain how the Harti Hauora Tool assists with better access to health services</td>
</tr>
<tr>
<td>Pitama, S. 2003</td>
<td>Exploring Maori health worker perspectives on colorectal cancer and screening</td>
</tr>
<tr>
<td>Rahiri, J-L. 2020</td>
<td>Enhancing responsiveness to Māori in a publicly funded bariatric service in Aotearoa New Zealand</td>
</tr>
<tr>
<td>Reid, J. 2016</td>
<td>The significance of socially-assigned ethnicity for self-identified Māori accessing and engaging with primary healthcare in New Zealand. Health</td>
</tr>
<tr>
<td>Stokes, T. 2019</td>
<td>Improving access to health care for people with severe chronic obstructive pulmonary disease (COPD) in Southern New Zealand: qualitative study of the views of health professional stakeholders and patients</td>
</tr>
<tr>
<td>Walker, R.C. 2019</td>
<td>Patients’ Experiences of Community House Haemodialysis: A Qualitative Study</td>
</tr>
<tr>
<td>Walker, T. 2008</td>
<td>The road we travel: Māori experience of cancer</td>
</tr>
<tr>
<td>Wilson, D. 2012</td>
<td>Indigenous hospital experiences: a New Zealand case study</td>
</tr>
<tr>
<td>Wright, T. 2018</td>
<td>Patient experience of a psychiatric Mother Baby Unit</td>
</tr>
</tbody>
</table>
generally, Māori find the system hard to navigate, feel uncomfortable and isolated as inpatients, disrespected by healthcare staff who mispronounce names and discriminate against by being “badgered” about health-risk behaviours like smoking. A study by Wilson et al (2012) found that these factors led to Māori seeking an early discharge from hospital at higher rates than non-Māori. Makowharemahihi et al (2019) found that Māori would not seek care from providers who were perceived as having negative views towards Māori or had provided negative experiences in the past.

**Transition from primary care to hospital services.** Although we excluded papers solely focused on primary care or community services, a small number of articles commented on the experience of Māori in community and primary care and the impact on hospital service access. Common primary care barriers included poor relationships with general practitioners (GPs), no available GPs, not being registered with a GP, no access to a GP known as “culturally safe” and difficulty accessing screening in primary care.

Barker et al, who looked into the factors impacting on Māori presenting to hospitals with conditions that could have been managed by a GP, found that an inability to get an appointment within 24 hours, a lack of transport and finance, the inability to pay for prescriptions and pre-existing debt with GPs were common reasons to seek healthcare at hospitals rather than general practice.

**Racism** featured in the literature, both in the experiences of whānau and in the feedback from health practitioners. Providers did not account for Māori cultural beliefs, which was particularly noticeable within breast or cervical cancer screening and prostate exams. Māori describe how being identified as Māori is negatively received in a predominantly Pākehā health system and find that socially assigned ethnicity, based on phenotypic markers of skin colour or facial features, was understood and experienced as discrimination. Some providers recounted their experiences with Māori patients in such a way that highlighted providers’ focus on clinical risk factors (rather than social determinants) and their use of a victim-blaming positioning, suggesting that Māori patients obfuscated and wasted their time.

A study exploring Māori health worker perspectives of colorectal screening participants described Māori as being actively discouraged from attending screening by non-Māori health workers despite qualifying for screening.

**Practical barriers** included financial barriers, lack of access to transport to attend appointments, lack of sick leave or support from employers to attend appointments and lack of childcare.

**Facilitators**

**Whakawhanaungatanga** represents the importance of relational interactions and relationship building with healthcare providers. It is an important facilitator to accessing healthcare services for Māori. More than rapport, whakawhanaungatanga implies a reciprocal relationship, exemplified in the health setting as mutual sharing to create a relationship built on trust. In the literature this was described variously as rapport, the ability to communicate and the ability to be included. Whakawhanaungatanga was found in friendly interactions and the provision of information that was readily available, appropriate and understood.

Established relationships across the healthcare pathway that allowed seamless integration for Māori moving between multiple services were positive.

Whānau involvement was seen positively by most Māori participants. However, whānau often felt like a “nuisance” in hospital environments and generally reported feeling unwelcome. Having whānau present in hospital allowed family members to provide a care role in what felt like a hostile environment. This included personal cares such as bathing and supporting whānau with toileting. Whānau also talked about the need to advocate for their family members by pushing nurses and doctors for more information about diagnosis, treatment and procedures,
as well as encouraging patients to seek healthcare.\textsuperscript{22,23} Māori providers were praised for “being available” to patients and their whānau in ways that were not reported as frequently for mainstream providers.\textsuperscript{24,25}

**Manaakitanga** was an important facilitator for Māori to access hospital services. It includes personal attributes of staff with caring attitudes seen as more important than clinical skills, and health professionals who made themselves available to answer questions were rated highly.\textsuperscript{23} Māori valued providers who had the knowledge to provide a good service, to take appropriate action to treat whānau and genuinely cared for their wellbeing as Māori.\textsuperscript{21,32} Peer support was an important facilitator, especially for Māori with chronic and incurable conditions. Community treatment options were strongly preferred over hospital-based treatment, where appropriate.\textsuperscript{34}

**Ethnic concordance** between healthcare providers and patients was important. Māori consistently reported positive experiences with Māori providers who were able to understand and interpret the complex issues that affect whānau Māori.\textsuperscript{24,25} The Māori workforce in general (including Māori providers) was seen as an important facilitator to access services.\textsuperscript{21,25} In Rahiri et al, a Māori participant offering suggestions for how to improve bariatric surgery services for Māori said, “You know if you speak to a Māori doctor or a Māori nurse, you get to be whānau and it’s a better feeling.”\textsuperscript{35} Māori models of health and tikanga-based frameworks were acknowledged as key facilitators by several studies.\textsuperscript{21,27,35} In one study, Māori recognised that mimicking norms associated with whiteness, such as presenting to the doctor in tidy clothes, facilitated access to services, and that social assignment as Pākehā (for fair-skinned Māori) aided in gaining positive and less-judgemental interactions with health practitioners.\textsuperscript{36} Similarly, Pitama et al (2012) found that Māori health workers who possess high health literacy (defined as knowledge of the public health system, a Western model of healthcare and service delivery) were most effectively able to support whānau to access timely and appropriate care.\textsuperscript{21}

**Practical facilitators** were found to originate predominantly, though not exclusively, from the involvement of Māori providers. This included transport to appointments, delivery of prescriptions, having an ambulance alarm connected in the house after an admission to hospital, provision of car seats and navigators aiding with the identification of appropriate healthcare services and access to tikanga Māori services.\textsuperscript{19,25,32} Practical facilitators arising from non-Māori provider input included flexible payment options in primary care and flexible community integrated models of care.\textsuperscript{20,33}

**Discussion**

This literature review summarises evidence on access to hospital services for Māori via ten themes including barriers experienced by whānau Māori (poor communication, hostile healthcare environment, primary care barriers, racism and practical barriers) and facilitatory factors (practical facilitators, whakawhanaungatanga, whānau, manaakitanga and cultural safety). The studies included are diverse in methodology and subject matter. They were selected because they identified barriers and facilitators of access to hospital services for Māori and critically analysed these experiences.

The literature reinforces evidence that there are barriers for Māori to outpatient service attendance. Although this is well known in the literature, only a small number of articles look critically at the barriers to accessing hospital services specifically for whānau Māori. Of concern, this review found that Māori whānau experience a healthcare environment that is hostile towards them as Māori. This aligns with the findings of a recent review into the experience of Māori in the public health system by Graham and Masters-Awatere.\textsuperscript{37} This experience of hostility has been picked up by other authors who have found that Māori interpreted health practitioners’ targeting of Māori for lifestyle discussions (such as smoking) as racial stereotyping.\textsuperscript{36}

Despite a growing body of evidence of racism in healthcare, some individuals and organisations struggle to accept racism as a causal factor that can be both structurally and personally mediated.\textsuperscript{38-40} It is generally accepted that individuals can hold and act on racist views, but it has been difficult
to engage policymakers, politicians and health leaders to understand and act on the causes of, manifestations of and solutions to structural racism. As a result, surface-level interventions, such as addressing transport barriers, are often supported, whereas the more complex fundamental interventions required to identify, monitor and eliminate racism within healthcare service delivery are not. To put it simply, there is no point solving someone’s transport barrier by giving them a taxi chit if the taxi drives them towards a racist health service. Therefore, it is imperative to mitigate problems of access, in addition the problems of quality and cultural safety in the healthcare services being provided. Whānau have been shown to innovate within this system. Barker et al (2016) found that Māori sometimes responded to practical barriers to accessing primary care by utilising emergency departments, because they perceived that hospital-based care was better quality, incurred lower costs to whānau and mitigated a lack of convenient appointments with their GP. However, this remains concerning, as it highlights an unacceptable issue with healthcare access. Attention must be paid to the fundamental environmental and structural drivers of ethnic health inequities in both primary and secondary care if inequities for Māori are to be comprehensively addressed.

These concerns were also found in Māori experiences of culturally unsafe healthcare, despite a commitment to culturally safe care being present in district health board (DHB) operating guidelines, code of conduct agreements for health professionals, competency frameworks from professional guidelines and Medical Council of New Zealand (MCNZ) requirements. If New Zealand continues to operate healthcare services that are culturally unsafe, DHBs will be unlikely to achieve equity within their services, and health practitioners will fail to meet the standards set by their professional organisations.

Systems that privilege one group over another (eg, by attending to their cultural norms while ignoring those of other groups) are shown here to contribute to inequities in healthcare access, which can be extrapolated as contributing to Māori health inequities. In addition, Māori experiences of feeling targeted for issues like smoking and weight loss show that Māori can perceive health practitioners as having an agenda and interpret these discriminatory experiences as barriers to be overcome to receive necessary healthcare. These experiences may act cumulatively and be shared among communities so that one person’s negative experience of healthcare becomes magnified among whānau and friends. Prior negative experiences in healthcare were a key factor in the literature that prevented Māori from accessing healthcare services when in need.

Facilitators are important to understand in tandem with barriers. The literature identified reciprocal relationships (whanaungatanga) and care for patients as Māori (manaakitanga) as facilitatory factors for hospital service access. This is consistent with Māori-led interventions such as the Hui Process designed for healthcare settings and taught at medical schools in New Zealand as a way of bringing whanaungatanga into the clinical setting. This is a tool that has been developed for utilisation by any healthcare professional irrespective of whether they are Māori or non-Māori and may offer tangible solutions for individuals and healthcare organisations aiming for pro-equity, culturally-safe healthcare delivery.

The literature promotes manaakitanga as an important facilitator of access for Māori, with ethnic concordance between Māori health practitioners and patients providing a positive impact. The importance of supporting and maintaining a pipeline of Māori health professionals remains paramount. This starts at high school with outreach programmes in schools and continues through to the social justice/equity admission processes of health professional training and the commitment of specialty training colleges to increasing the numbers of Māori trainees. It is also important to see the growth of the Māori clinical workforce mirrored in the appointment of Māori to senior executive and governance roles within the health system.

The strengths of this study lie in the Kaupapa Māori positioning and the methods of analysis and the focus on Māori
experiences in the public healthcare system within hospital settings. By employing a Kaupapa Māori critical analysis, we were able to interrogate the literature in a way that is meaningful for Māori. This is important to enable correct and meaningful identification of inequities, barriers and facilitators.

Study limitations include the narrow inclusion criteria. Our focus was specifically on Māori and the New Zealand health system. We acknowledge that we may have excluded a broader literature base (including grey literature) that is still relevant, but it was outside the scope of this literature review. Therefore, these findings may not be generalisable to other populations. However, we expect the findings to be broadly relevant to other Indigenous populations who face similar structural barriers.

Conclusion

This literature review identifies common barriers to and facilitators of access to hospital services for Māori. It confirms what is well known about practical barriers and facilitators to access and contributes to an emerging body of evidence about how racism and culturally unsafe services prevent Māori from accessing health services. The facilitators identified provide a potential roadmap for the redesign of services so they are accessible and effective for Māori. If the barriers identified within this literature review are addressed and the facilitators identified are used to guide service delivery, it may be possible for the Ministry of Health, DHBs and professional organisations to meet their commitment to provide healthcare services that are compliant with the Treaty of Waitangi, pro-equity, anti-racist and culturally safe for Māori.
Competing interests:
Nil.

Acknowledgements:
We are grateful to the Auckland Medical Research Foundation for funding to provide open access for this paper.

Author information:
Emma Espiner: MBChB, BA, RMO, Middlemore Hospital, Auckland.
Sarah-Jane Paine: PhD, Senior Lecturer, Te Kupenga Hauora Māori, University of Auckland, Auckland.
Maree Weston: FRACS, MBChB, General Surgeon, Middlemore Hospital, Auckland.
Elana Curtis: NZCPHM, MD, MPH, MBChB, BHB, Associate Professor, Te Kupenga Hauora Māori, University of Auckland, Auckland.

Corresponding author:
Dr Emma Espiner, RMO, Middlemore Hospital, Auckland ewehipeihana@gmail.com

URL:

REFERENCES


10. Walter M. Indigenous statistics : a quantitative research methodology / Maggie Walter and Chris Andersen. Left Coast Press Walnut Creek, CA; 2013

11. Covidence systematic
review software [Internet] [cited 2020] Available from: www.covidence.org


57850903374476. PMID: 20017040.


Access to primary care services using public transport in Ōtautahi Christchurch

Molly Hartley, Angela Curl, Rose Crossin, Christina McKerchar

ABSTRACT

AIMS: Lack of transport is a contributor to poor access to healthcare and missed appointments. This research aimed to understand the accessibility of primary care for patients using public transport in Ōtautahi Christchurch, and to describe spatial and social distribution.

METHODS: We measured access to primary care using geospatial analysis based on the time taken to reach the nearest general practice, the number of practices accessible within given time thresholds and the frequency of public transport services. Results are disaggregated by ethnicity, age, socioeconomic deprivation and car ownership.

RESULTS: The poorest levels of access were in areas with the least deprivation and a greater NZ European population. Children aged 5–14 had low levels of access. Only 58.4% of the population in the most deprived areas had access to high-frequency bus services.

CONCLUSIONS: This study highlights connectivity gaps between public transport and primary healthcare for key groups known to have a greater dependence upon public transport and poorer health outcomes. From an equity perspective, it highlights the need for further investigation into transport and health solutions to improve access to primary care for lower socioeconomic groups.

In Aotearoa, there is long-standing evidence of enduring health inequities related to socioeconomic status and ethnicity. Access to healthcare is a social determinant of health, and differences in the availability and attendance at healthcare appointments contribute to inequitable health outcomes. Appointments that are missed or that cannot be attended lead to the later diagnosis and treatment of disease, which worsens disease outcomes, quality of life and mortality rates. Primary care is a crucial part of the healthcare system and the predominant vehicle in New Zealand by which we treat acute illness, manage chronic conditions, control access to publicly funded secondary services, promote population health and reduce health inequities.

Lack of transportation is consistently cited as a problem to accessing primary healthcare. In 2019/2020, 6.6% of Māori adults missed general practitioner (GP) appointments due to lack of transport, compared with 2.0% of NZ European adults. Māori were 2.9 times more likely than non-Māori to have unmet need on the basis of transport-related access, and Pacific peoples were 2.5 times more likely than non-Pacific peoples. Adults in the most deprived areas were 4.1 times more likely to miss an appointment due to lack of transport than those in the least deprived areas, and children were slightly less likely across all ethnicities and deprivation indices compared to their adult counterparts.

Although rates of car ownership in New Zealand are high, previous studies have shown that up to 30% of New Zealanders do not have access to a car. Unequal access to private vehicles among different population groups underpins the importance of evaluating access by way of public transport. Public transport helps to address health inequities by providing access to primary care and reducing the environmental impact of transport to healthcare,
which contributes to a more sustainable healthcare system. Availability of care tends to be inversely proportional to need. Therefore, the location of primary care services in relation to population need could be implicated in some of the reported difficulties accessing care among different groups. A recent study in Christchurch examined accessibility to health and social services by car and on foot. The results suggested a rural–urban gradient, with poorer availability of services further away from the central city (although one notable exception was the more deprived eastern suburbs, which had poorer access relative to centrality, which is suggestive of social inequity in accessibility). Previous studies in Auckland have found that public transport provision prioritises higher income areas and services are not of sufficient frequency to meet need. These studies also noted a significant opportunity to enhance spatial access to healthcare by increasing public transport provision in areas of high need.

The aim of this study is to undertake a spatial analysis of access to primary healthcare for patients using public transport in Ōtautahi Christchurch, and to examine whether accessibility varies across neighbourhoods, populations and indices of deprivation.

Methods

The study area was defined by the extent of the public transport (bus and ferry) network serving the city of Christchurch and surrounding areas (Figure 1), including Rangiora to the north, Rolleston and Lincoln to the south, hereafter referred to as “Greater Ōtautahi.” The public transport system is predominantly bus based, with one ferry service.

We undertook a spatial analysis of public transport accessibility to primary care (specifically general practices) within Greater Ōtautahi and explored the relationship with population demographic data.

General practitioner (GP) locations were provided by the Ministry of Health (MoH) based on Healthpoint data. Public transport stops and timetable data were obtained through the Google Transit Feed Specifi-
For the week of 9 November 2020. OpenStreetMap road network data were used. Population data were sourced from the 2018 census and NZDep2018.

To establish the need for the public transport network in providing access, we used the road network distance, as opposed to Euclidean distance used in previous studies, to undertake preliminary analysis and ascertain the population living within 400m and 800m of a GP or medical centre. An 800m walking buffer has previously been used as an upper limit for accessing primary care on foot.

For the main analysis, we report three measures of access: time taken to reach the nearest service; the number of options within a given time threshold; and frequency of public transport services. All results are disaggregated by population age, ethnicity, deprivation and household car ownership.

Time taken to travel to the nearest service

Network Analyst and the Transit Feed toolset in ArcGIS Pro were used to calculate services areas around GP locations. Given the focus on access provided by the public transport system, we clipped the road network to allow a maximum of 400m (five minutes at 4.5km/hr) walk at either end of the public transport journey. These metrics were informed by evidence that people will walk up to 400m to public transport stops or stations, a value typically used by urban planners. An upper limit of 800m has been suggested, with an inverse relationship between required walking distance and public transport use becoming marked beyond the 800m walking threshold.

We constructed service areas showing the population able to access a GP within 10, 15, 20 and 30 minutes by walking and public transport. Service areas were overlaid with sociodemographic data at Statistical Area 1 (SA1) level using proportional overlap.

The number of options available to people within a specified time threshold

People often choose to attend a GP other than the nearest available. To account for the number of options available to the population, we calculated the number of GPs within each time threshold from the meshblock centroids (centre-points of statistical area units). Results are reported according to the meshblock deprivation level.

Frequency analyses

In addition to measures of time taken to travel, public transport frequency is also an important measure. Stops with frequent services are generally considered to be those with four or more trips per hour. We isolated stops with a minimum of four departures per hour and created 400m buffers around them to identify the proportion of the population living within range of a high frequency service. Service areas were overlaid with sociodemographic data at SA1 level using proportional overlap.

Results

Preliminary analysis showed that 14% of the total population of Greater Ōtautahi lived within 400m (approximately a five-minute walking time) and 41% within 800m (a 10-minute walking time) of a GP. Given that the majority of the population do not live within a reasonable walking distance of a GP, the importance of considering access by public transport is clear.

Time to nearest GP by public transport

Figure 3 and Figure 4 show the areas of the city that fall within each of the journey time thresholds (service area polygons). For example, areas shown in light blue are within 10 minutes of the nearest GP by public transport, whereas those areas not coloured are more than 30 minutes of the nearest GP by public transport. Table 1 shows the proportion of the population that falls within each of these service areas. Overall, 39% of the population are within 10 minutes of their nearest GP by public transport and 28% of the population cannot access a GP within 30 minutes using public transport.

Table 1 shows that, across the city as a whole, the least deprived areas and NZ Europeans have poorest levels of access in terms of journey time to the nearest GP. Households without a motor vehicle (56%) are more likely to live within ten minutes of their nearest GP than households with a car (39%). Children (ages 5–14) have poorer access than those in older age groups across...
Figure 2: 400m and 800m walking buffers around medical practices.
all time thresholds. The 65+ group has access comparable to that of the general population. Young adults (ages 15–29) consistently have the best access. Despite the overall pattern of poorer access in more peripheral areas, Figure 3 shows that there are some relatively central areas with poor levels of access to GPs, particularly in the eastern suburbs.

**Number of GP options available**

Figure 5 shows the proportion of the meshblocks within each deprivation decile that has different numbers of GPs available within 15 minutes. For example, 31% of the meshblocks in decile 6 have more than four general practices accessible within 15 minutes using public transport. Across the population, 30% of meshblocks cannot access a GP using public transport within 15 minutes. When considering those with the most (4+) options, it can be seen that more deprived areas (NZDep2018 decile 6 and greater) are more likely to have four or more options accessible within 15 minutes. When looking at longer journey time thresholds (Appendix), the majority of meshblocks in all deciles (except the least deprived) have access to 4+ GPs within 30 minutes by public transport.

**Frequency analysis**

Overall, 41% of the meshblock centroids were within 400m of a high-frequency bus stop (at least four departures per hour). This varied based on deprivation, with 18% of centroids in the least deprived (decile 1) areas compared with 58% of centroids in the most deprived areas being within 400m of a high-frequency bus stop (Table 1). Of the major ethnic groups, Asian had the highest proportion of people (52%) within 400m of a high-frequency route, followed by Pasifika (47%), other (43%), Māori (42%) and European (38%). Similar to the journey time metric above, 15–29-year-olds had the best access from a service-frequency perspective, with 46% living within 400m of a higher-frequency route. Children aged 5–14 had the poorest access to a high-frequency route at 37%. Households without a vehicle (57%) were more likely to live in proximity to a high-frequency route than those with a vehicle (40%) (Table 1).

**Discussion**

This project aimed to explore public transport access to primary care in Greater Ōtautahi and fill a significant knowledge gap.
Figure 4: Areas of Greater Ōtautahi that can access a GP within 10, 15, 20 and 30 minutes using public transport (full study area extent).

Figure 5: Proportion of meshblocks that have 1, 2, 3 or 4+ medical practices within 15 minutes using public transport, by NZDep2018 X² (36, N=4,923)=733.48, p<0.01.
Table 1: Population (%) with access to (a) a GP within journey time thresholds by public transport and (b) a high-frequency bus stop, by demographic group and deprivation.

<table>
<thead>
<tr>
<th>Demographic Group</th>
<th>Greater Ōtautahi</th>
<th>Time to nearest GP &lt;10 min</th>
<th>Time to nearest GP &lt;15 min</th>
<th>Time to nearest GP &lt;20 min</th>
<th>Time to nearest GP &lt;30 min</th>
<th>High-frequency stop within 400m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>452,607</td>
<td>177,879 (39%)</td>
<td>263,412 (58%)</td>
<td>301,846 (67%)</td>
<td>324,653 (72%)</td>
<td>184,287 (41%)</td>
</tr>
<tr>
<td>European</td>
<td>362,730</td>
<td>133,966 (37%)</td>
<td>201,757 (56%)</td>
<td>232,883 (64%)</td>
<td>252,300 (70%)</td>
<td>139,367 (38%)</td>
</tr>
<tr>
<td>Māori</td>
<td>43,965</td>
<td>17,453 (40%)</td>
<td>26,383 (60%)</td>
<td>30,354 (79%)</td>
<td>32,568 (74%)</td>
<td>18,520 (42%)</td>
</tr>
<tr>
<td>Asian</td>
<td>59,259</td>
<td>30,933 (52%)</td>
<td>42,153 (71%)</td>
<td>46,572 (79%)</td>
<td>48,593 (82%)</td>
<td>30,930 (52%)</td>
</tr>
<tr>
<td>Pasifika</td>
<td>15,597</td>
<td>6,627 (42%)</td>
<td>10,231 (66%)</td>
<td>11,794 (76%)</td>
<td>12,506 (80%)</td>
<td>7,302 (47%)</td>
</tr>
<tr>
<td>Other (MEELA, other, New Zealander)</td>
<td>18,720</td>
<td>7,947 (42%)</td>
<td>11,414 (61%)</td>
<td>12,894 (69%)</td>
<td>13,708 (73%)</td>
<td>8,076 (43%)</td>
</tr>
<tr>
<td>0–4</td>
<td>26,226</td>
<td>9,984 (38%)</td>
<td>15,118 (58%)</td>
<td>17,417 (66%)</td>
<td>18,765 (72%)</td>
<td>10,409 (40%)</td>
</tr>
<tr>
<td>5–14</td>
<td>54,915</td>
<td>19,355 (35%)</td>
<td>30,008 (55%)</td>
<td>34,985 (64%)</td>
<td>38,040 (69%)</td>
<td>20,166 (37%)</td>
</tr>
<tr>
<td>15–29</td>
<td>98,004</td>
<td>44,864 (46%)</td>
<td>63,072 (64%)</td>
<td>70,495 (72%)</td>
<td>74,463 (76%)</td>
<td>45,064 (46%)</td>
</tr>
<tr>
<td>30–64</td>
<td>205,164</td>
<td>78,258 (38%)</td>
<td>116,568 (57%)</td>
<td>134,030 (65%)</td>
<td>144,871 (71%)</td>
<td>81,107 (40%)</td>
</tr>
<tr>
<td>65+</td>
<td>68,130</td>
<td>25,253 (37%)</td>
<td>38,491 (56%)</td>
<td>44,779 (66%)</td>
<td>48,378 (71%)</td>
<td>27,457 (40%)</td>
</tr>
<tr>
<td>Total households</td>
<td>167,514</td>
<td>67,775 (40%)</td>
<td>99,414 (59%)</td>
<td>113,402 (68%)</td>
<td>121,822 (73%)</td>
<td>69,487 (42%)</td>
</tr>
<tr>
<td>No motor vehicles</td>
<td>10,086</td>
<td>5,697 (56%)</td>
<td>7,669 (56%)</td>
<td>8,268 (63%)</td>
<td>8,572 (69%)</td>
<td>5,734 (57%)</td>
</tr>
<tr>
<td>1+ motor vehicles</td>
<td>146,944</td>
<td>57,085 (39%)</td>
<td>84,822 (58%)</td>
<td>97,306 (66%)</td>
<td>105,014 (71%)</td>
<td>58,706 (40%)</td>
</tr>
<tr>
<td>Total meshblocks</td>
<td>4,923</td>
<td>2,206 (45%)</td>
<td>3,451 (70%)</td>
<td>3,393 (81%)</td>
<td>4,443 (90%)</td>
<td>2,001 (41%)</td>
</tr>
<tr>
<td>NZDep2018 1</td>
<td>730</td>
<td>179 (25%)</td>
<td>349 (48%)</td>
<td>417 (57%)</td>
<td>577 (79%)</td>
<td>133 (18%)</td>
</tr>
<tr>
<td>NZDep2018 2</td>
<td>527</td>
<td>165 (31%)</td>
<td>299 (57%)</td>
<td>356 (68%)</td>
<td>440 (83%)</td>
<td>141 (27%)</td>
</tr>
<tr>
<td>NZDep2018 3</td>
<td>470</td>
<td>181 (39%)</td>
<td>303 (64%)</td>
<td>361 (77%)</td>
<td>397 (84%)</td>
<td>169 (36%)</td>
</tr>
<tr>
<td>NZDep2018 4</td>
<td>464</td>
<td>198 (43%)</td>
<td>315 (68%)</td>
<td>375 (81%)</td>
<td>402 (87%)</td>
<td>184 (40%)</td>
</tr>
<tr>
<td>NZDep2018 5</td>
<td>517</td>
<td>293 (57%)</td>
<td>393 (76%)</td>
<td>456 (88%)</td>
<td>490 (95%)</td>
<td>233 (45%)</td>
</tr>
<tr>
<td>NZDep2018 6</td>
<td>498</td>
<td>275 (55%)</td>
<td>402 (81%)</td>
<td>450 (90%)</td>
<td>477 (96%)</td>
<td>258 (52%)</td>
</tr>
<tr>
<td>NZDep2018 7</td>
<td>507</td>
<td>274 (54%)</td>
<td>410 (81%)</td>
<td>465 (92%)</td>
<td>486 (96%)</td>
<td>258 (51%)</td>
</tr>
<tr>
<td>NZDep2018 8</td>
<td>476</td>
<td>249 (52%)</td>
<td>384 (81%)</td>
<td>431 (91%)</td>
<td>462 (97%)</td>
<td>224 (47%)</td>
</tr>
<tr>
<td>NZDep2018 9</td>
<td>532</td>
<td>274 (52%)</td>
<td>413 (78%)</td>
<td>464 (87%)</td>
<td>496 (93%)</td>
<td>283 (53%)</td>
</tr>
<tr>
<td>NZDep2018 10</td>
<td>202</td>
<td>105 (52%)</td>
<td>163 (81%)</td>
<td>186 (92%)</td>
<td>193 (96%)</td>
<td>118 (58%)</td>
</tr>
</tbody>
</table>
gap related to primary healthcare access in New Zealand’s second-largest city. Across all three metrics of accessibility (journey time to nearest GP; number of GPs within different time thresholds; proximity to frequent public transport services), we found poor levels of accessibility across the study area, which is problematic from a health equity and sustainability perspective. Despite overall poor access, results indicate that public transport provision is greatest in more deprived areas, which is consistent with previous international research.\textsuperscript{1,2,3,4}

Overall, public transport accessibility to primary healthcare across the city is poor, with almost 30% of the population in Greater Ōtautahi being more than 30 minutes from their nearest GP by public transport. In comparison, 99.5% of England’s urban population can reach a GP within 30 minutes by public transport.\textsuperscript{25} Although 58% of the Greater Ōtautahi population can access a GP within 15 minutes using public transport, this compares to 79% of the urban population of England.\textsuperscript{25} Research elsewhere has also reported considerably greater levels of access to GPs by walking in urban areas than we found here.\textsuperscript{11} Previous research suggests that 99% of the population of Greater Ōtautahi can reach a GP within 10 minutes of driving,\textsuperscript{11} whereas we found that only 41% can reach a GP within 10 minutes of walking, and that 39% can use public transport to reach a GP within 10 minutes. This discrepancy in the level of accessibility to primary care between different modes of transport is problematic from an equity perspective, given patterns of car ownership and access across the population, and from a sustainability perspective, given that reducing levels of car dependence requires adequate accessibility by other modes. Those in more deprived areas are more likely to have a greater number of options of GP practices accessible by public transport (Figure 5).

The overall frequency of services was low, which is particularly problematic for those living in the most deprived deciles who might be more likely to rely on public transport due to lower rates of household car ownership. In the most deprived areas, 42% of the population are more than 400m from a high-frequency service, and 56% of households own one or no vehicles to serve an average household size of 3.7 (2018 census). At a city level, levels of accessibility to primary care reflect the social geography of the city, in that those living in more peripheral, affluent peri-urban areas have the poorest levels of access, which is consistent with previous research.\textsuperscript{1,2,3,4} However, even in more central areas there are levels of poorer accessibility for particular groups, particularly in the eastern suburbs (Figure 3), as previously identified.\textsuperscript{11} There are comparatively poor levels of access for children (aged <15). The 65+ group, who have a greater dependence on public transport\textsuperscript{11} and who often have higher health needs, had access levels comparable with those of the general population (Table 1).

It is not straightforward to assume that these city-level patterns mean that there are no problems of access among disadvantaged populations. Poorer public transport access in peri-urban areas may be less likely to translate to unmet need given the high socioeconomic status of populations in these areas and high levels of household car ownership. It is therefore important to consider accessibility relative to need. Data are not currently available on the usage of public transport to access healthcare, but future studies should seek to understand the extent to which populations use public transport to access healthcare and how that relates to availability of services. Studies such as ours, which consider potential accessibility to healthcare based on time/distance separation of people from facilities, are common and important in understanding the distribution of resources at the population level. However, despite known inequities in realised access, or utilisation, and health outcomes, we do not find corresponding inequities in provision of transport to primary care. This suggests that other approaches are also needed.

A pro-equity policy approach would improve the situation of the most disadvantaged first.\textsuperscript{26} Future studies of access to healthcare might be to focus on transport accessibility among populations with known health and utilisation inequities. Future studies could consider setting minimum levels of access relative to need and urbanity, with recognition that closer proximity to services can be expected in denser urban areas and that improving provision of
primary healthcare in more deprived urban areas can reduce health inequities.1,27

Objective measures of spatial accessibility make assumptions about the ability of individuals in terms of mobility and the appropriateness or affordability of both public transport and healthcare services. However, older people may experience reduced mobility, meaning their journey times are typically longer than what is modelled, large families may not be able to afford public transport services and some people may experience racism and safety concerns on public transport. Consideration needs to be given to non-spatial barriers to accessing care, such as affordability, acceptability and appropriateness of services, recognising that the nearest facilities may not actually be considered accessible from the patient perspective. Furthermore, we have not considered the capacity of practices relative to population, which is important given variation in the size and resources available at different practices. As we noted in the results, the relatively poor access to GPs in some central areas suggests a need for further research into the density of primary care services relative to population need.

Although measures of access to the nearest service are typically used, they do not reflect the usage of primary care in New Zealand. In a study using patient registration data in the Waikato it was found that almost 70% of people bypassed their nearest service.21 A number of service factors were identified as explanations for this bypassing of the nearest service, such as hours, clinic fees, after hours and provision of Māori health services.21 It is therefore important to consider the number of different options available to the population, especially where the nearest service is bypassed for reasons of availability of appointments, cost or Māori health services. Indeed, the Waikato study found that non-European ethnic groups were most likely to bypass the nearest service, implicating the need for not only spatial proximity, but availability of culturally appropriate and acceptable services.21 Although we did not explicitly consider the services provided at different GP locations, we considered the number of options available as a proxy for this.

Understanding levels of non-car access across the population is important from a sustainable transport and healthcare system perspective. A high level of car dependence in New Zealand has negative effects on individual, population and environmental health28 through reduced physical activity and increases in associated chronic illnesses, air and noise pollution, climate change, road safety, social isolation and exclusion from accessing essential services such as employment, education and healthcare for those without a car. The results of this study suggest that the levels of access to primary care through walking or public transport are not sufficient for a major urban area, potentially leading to forced car ownership29 and reducing disposable income for other necessities, including healthcare. As the transport and health systems shift towards meeting environmental sustainability objectives, it is vital to understand how the existing systems can support reduced car dependence without widening existing inequities in accessing healthcare. Our findings suggest that this requires consideration of the existing public transport provision and the locations of GP services across the city. Strategic planning of the location of primary healthcare services relative to population need to improve access could help address equity and sustainability issues in the health system and should be considered as part the current health system reforms.

Conclusion

The findings of this study emphasise the need to prioritise the most vulnerable groups when planning improvement in the connectivity between people, the public transport system and primary healthcare. Despite pervasive issues of inequity in health outcomes and utilisation of healthcare services, there is limited evidence of disparities in accessibility when considered at a city level. However, more consideration needs to be given to the level of access relative to need. There is the potential to improve access for disadvantaged groups, and thus improve health outcomes and address health inequities. Improving public transport accessibility can also help to meet health system sustainability objectives.
Competing interests:
The authors report studentship from University of Otago Transport Research Network during the conduct of the study.

Acknowledgements:
This research was undertaken as a summer studentship funded by the University of Otago Transport Research Network. We thank the following for their assistance with data, guidance and community outreach: Karen Keelan, University of Otago Christchurch; Iaean Cranwell and Tane Apanui, Environment Canterbury; Jenna Manahi, Canterbury DHB; Ben Adams, University of Canterbury; John McCarthy, Ministry of Health. We acknowledge the 2018 New Zealand Census and Otago University's New Zealand Index of Deprivation for the population data used, and ESRI, the manufacturer of the Geographic Information software used.

Author information:
Molly Hartley: 5th year Medical Student, University of Otago Christchurch.
Angela Curl: Senior Lecturer, Department of Population Health, University of Otago Christchurch.
Rose Crossin: Lecturer, Department of Population Health, University of Otago Christchurch.
Christina McKerchar: Lecturer, Department of Population Health, University of Otago Christchurch.

Corresponding author:
Dr Angela Curl, Department of Population Health, University of Otago Christchurch, 34 Gloucester Street, Christchurch, 8013, 03 364 36 26
angela.curl@otago.ac.nz


REFERENCES
12. Nazari Adli S, Chowdhury


Cancellation of elective orthopaedic procedures is not a benign practice and is often preventable
Matthew McCall, Mike Peebles, N Amir Sandiford

ABSTRACT

AIM: To quantify the reasons for cancelled elective orthopaedic operations, in particular hip and knee arthroplasty. Secondary aims included defining how long these patients had to wait until their operation, and investigating the impact delayed surgery has on patients in terms of re-presentation to healthcare services.

METHODS: We reviewed hospital records for all cancelled elective orthopaedic operations over a two-year period at a secondary hospital in New Zealand, investigated the reasons for these cancellations, wait times and comorbidities and compared total hip and knee arthroplasty to other elective orthopaedic operations.

RESULTS: 76 orthopaedic elective cases were cancelled. 28 (37%) were hip and knee arthroplasties. 71% of these arthroplasties were cancelled due to hospital related factors (bed availability, operating theatre capacity). Mean wait time for an eventual operation was 56.20 days. Hip joint arthroplasties waited significantly longer (76.10 days, p=0.008). 10% of patients awaiting hip and knee arthroplasties re-presented to healthcare services before their eventual operation.

CONCLUSIONS: Patients are having their elective hip and knee arthroplasty operations cancelled for hospital-related reasons that could be avoidable. There are significant wait times contributing to decreased quality of life and may be contributing to avoidable re-presentation with its associated demand on healthcare services.

OSTEOARTHRITIS is the commonest form of arthritis. It causes debilitating pain, impairment of function, significant physical disability and consequences to mental health. The disease itself is characterised by loss of articular cartilage, which leads to damaged bone and inflammation. Osteoarthritis affects approximately 50% of people aged over 60 years and almost everyone aged over 80 years.

Total joint arthroplasty, in particular hip and knee arthroplasty, are cost-effective procedures that significantly improve patients’ mobility, independence and quality of life. The ageing population has led to an increase in demand for arthroplasty worldwide, and particularly in New Zealand, where the population is ageing and the burden of osteoarthritis is becoming more significant.

Timely access to necessary elective surgery is critical for patients’ symptomatic control, functioning, independence and wellbeing. In each region in New Zealand there are strict qualifying criteria before patients can access and undergo these procedures. While awaiting surgery, these patients are at risk of having progression of symptoms and re-presenting to healthcare services with sequelae of their condition: for example, pain, falls or over-use of opioid analgesia. Cancellation of operations is also distressing for patients and their families and causes significant anxiety and depression.

These cancellations are disruptive and potentially costly for the healthcare system as a result of loss of funding specifically for these procedures as well as inefficiency related to underutilised operating theatres.
Internationally, and particularly in New Zealand, there is a paucity of data examining the impact of cancelled elective orthopaedic procedures.

The aim of this study was to look at the incidence and cause of cancellation of elective orthopaedic procedures, specifically total hip and knee joint replacement, in a regional New Zealand hospital over a two-year period. The secondary aim was to follow these patients’ path between cancellation and having their procedure, focusing specifically on re-presentations to healthcare services as a result of their symptomatic osteoarthritis.

We hypothesised that, among orthopaedic cancellations, hip or knee joint arthroplasty would represent a significant proportion of cancellations. We further hypothesised that cancellation of these procedures would mean lengthy delays in eventual surgery and a need for further medical attention between the cancellation and eventual surgery.

**Methods**

Southland Hospital is a secondary hospital with 157 beds and approximately 1,500 staff offering both acute and elective healthcare. It services a fixed population of 108,000 people, as well as the transient tourism population of Queenstown and the majority of the wider Queenstown-Lakes District. It carries out on average 5,000 operations per year and sees 30,000 presentations through the emergency department annually. On average, 120 primary joint arthroplasties are performed, although there are 300–340 planned primary arthroplasty procedures per year based on scheduling.

A retrospective study of cancelled elective orthopaedic operations at Southland Hospital was performed. Cancelled orthopaedic procedures were identified between June 2017 and July 2019 using hospital records and reports. Inclusion criteria were cases that were scheduled for an elective orthopaedic procedure. We defined “elective” as a procedure that was scheduled in advance (ie, not requiring an immediate operation).

Data were generated from our clinical records department. Records were then cross-referenced with an electronic patient record management system (Health Connect South) to determine which patients had been scheduled for elective orthopaedic procedures. The following data were recorded for each case:

- Planned operation
- Date of planned operation
- Date of actual operation (and wait time after cancellation)
- Patient age
- Comorbidities and patient’s American Society of Anesthesiologists (ASA) score
- Reason for cancellation
- Intervening hospital presentations

The reasons for cancellation were divided into three categories:

1. **Patient-related factors:**
   - Patient presented unfit for surgery, or the patient decided not to proceed with surgery
   - Causes related to preoperative optimisation and management, including medication errors or a change in treatment plan

2. **Hospital-related factors,** such as a lack of post-operative ward or critical care unit (CCU) beds, theatre delays or too many acute cases

3. **Other causes**

We also analysed the data based on the type of operation:

1. Hip arthroplasties
2. Knee arthroplasties
3. All other elective operations

We compared baseline characteristics of these patients by age, sex, ASA score, reason for cancellation and time to eventual surgery. Data were tabulated using Microsoft Excel (Microsoft, CA, USA).

**Statistical analysis**

Statistical analysis was performed using GraphPad Prism version 8. Data were tested for normality with the D’Agostino-Pearson omnibus K2 test. The patients were analysed in three separate groups depending on the planned initial operation: hip arthroplasty, knee arthroplasty and other (for all other elective operations). Differences between groups were assessed using unpaired t-tests with Welch’s correction. Significance was set at a P-value of 0.05 (GraphPad Prism, CA).
Results

During the study period, 2,397 operations were cancelled in total. Of these, 170 (7%) were orthopaedic procedures, and 76 (45%) were cancelled elective orthopaedic procedures. Of these cancelled elective orthopaedic procedures, 28 (37%) were patients awaiting total hip and knee joint arthroplasty (20 hips and 9 knees) (Table 1). The average age of patients who had cancelled elective hip joint arthroplasty surgery was 70.3 years (47–86; p=0.005) and of knee joint arthroplasty patients was 68.0 years (53–84; p=0.045).

Hospital-related factors accounted for 57% of all cancelled elective orthopaedic operations. Reasons for cancellations included theatre delays (21%), a shortage of post-operative beds (16%), too many acute patients (who took priority) (12%) and theatre issues, most frequently due to a lack of theatre staff or a lack of equipment (8%) (Table 2). Patient-related factors accounted for 29% of cancellations. These included patients becoming unwell prior to surgery (16%), medication issues (most commonly not stopping anticoagulation prior to procedure) (9%) and a patient’s decision to withdraw from the surgery (4%) (Table 2).

In comparison, 71% of cancelled arthroplasties were due to hospital-related factors. Thirty-two percent of cancelled joint arthroplasty operations were due to a lack of beds. Fourteen percent of cases were cancelled due to there being too many acute operations. Twenty-five percent of cancellations were attributable to theatre related factors. Twenty-one percent of cancelled joint arthroplasties were due to patients being unwell at time of operation (Table 2).

The ASA classification is a preoperative grading system designed as a subjective assessment of a patient’s overall health. Classification is based on five classes ranging from ASA-I, describing a completely healthy patient, to ASA-V, describing a moribund patient not expected to live 24 hours without surgery. The mean ASA score for all cancelled elective cases was 2.36. The ASA for knee replacements was 2.67 (p=0.04), and for hip cases the ASA was 2.55 (p=0.005) (Table 3).

The average wait time from cancellation to time of eventual operation for all elective orthopaedic cancellations was 56.2 days. The average wait time for cancelled elective hip arthroplasty was 76.1 days (p=0.008). The average wait time for cancelled knee joint arthroplasty was 26.5 days (p=<0.001) (Table 4).

Eleven patients (14.5%) whose elective orthopaedic procedures had been cancelled presented to hospital in between cancellation of their procedure and their eventual operation (including to ED, acute orthopaedic outpatient clinic and/or being admitted to hospital). Three (10%) of the cancelled elective hip and knee arthroplasties re-presented to other healthcare services.

Of this group, four presented with problems that were potentially attributable to having delays in their surgery. One patient awaiting hip arthroplasty presented to ED with a fall and hip pain. No patient requiring knee arthroplasty re-presented to healthcare services.

Table 1: Baseline characteristics.

<table>
<thead>
<tr>
<th>Total number of cancellations (all elective orthopaedic procedures)</th>
<th>76 (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of primary elective hip arthroplasties cancelled</td>
<td>19 (26%)</td>
</tr>
<tr>
<td>Number of primary elective knee arthroplasties cancelled</td>
<td>9 (12%)</td>
</tr>
<tr>
<td>Number of other elective orthopaedic operations cancelled</td>
<td>48 (63%)</td>
</tr>
<tr>
<td>Average age (range)</td>
<td>62 (7, 94)</td>
</tr>
<tr>
<td>Male/female</td>
<td>55%/45%</td>
</tr>
</tbody>
</table>
**Table 2: Reasons for cancelled elective orthopaedic operations.**

<table>
<thead>
<tr>
<th>Reason for cancellation</th>
<th>Number of cancelled elective orthopaedic operations (% of total cancellations)</th>
<th>Number of cancelled joint arthroplasty operations (% of cancellations)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Institutional reasons for cancellation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theatre delay</td>
<td>16 (21)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Insufficient beds</td>
<td>12 (16)</td>
<td>9 (32)</td>
</tr>
<tr>
<td>Too many acutes</td>
<td>9 (12)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>Theatre issue</td>
<td>6 (8)</td>
<td>3 (11)</td>
</tr>
<tr>
<td>Total</td>
<td>43 (57)</td>
<td>20 (71)</td>
</tr>
<tr>
<td><strong>Patient-related reasons for cancellation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient unfit for surgery</td>
<td>12 (16)</td>
<td>6 (21)</td>
</tr>
<tr>
<td>Medication error</td>
<td>7 (9)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Patient decision</td>
<td>3 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>22 (29)</td>
<td>6 (21)</td>
</tr>
<tr>
<td><strong>Other reasons for cancellations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managed non-operatively</td>
<td>7 (9)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Strike</td>
<td>2 (3)</td>
<td>2 (7)</td>
</tr>
<tr>
<td>Total</td>
<td>9 (12)</td>
<td>2 (7)</td>
</tr>
<tr>
<td><strong>Overall total</strong></td>
<td>76 (100)</td>
<td>28 (100)</td>
</tr>
</tbody>
</table>

**Table 3: American Society of Anesthesiologists (ASA) score of cancelled elective orthopaedic operations.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean ASA score</th>
<th>p value (vs other orthopaedic elective cancellations)</th>
<th>Age</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip arthroplasty</td>
<td>2.55</td>
<td>0.07</td>
<td>70.25</td>
<td>0.005*</td>
</tr>
<tr>
<td>Knee arthroplasty</td>
<td>2.67</td>
<td>0.04*</td>
<td>68</td>
<td>0.04*</td>
</tr>
<tr>
<td>Other orthopaedic electives</td>
<td>2.23</td>
<td></td>
<td>57.62</td>
<td></td>
</tr>
<tr>
<td>All orthopaedic electives</td>
<td>2.36</td>
<td></td>
<td>62.17</td>
<td></td>
</tr>
</tbody>
</table>
Reasons for presenting to healthcare services included, pain, disability related to the affected joint and concurrent medical illness requiring investigations. In one case, the cause for presenting was unknown due to a lack of documentation.

Discussion

Osteoarthritis is a modern epidemic. It is a cause of significant morbidity, mortality and disability and is incurring substantial costs to patients, healthcare institutions and the wider society.\(^1\)\(^2\) Total joint arthroplasty, in particular hip and knee arthroplasty, have been shown to be clinically effective and cost-effective approaches for the management of hip and knee osteoarthritis. They significantly improve patients’ mobility, independence and quality of life.\(^2\) This benefit is particularly pertinent in New Zealand where the population is ageing and the burden of osteoarthritis is becoming more apparent, with the over-65 age group predicted to make up over 25% of the population in the next 20 years.\(^3\)\(^4\) Kurtz et al have also suggested that patients under the age of 65 will contribute more to the future demand for joint replacement, further emphasising the need for accessibility to timely operations.\(^13\)

In this study, hospital-related factors contributed to 71% of cancelled elective joint replacements and 64% of the total cancelled elective orthopaedic operations. Twenty-five percent of cancelled joint replacements were due to a delay in theatre or a lack of theatre staff or equipment. Caeser et al found that 39% of patients awaiting elective orthopaedic operations experienced at least one cancellation, with 9% of cancellations being due to “organisational reasons.”\(^14\)

The prioritising of cases at Southland Hospital was a decision made between specialties who shared operating time in four theatres. There was no formalised process. We were noticing that emergency obstetric and gynaecological operations took priority, followed by emergency general surgery operations, then orthopaedic trauma, elective cancer cases and other electives (including arthroplasty).

The impact of increasing operating theatre capacity on cancellation rates of all elective operations has also been described in the literature. Fayed et al compared cancellation rates of elective procedures before and after the opening of new operating theatres. They observed a statistically significant drop in cancellation rates from 11.1% to 9.0%.\(^7\) A lack of theatre availability has been reported by other authors investigating cancelled elective procedures, who estimated that cancellation rates ranged from 19% to 65%.\(^7\)\(^15\) However, these studies were conducted in larger hospitals. There is limited data of rates of cancellation, or reasons for cancellation, in regional hospitals where staffing operating theatres could be more difficult due to geographical isolation or less populated centres.

The remaining 28% of hospital-related cancellations in the current study were due to a lack of post-operative ward beds or too many acute operations taking priority over elective operations. Cancelled elective joint arthroplasties were more likely to be due to a lack of post-operative beds (26%).

Table 4: Mean time (in days) from cancellation to eventual operation.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Wait time (days)</th>
<th>p value (vs other orthopaedic elective cancellations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip arthroplasty</td>
<td>76.1</td>
<td>0.008*</td>
</tr>
<tr>
<td>Knee arthroplasty</td>
<td>26.5</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Other orthopaedic electives</td>
<td>51.75</td>
<td></td>
</tr>
<tr>
<td>All orthopaedic electives</td>
<td>56.2</td>
<td></td>
</tr>
</tbody>
</table>
There were also avoidable cancellations due to patient-related factors, including errors in starting or stopping medications (8%), the most common being not stopping anticoagulation. Sixteen percent of cancellations were due to the patient being assessed as unfit for surgery. As the hospital is in a rural city, a significant number of patients had occupations including farming and industrial work and would present with cuts and superficial skin infections that we deemed largely unavoidable and an important factor to consider when analysing cancellation rates. However, to our knowledge, the impact of these cancellations on patients has not been reported.

The results of this study suggest that 9.35% of people awaiting total hip or knee joint arthroplasty experienced at least one cancellation. Patients awaiting hip joint arthroplasty waited a significant 19.9 days longer than the average wait for elective orthopaedic procedures (p=0.008). The mean ASA score of patients who had cancelled hip arthroplasty was 2.55, and the mean ASA score of patients who had cancelled knee arthroplasty was 2.67. According to the New Zealand Joint Registry, the mean ASA score of patients who had elective hip arthroplasties nationally was 2.1, and the mean ASA score for patients who had elective knee arthroplasties was 2.15. This shows that the patients who are having their elective joint replacements cancelled are on the whole a more comorbid population when compared to the national average, yet they are waiting longer for their eventual operation. The exact reason for this is unclear.

Although it is beyond the scope of this study to establish a strategy that would improve rates of cancellation, there are certainly points for consideration that could potentially result in reduced rates of cancellation. Measuring data on operating theatre efficiency may also help improve cancellation rates, and this has been described in the literature. For example, Pandit et al have measured efficiency and “production potential” in the operating theatre by quantifying a number of variables among surgical specialties including speed of operating, the number of lists over or under-running, time spent in between cases, the quality of operating and rates of complications. Although the study suggested shortfalls in one area may be made up for with good performance in others, cancellations had a significant impact and would be reason enough for this to be addressed. This study also failed to address the impact that cancellations had on patients.

Addressing patients’ preoperative optimisation, including compliance to perioperative medication changes, may be another way to improve the rates of cancellation. The hospital in the current study does have a pre-assessment process led by nurse specialists and anaesthetists. Although not a major contributor to cancellations in the current study, the literature describes this as a recognised issue with a number of strategies similar to the aforementioned being implemented in many hospitals worldwide. Vetter et al also suggested pictorial or colourful medication charts as well as written charts helped with compliance, and that elderly patients with more comorbidities require a more concerted effort when it comes to medication compliance.

Nursing resource teams are another way Southland Hospital have tried to improve efficiency in the operating theatre. These teams were designed to have consistent personnel to enhance continuity and theoretically enhance performance. There were no data available to indicate the efficacy of this strategy. However, this may be a way to improve efficiency and throughput during hospital and primary care follow-up of these patients would be beneficial to fast-track these patients onto new operating lists in an attempt to reduce significant waiting times.
individual lists and thus reduce the rates of cancellation.

The joint reconstruction team at Southland Hospital has standardised implants and inventory related to hip and knee arthroplasty in order to reduce the rates of equipment error and inefficiencies related to this aspect of care delivery and operative output.

Limitations

This study was limited by the relatively small study size. However, we followed the population over a longer period to capture variation and minimise temporal bias. We cannot draw definitive conclusions about the causative relationship between cancelled orthopaedic procedures and patient complications, given the lack of temporality in the study, but it gives us reason to suspect that some patients awaiting operations after cancellation are suffering adverse events as a result of delay.

The data collected are from hospital theatre records and accuracy relies on the input of data from surgical teams and theatre staff. To the best of our knowledge, all cancelled cases were included in the dataset, but we cannot say with absolute certainty that all cancellations were recorded over the two-year period.

Access to general practitioner records would have been beneficial to get an accurate gauge of the impact of cancelled operations on patients (eg, use of opioid analgesia or falls that did not require a hospital presentation).

External validity may be limited given the study was conducted in a secondary hospital. Multi-centre studies and comparison with larger centres would be beneficial.

Conclusion

Cancelled elective orthopaedic operations, in particular hip and knee arthroplasty, are not an infrequent occurrence. Cancellations affect patients’ quality of life and national district health boards. These patients are experiencing significant delays in eventual surgery. Fifty percent of these cancellations are due to hospital and theatre issues that are often preventable. Resources should be directed towards improving the systems in place to reduce the rate of cancellations. These patients have significant comorbidities and are at risk of further medical complications before rescheduled surgery. We found limited evidence supporting our hypothesis that delayed operations are leading to more frequent re-presentations to healthcare services with sequelae of worsening osteoarthritis. However, given the small study size and limited access to information from primary care facilities, this is an area where further research would be valuable.
Competing interests:
Nil.

Author information:
Matthew McCall: House Officer, Christchurch Hospital, Canterbury District Health Board, Christchurch, New Zealand.
Mike Peebles: Registrar, Obstetrics and Gynaecology, Hutt Hospital, Hutt Valley District Health Board, Lower Hutt, New Zealand.
Nemandra Amir Sandiford: Orthopaedic Surgeon, Senior Lecturer, University of Otago, Southland Hospital, Southern District Health Board, Invercargill, New Zealand.

Corresponding author:
Matthew McCall, Christchurch Public Hospital, 2 Riccarton Avenue, Christchurch 8011, 027 771 5595 matthew.mccall2@cdhb.health.nz

URL:

REFERENCES


Setting up the Prostate Cancer Outcomes Registry of New Zealand: reflecting and influencing clinical practice

Stephen Mark, Judith Clarke, Brett Shand, Jeremy Millar, Nathan Papa

ABSTRACT

AIM: To describe the establishment of a national prostate cancer clinical quality registry (PCOR-NZ) within the New Zealand healthcare system and discuss the challenges encountered and achievements obtained during its development. Additionally, to provide a descriptive snapshot of the patients enrolled thus far.

METHODS: A review of the processes underpinning the start-up and maintenance of the registry was undertaken. We also extracted data from PCOR-NZ in April 2021 to report on patients diagnosed between 2016 and 2019 that had at least 12 months of follow-up.

RESULTS: Following ethical approval in 2015, a steering committee made up of clinicians, public health specialists and patient representatives was constituted, and site recruitment commenced. Men aged ≥18 years with a diagnosis of incident prostate cancer from participating sites are eligible for enrolment in PCOR-NZ. The registry functions with an opt-out consent model and captures diagnosis, treatment and short-term outcomes, with a particular focus on quality-of-life measures. As of January 2021, 100% of public hospitals and 36% of private urology clinics in New Zealand are actively participating in the registry. 5,858 men, including 411 who identified as Māori (7.0%), were diagnosed between 2016 and 2019 and enrolled in the registry. Population coverage is currently estimated to be almost 70%. Opt-out is estimated to be 2.8%.

CONCLUSIONS: PCOR-NZ is providing quality diagnostic, treatment and outcome data for promoting enhancements in the care of men with prostate cancer. The registry resources are therefore valuable for informing and supporting quality improvement resourcing of this common cancer.
change, such as increasing adoption of active surveillance for low-risk patients and decreasing positive surgical margin rates.\textsuperscript{4}

This paper describes the processes and challenges faced during the set-up of this clinical quality registry within the New Zealand health care system. We also provide a descriptive analysis of enrolled patients and their associated patient reported outcome measures (PROMs) 12 months following treatment.

**Methods**

The PCOR-NZ was initiated to systematically collect demographic, diagnostic, treatment and outcome data to capture practice patterns and measure variation in the treatment and quality-of-life of newly diagnosed prostate cancer patients in New Zealand. The binational arrangement, with each participating state jurisdiction having its own registry and access to its own data, enabled cost and organisational efficiencies and the capacity to easily benchmark from both sides of the Tasman Sea. The objective was to better understand outcomes and learn how local changes might enable better treatment outcomes. Funding and ongoing support is provided by the Movember Foundation New Zealand (https://nz.movember.com/about/cause).

We reviewed the steps taken to commence PCOR-NZ, in particular the governance framework, recruitment and data collection procedures. We provide a description of the demographic, clinicopathologic and pre- and post-treatment quality-of-life outcomes for patients diagnosed and enrolled in the first four years of the registry (2016–2019). These are presented in aggregate and by treatment modality. To aid interpretation, each patient was assigned one treatment type according to a hierarchy, with surgery assigned first and radiation therapy (RT) second, including brachytherapy, androgen deprivation therapy (ADT) with or without chemotherapy and then non-interventional management (active surveillance or watchful waiting). If two treatments were recorded, the higher was assigned (e.g., RT with ADT was counted as “radiation therapy”). Non-interventional management strategies have been grouped together. Although non-interventional management approaches are quite different, they can be difficult to differentiate at a population level. Because watchful waiting is not curative treatment, patients in this group will either continue to be monitored or eventually receive palliative treatment, whereas patients receiving active surveillance may be treated subsequently by radiation or surgery with the intent to cure. The registry allows patients who started on active surveillance to be followed and divided into groups based on whether they continued to receive surveillance, had active treatment started or had their disease follow the natural history of ageing.

A major component of the PCOR-NZ has been the collection of PROMs prior to treatment (baseline) and then at 12 months after the treatment decision.\textsuperscript{5} The collection of PROMs at 12 months is a standard within all international prostate cancer outcome datasets. PROMs for prostate disorders were measured using the 26-item Expanded Prostate Index Composite for Clinical Practice questionnaire (EPIC 26), a validated short form of EPIC-50 that follows long-term domain-specific changes in patients’ views of symptoms, functional status and health-related quality-of-life.\textsuperscript{6} The EPIC-26 questionnaire can be completed within 10–15 minutes, making it practical for use in research and quality assurance in both single- and multi-centre studies.\textsuperscript{7} The questionnaire was sent to men by post or email. The responses in the questionnaire were transformed into a 0–100 score (100=best function) for the symptom domains of urinary incontinence, urinary irritation, bowel function, sexual function and hormonal (e.g., lack of energy, change in body weight, hot flashes etc). The domain scores were expressed graphically as violin plots for each treatment modality.

**Results**

National ethical approval to establish the PCOR-NZ was granted in 2015 by the National Health and Disability Ethics Committee (HDEC) following the submission of protocols and policies governing patient recruitment, data collection and usage. New sites were added to the HDEC approval as recruited. The registry (https://prostatecancerregistry.org/) is governed by a steering committee with an independent chairperson and made-up of radiation
oncology and urology clinicians, a Māori and a patient representative, a public health academic member, the PCOR-NZ manager and a PCOR-ANZ representative from Monash University, Australia.

A project to establish the registry was initiated in 2016. Sites were recruited at different time points depending on local approval processes and the ability to access and collect data. Notifications of new cases of prostate cancer are sent to PCOR-NZ from participating sites. Missed cases from these sites are captured through a quarterly linkage with the New Zealand Cancer Registry (NZCR, https://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/collections/new-zealand-cancer-registry-nzcr) (Figure 1). The Ministry of Health, despite indicating the value of such a registry, elected not to fund data collection, due in part to the registry being funded by the Movember Foundation and run by a charitable trust, the Centre for Health Outcome Measures New Zealand (CHOMNZ, www.chomnz.org.nz).

As a population-based registry, patient recruitment is via “opt-out consent,” which is required to improve coverage and avoid selection bias. Upon receiving a notification of a new diagnosis from a participating site or the NZCR, data collectors, with approval to remotely access patient notes, check for evidence that the man has been notified of his diagnosis prior to uploading the case to PCOR-NZ and checking eligibility. Men can be deemed ineligible to participate as per agreed criteria, including being too unwell and non-English speaking, as well as at the discretion of the diagnosing clinician or data collector. Eligible men are sent a letter of invitation and an information sheet about the registry advising how to opt-out of the study. Men can opt-out at any time via email, mail or phone. If notification is received within three months of diagnosis, a “baseline” questionnaire on PROMS is also sent. If the questionnaire is not returned within three weeks, a follow-up call is made by registry staff, who provide another opportunity for men to ask questions or to opt-out of the study. Men may choose to opt-out of the registry completely or choose data collection only, whereby clinical data is collected but no questionnaires are sent. A similar process of contacting men, and another opportunity to opt-out, occurs when the 12-month PROMS questionnaire is sent.

A key performance indicator is to register 90% of men with a new diagnosis of prostate cancer in New Zealand. It is important that maximum participation of both doctors and patients is achieved so that sufficiently representative data are collected to inform the changes necessary to achieve population-level quality improvement. Public hospitals in New Zealand are currently managed by 20 district health boards (DHBs), and it has taken five years for the DHBs to be progressively recruited to PCOR-NZ. As of January 2021, 100% of public hospitals are actively participating in the registry. In the private health sector, although 53 of 57 (93%) of urologists working in private have signed agreements to participate, only 12 of 33 (36%) private clinics currently have systems in place that allow patients to be recruited to the registry and have data collected via remote access. The majority of private clinics participating are larger group private practices. Data entry is carried out manually as electronic data transfer is not currently available in New Zealand because of differences in information technology (IT) systems.

Data collection and collation and access to the registry are guided by strict protocols to ensure the security, privacy and confidentiality of participants and information collected. The data are stored on an ISO 27001-certified environment server at the PCOR-ANZ Monash University registry office in Australia and backed up daily in New Zealand on a hospital-level secure server. The accuracy and completeness of the data is checked by audits and reports and via triangulation with other New Zealand Ministry of Health datasets.

The PROMs, alongside other PCOR-NZ data, have been used to benchmark key quality outcome indicators against all institutions and clinicians participating in PCOR-ANZ. Because these indicators are qualitative measures that are often self-reported, they are likely to fluctuate naturally over time as different generations enter the register. Local and international benchmarking of patient outcomes from a similar region in Australia and New Zealand is therefore vital to obtain contemporary comparison and visibility of any outcome variance.
The outcome measures in PCOR-ANZ (e.g., EPIC-26) were selected by the Delphi system and deemed to be the most valuable validated outcome measures for both the patient and urologist to improve the quality of care. At this stage, baseline and 12-months PROMs are providing the most valid data in the PCOR-NZ, although follow-up is planned, possibly at five-years.

The data allow trends in the diagnosis and management of prostate cancer across Australia and New Zealand to be compared and disparities in treatment and clinical outcomes to be identified. Examples of these indicators are shown in Table 1. The information is sent directly to clinical directors of hospital urology units and to participating clinicians as confidential six-monthly, risk-adjusted quality indicator reports. Participating sites and clinicians may apply for their own site-specific data, and external researchers may apply for de-identified data to be released from PCOR-NZ following a successful application to the steering committee. In addition, PCOR-NZ contributes to the TrueNTH Global Registry, an international project that centralises and compares clinical data on prostate cancer from 13 countries.

Registry profile

Five thousand eight hundred and fifty-eight men diagnosed with prostate cancer between 2016 and 2019 were consented and entered into PCOR-NZ. Four hundred and eleven (7.0%) identified as Māori, which was the most common ethnicity after European. Year-to-year accrual into the registry has been growing strongly, from 260 in 2016 to 2,887 in 2019 (Figure 2). The percentage of eligible men choosing to opt-out in the

*Quarterly extracts from NZCR provide secondary source of notifications (notifications are received 6–12 months post-diagnosis so these men are not eligible for baseline PROMS).

**Men can choose to opt-out or change to data collection only at any stage.
Table 1: Quality indicators provided in reports issued by the PCOR-ANZ.

<table>
<thead>
<tr>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA level documented at diagnosis.</td>
</tr>
<tr>
<td>Clinical T category documented in the medical record.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA level documented post-radical prostatectomy.</td>
</tr>
<tr>
<td>High/very high risk or metastatic disease with no treatment.</td>
</tr>
<tr>
<td>The proportion of low-risk prostate cancer cases managed with interventional treatment.</td>
</tr>
<tr>
<td>Low-risk disease in men who have a radical prostatectomy.</td>
</tr>
<tr>
<td>Active treatment in men with low-risk disease.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality.</td>
</tr>
<tr>
<td>Prevalence of positive surgical margins post-radical prostatectomy</td>
</tr>
<tr>
<td>• Intermediate risk (a) at all institutes and (b) public institutes</td>
</tr>
<tr>
<td>• High/very high risk (a) at all institutes and (b) public institutes</td>
</tr>
<tr>
<td>• pT2 (a) at all institutes and (b) public institutes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient reported outcome measures at 12-month follow-up post-prostatectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary bother and incontinence.</td>
</tr>
<tr>
<td>Bowel bother and function.</td>
</tr>
<tr>
<td>Sexual bother and function.</td>
</tr>
</tbody>
</table>

Discussion

A goal of PCOR-NZ is to record and collate high-quality population-level data on the diagnosis and treatment of prostate cancer in New Zealand. This objective is being achieved, with recruitment increasing and data collection ongoing. The registry has the goal of data accuracy and nation-wide collection of prostate cancer. This is fulfilled by local case notification plus quarterly alignment with the NZCR and subsequent review with the patients enrolled in the New Zealand Radiation Oncology Registry. An independent audit, typically carried out from time-to-time in most cancer registries, may also be a useful additional assessment of accuracy. The registry has provided meaningful clinical information with standardised PCOR-ANZ reports sent every six months to hospital departments and individual clinicians. These reports provide comparisons of clinical practice and highlight variances in patient care and outcomes. The longer-term aim of the registry is to share de-identified data with agencies that develop policy and fund healthcare. This
information will assist in supporting Te Aho o Te Kahu – Cancer Control Agency (https://teaho.govt.nz/) with their key principles of being equity-led, knowledge driven and outcomes focused.

The registry encountered significant challenges during its development. Although ethical approval for the registry was granted by the HDEC, and endorsements were received from a variety of national health, Māori and IT organisations, a replicable pathway to recruit across the 20 DHBs was never established. Requirements for approval at each DHB to participate in the registry and to collect data were complex and varied from simple CEO approval via HDEC locality authorisation to lengthy consultation and documentation requirements, each with different forms and processes. Approvals to recruit, gain IT access and set-up notification systems across the 20 DHBs has taken five years to complete nationally. DHBs require annual updates and advice on HDEC amendments and changes to documentation, which results in duplication of work. A simpler standard system of process sign-off and reporting of updates would be valuable if further national data collections are to be undertaken.

The process of establishing the registry at private urology clinics was less cumbersome with each clinician signing an agreement to participate and a clinical director providing approval via HDEC locality authorisation. The challenge for private clinics in New Zealand has been accessing patient notes and collecting data. Using local resourcing within private clinics for this work proved unsuccessful due to the time commitment required and the complex nature of the data being collected. Instead, CHOMNZ have moved to a system whereby a CHOMNZ-approved data collector either visits the clinic rooms to collect data (two sites) or is provided with remote access to the clinic’s electronic patient management systems (seven sites). A challenge remains for those private clinics that are either paper based or have electronic systems that cannot be remotely accessed by CHOMNZ, or that have security

![Figure 2: Number of men enrolled in PCOR-NZ between 2016 and 2019.](image)
Table 2: Characteristics of registry participants diagnosed between 2016 and 2019 by primary treatment received. Median (IQR) or n (column %). n=128 with other or unknown treatment.

<table>
<thead>
<tr>
<th></th>
<th>All participants (n=5,858)</th>
<th>Surgery (n=2,101)</th>
<th>Radiation therapy (n=1,346)</th>
<th>ADT +/- chemotherapy (n=651)</th>
<th>AS or WW (n=1,632)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age at diagnosis, years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>67 (62–72)</td>
<td>65 (60–69)</td>
<td>69 (64–74)</td>
<td>76 (69–81)</td>
<td>67 (62–71)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>5,099 (87)</td>
<td>1,865 (89)</td>
<td>1,144 (85)</td>
<td>543 (83)</td>
<td>1,444 (88)</td>
</tr>
<tr>
<td>Māori</td>
<td>411 (7.0)</td>
<td>100 (4.8)</td>
<td>131 (9.7)</td>
<td>64 (9.8)</td>
<td>104 (6.4)</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>119 (2.0)</td>
<td>37 (1.8)</td>
<td>24 (1.8)</td>
<td>21 (3.2)</td>
<td>34 (2.1)</td>
</tr>
<tr>
<td>Other</td>
<td>186 (3.2)</td>
<td>77 (3.7)</td>
<td>39 (2.9)</td>
<td>17 (2.6)</td>
<td>45 (2.8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>43 (0.7)</td>
<td>22 (1.0)</td>
<td>8 (0.6)</td>
<td>6 (0.9)</td>
<td>5 (0.3)</td>
</tr>
<tr>
<td>**PSA at diagnosis, ng/ml ***</td>
<td>7.3 (5.3–12.3)</td>
<td>6.4 (5.0–9.2)</td>
<td>9.4 (6.2–15.2)</td>
<td>31.9 (15.4–100)</td>
<td>6.0 (4.8–8.5)</td>
</tr>
<tr>
<td><strong>Clinical T-stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cT1</td>
<td>2,956 (50)</td>
<td>1,153 (55)</td>
<td>566 (42)</td>
<td>88 (14)</td>
<td>1,110 (68)</td>
</tr>
<tr>
<td>cT2</td>
<td>1,356 (23)</td>
<td>528 (25)</td>
<td>446 (33)</td>
<td>165 (25)</td>
<td>190 (12)</td>
</tr>
<tr>
<td>cT3/4</td>
<td>496 (8.5)</td>
<td>61 (2.9)</td>
<td>192 (14)</td>
<td>224 (34)</td>
<td>11 (0.7)</td>
</tr>
<tr>
<td>cTX</td>
<td>1,050 (18)</td>
<td>359 (17)</td>
<td>142 (11)</td>
<td>174 (27)</td>
<td>321 (20)</td>
</tr>
<tr>
<td><strong>ISUP Grade Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2,030 (35)</td>
<td>405 (19)</td>
<td>172 (13)</td>
<td>22 (3.4)</td>
<td>1,408 (86)</td>
</tr>
<tr>
<td>2</td>
<td>1,622 (28)</td>
<td>904 (43)</td>
<td>469 (35)</td>
<td>52 (8.0)</td>
<td>150 (9.2)</td>
</tr>
<tr>
<td>3</td>
<td>821 (14)</td>
<td>411 (20)</td>
<td>273 (20)</td>
<td>86 (13)</td>
<td>38 (2.3)</td>
</tr>
<tr>
<td>4</td>
<td>608 (10)</td>
<td>219 (10)</td>
<td>212 (16)</td>
<td>141 (22)</td>
<td>21 (1.3)</td>
</tr>
<tr>
<td>5</td>
<td>682 (12)</td>
<td>152 (7.2)</td>
<td>213 (16)</td>
<td>293 (45)</td>
<td>11 (0.7)</td>
</tr>
<tr>
<td>Not recorded</td>
<td>95 (1.6)</td>
<td>10 (0.5)</td>
<td>7 (0.5)</td>
<td>57 (8.8)</td>
<td>4 (0.2)</td>
</tr>
<tr>
<td><strong>NCCN risk category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1,581 (27)</td>
<td>335 (16)</td>
<td>112 (8.3)</td>
<td>9 (1.4)</td>
<td>1,116 (68)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>2,243 (38)</td>
<td>1,259 (60)</td>
<td>614 (46)</td>
<td>40 (6.1)</td>
<td>280 (17)</td>
</tr>
<tr>
<td>High/Very High</td>
<td>1,194 (20)</td>
<td>409 (19)</td>
<td>442 (33)</td>
<td>239 (37)</td>
<td>82 (5.0)</td>
</tr>
<tr>
<td>Regional (cN1)</td>
<td>178 (3.0)</td>
<td>28 (1.3)</td>
<td>90 (6.7)</td>
<td>53 (8.1)</td>
<td>0</td>
</tr>
<tr>
<td>Metastatic</td>
<td>385 (6.6)</td>
<td>12 (0.6)</td>
<td>54 (4.0)</td>
<td>308 (47)</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Not recorded</td>
<td>277 (4.7)</td>
<td>58 (2.8)</td>
<td>34 (2.5)</td>
<td>2 (0.3)</td>
<td>152 (9.3)</td>
</tr>
</tbody>
</table>

* 350 no recorded PSA. ADT = androgen deprivation therapy. AS = active surveillance. ISUP = International Society of Urological Pathology. NCCN = National Comprehensive Cancer Network. PSA = prostate specific antigen. WW = watchful waiting.
or privacy concerns in providing remote access. Consequently, the estimated 30% of men missing from PCOR-NZ were diagnosed or treated almost exclusively at these non-contributing private sites.

Another challenge for the registry has been the need for rapid case ascertainment to enable the collection of pre-treatment PROMs at baseline. There is therefore a reliance on participating sites to provide notifications on a regular and timely basis. A variety of sources are used across sites, with the accuracy and completeness of this information being reliant on the quality of the reporting systems in place. A second source of notifications is by a quarterly linkage to the NZCR. This has proved useful as a mechanism for capturing missed cases. The difficulty with notifications received through the NZCR is that diagnosis is reported by pathology laboratories rather than by diagnosing institute. Despite most laboratories processing local cases, it is not always possible to ascertain which hospital or private clinic is managing the patient, so these men cannot always be uploaded to PCOR-NZ. In addition, the lag between diagnosis date and coding means men in the NZCR extracts may have been diagnosed between 6 and 12 months earlier. As baseline PROMs can only be completed in the first three months post diagnosis, the late notification of men from the NZCR makes them ineligible to be sent a baseline PROMs questionnaire.

Overall, the responses in the analytic sample, grouped by treatment type, were consistent with those reported in international studies. Observational management was associated with the best quality-of-life outcomes, as seen in other international studies. Future work focused on PROMs will assess the variance of quality-of-life across age and ethnicities after adjustment for baseline clinicopathologic factors and pre-treatment function.

In conclusion, PCOR-NZ, a constituent of PCOR-ANZ and the TrueNTH Global Registry, is providing quality diagnostic, treatment and outcome data for promoting improvements in care in men with prostate cancer. It has achieved coverage from all districts of New Zealand, and in future years its findings will be readily generalisable to the entire population. The registry also distributes important clinical information on prostate cancer care to urologists, urology clinics and hospital departments and allows contemporary local and international benchmarking of outcomes to be examined. PCOR-NZ resources are therefore valuable for informing and supporting quality improvement resourcing of this common cancer.

Figure 3: Violin plots for each symptom domain score, by primary treatment, 12 months after treatment started.
Competing interests:
Mr Mark and Ms Clarke report grants from Urology Association Australia and NZ (USANZ) NZ Section, during the conduct of the study.

Acknowledgements:
Data for analysis in this study have been obtained from the Prostate Cancer Outcome Registry of New Zealand, which is funded by the Movember Foundation. The Centre for Health Outcome Measures NZ acknowledges the funding and ongoing support of the Movember Foundation New Zealand, without whom this work would not be possible.

Author information:
Stephen Mark: Consulting Urologist, Department of Urology, Christchurch Hospital, Christchurch, New Zealand.
Judith Clarke: PCOR-NZ National Manager, Centre for Health Outcome Measures New Zealand (CHOMNZ), Christchurch, New Zealand.
Brett Shand: Clinical writer and analyst, Christchurch, New Zealand.
Jeremy Millar: Director Research, Alfred Health Radiation Oncology, Melbourne, Victoria, Australia.
Nathan Papa: Lead – Prostate Cancer Outcomes Registry Research Group, School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia.

Corresponding author:
Mr Stephen Mark, Department of Urology, Christchurch Hospital, Private Bag 4710, Christchurch, New Zealand, +64 3 355 5219
stephen@urology.co.nz

URL:

REFERENCES

How electronically available referral guidelines for primary medical practitioners can improve the timeliness of orchidopexy

Erika M Stark, Spencer W Beasley, Alison Campbell

ABSTRACT

AIM: This study determined whether easily used guidelines and an electronic referral process could decrease the age of referral of suspected undescended testes (UDT). An online resource for primary medical practitioners was introduced for which the UDT guideline advises referral to paediatric surgery for testes not sitting spontaneously in the scrotum at three-months corrected age.

METHOD: Data were collected prospectively for boys referred with UDT over a seven-year period (2012–2018), during which time agreed GP guidelines on the Community HealthPathways website for referral were introduced. Trends in the age at referral and age at orchidopexy were analysed.

RESULTS: Complete data were obtained for 212 boys. Referral before age six months increased from 13% to 61%, and before 12 months from 48% to 78%. Orchidopexy by 12 months increased from 16% to 39%, and by 18 months from 48% to 74%, during the same period. Median age at orchidopexy for this 2012–2018 cohort was 21.6 months compared with 31.1 months from 1997–2007.

DISCUSSION: These data demonstrate earlier referral of boys with UDT and earlier orchidopexy corresponded to the introduction of the GP Community HealthPathways website. A similar resource available in other regions or countries also might be expected to reduce the age of referral of suspected UDT from primary care providers.

Primary undescended testis (UDT) is a common presentation to general practitioners (GPs, primary medical practitioners). When UDT is suspected or confirmed, affected children should be referred to a paediatric surgeon for orchidopexy. Recent studies suggest that orchidopexy by one year provides the best chance of preserving fertility and reducing later development of malignancy.1 Studies published in 2008 and 2012 on boys who underwent orchidopexy between 1997 and 2007 by our paediatric surgical service showed a moderate trend towards lower age at orchidopexy from 2003 onwards, yet the mean age at surgery remained above the recommended age of <18 months.2,3 This suggested that an initiative to achieve earlier diagnosis and referral was vital if orchidopexy was to be performed at the optimal age for our population—that is, the South Island of New Zealand, which is home to just over one million people living in both cities and rural communities.

Initiated in 2008, the Canterbury Community HealthPathways (CPH) website (https://Canterbury.communityhealthpathways.org) provides an up-to-date, online resource that GPs and allied health professionals throughout the South Island of New Zealand can use to aid in the diagnosis of a variety of conditions. CPH also provides guidelines for the subsequent referral to specialty services. The UDT guideline advises referral to a paediatric surgeon if testes...
do not sit spontaneously in the scrotum at three-months corrected age. The sole paediatric surgical service for the South Island of New Zealand is based in Christchurch. Its surgeons travel to provincial hospitals where they conduct regular clinics and elective surgery, including for conditions such as orchidopexy.

This study reviewed the age at which boys with UDT were referred to this service in relation to the introduction and increased use of the CHP website. The purpose of the study was to determine whether there was any evidence that the CHP has been effective in reducing the age of referral of UDT so orchidopexy is performed at an earlier age.

Methods

Data were obtained from a prospectively collected database of demographic, clinical and surgical information on all boys who had orchidopexy carried out by our regional paediatric surgical service during a seven-year period following the introduction of GP guidelines in 2008 for referral for UDT as part of the CHP initiative. All boys (<16 years of age) who had an orchidopexy between January 2012 and August 2018 for UDT were reviewed.

Diagnostic information was gathered for all boys from operation notes and clinical letters. Patients who had an orchidopexy for reasons other than UDT were excluded relying on the expert opinion of specialists. Exclusion criteria included: post testicular torsion, post herniotomy (acquired cryptorchidism), impalpable, ascending, re-do or staged orchidopexies. Where there was ambiguity about the referral date, a date was approximated from the day of their first outpatient clinic visit.

Age at orchidopexy was compared with the data relating to the age at orchidopexy from our previously published series, which were published prior to the introduction of CHP. The same inclusion criteria were used to better validate comparison to our previous series.

Results

Since the UDT guideline was placed on the Community HealthPathways website, there was a progressive increase in its use. Its use has now plateaued. Table 1 demonstrates the number of GP “hits” on the undescended testis site in CHP for the period 2016–2018 in the three regions served by the service (Table 1).

Of the 797 boys who had an orchidopexy in our regional child health service during this time period, inclusion criteria were met by, and complete data were obtained for, 212 boys.

There was a trend towards earlier referral of boys under six months of age between 2012 and 2018 (Figure 1). Referral before the age of six months increased from 13% in 2012 to 61% in 2018, and before 12 months increased from 48% in 2012 to 78% in 2018. The estimated median age for referral at the beginning of 2012 was 297 days (95% CI 252 to 368 days). The median age at referral decreased by about 26 days (95% CI 18 to 41 days) each year between 2012 and 2018 (p=0.001).

A trend towards younger age at surgery was also demonstrated. Orchidopexy by 12 months increased from 16% in 2012 to 39% by 2018, and referral by 18 months increased from 44% in 2012 to 68% by 2018. The estimated median age for surgery at the beginning of 2012 was 568 days (95% CI 527

Table 1: Extent to which the UDT pathway is being accessed and used.

<table>
<thead>
<tr>
<th>Annual figures for use of UDT pathway on Community HealthPathways</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canterbury</td>
<td>644</td>
<td>608</td>
<td>452</td>
</tr>
<tr>
<td>Nelson Marlborough</td>
<td>214</td>
<td>220</td>
<td>199</td>
</tr>
<tr>
<td>Southern</td>
<td>136</td>
<td>201</td>
<td>201</td>
</tr>
</tbody>
</table>
to 636 days). The median age at orchidopexy decreased by about 30 days (95% CI 20 to 49 days) each year between 2012 and 2018 (p<0.001) (Figure 2).

A notable difference in our recent data has been a leftward shift towards younger age at orchidopexy since introduction of CHP in 2008 (Figure 3).

Median age at orchidopexy for the 2012–2018 (post CHP) cohort was 21.6 months compared with 31.1 months for 1997–2007 (pre CHP) (Figure 4). The largest difference was the decline in boys older than two years of age at the time of orchidopexy.

Wait time for operation was the time that lapsed between the age at referral and age at orchidopexy. This time period remained constant, roughly 3–6 weeks, across both studies, such that surgical waitlist times are not a significant contributor to the time of orchidopexy.

**Discussion**

Cryptorchidism affects 1–2% of boys.\(^1\) Guidelines for the timing of surgery for affected testes aim to maximise subsequent fertility and decrease the risk of later malignancy.\(^4,6\) British Association of Paediatric Urologists (BAPU) consensus guideline (2011) recommend paediatric urology referral of undescended testes by six months of age and completion of surgery by age 12 months.\(^7\) However, a UK-wide audit of orchidopexy in 2016 demonstrated that only 12% of boys with undescended testes were having surgery completed by 12 months of age (ORCHESTRA).\(^8\) These findings are similar to those of Hensel et al 2015, who demonstrated that less than 30% of boys in Germany were having surgery before the age of 2, despite European Society for Paediatric Urology (ESPU) guidelines recommending surgery before 18 months.\(^1,9\)

A previous study in our centre (1997–2007) demonstrated a modest trend towards earlier orchidopexy, with the median age considerably lower than that reported in Europe, but still greater than 18 months.\(^3\) This study identified that the age of the boy at time of primary care referral was the major contributing factor to the older-than-ideal age at orchidopexy. Following the introduction of the readily accessible Community HealthPathways guideline for referral of UDT, we demonstrated a progressive and much more pronounced improvement in the age at referral, with a year-on-year trend to earlier referral. By 2018, more than 60% of UDTs were referred before the age of six months, with about 40% of patients having surgery before 12 months of age (2016–2018) and 86% by age 2 years (2012–2018). This is similar to the findings of a recent publication from another New Zealand centre where the median age at referral

**Figure 1:** Age of boys referred for UDT in the period 2012–2018.
was 5.3 months for the years 2014–2016 and 12.6 months for surgery.\textsuperscript{10}

Our data suggest that education of primary care physicians and the ready availability of diagnostic and referral guidelines has resulted in earlier referral, and that has enabled earlier surgery. The potential value of this earlier age of referral for UDT may ultimately be expressed in improved fertility and a decreased incidence of malignancy.

The evidence provided here suggests that easily accessible, website-based guidelines for primary medical practitioners referring boys with UDT may lead to surgery being performed closer to the optimal age.

**Conclusion**

These data demonstrate a trend to earlier referral and surgery for undescended testes that correlates with the introduction of website guidelines for the diagnosis and referral of boys with UDT. The Community HealthPathways would appear to have led to a substantial improvement in the quality of our regional child health services. A similar resource made available in other regions or countries also might be expected to reduce the age of referral for this condition. This would enable orchidopexy to be performed more often at the optimal age for the procedure and allow for the best long-term outcomes to be obtained.

**Figure 2:** Age distribution of boys who underwent orchidopexy in our regional child services in the period 2012–2018.
Figure 3: Cumulative age distribution of boys undergoing orchidopexy pre CHP (1997–2007) and post CHP (2012–2018).

Figure 4: Comparison of age at orchidopexy pre and post introduction of CHP.
Competing interests:
Nil.

Author information:
Erika M Stark: Resident Medical Officer, Canterbury District Health Board.
Spencer W Beasley: Clinical Director, Department of Paediatric Surgery, Christchurch Hospital, and Professor of Paediatric Surgery, University of Otago, Christchurch.
Alison Campbell: Senior Registrar Paediatric Surgery, Sheffield Children's NHS Foundation Trust.

Corresponding author:
Erika M Stark, Resident Medical Officer, Canterbury District Health Board, 0273152480
Erika.stark@cdhb.health.nz

URL:

REFERENCES
10. Bajaj M, Upadhyay V. Age at referral for undescended tests: has anything change in a decade. 2017;130:45-9.
Frailty prevalence in Aotearoa New Zealand haemodialysis patients and its association with hospitalisations

Katherine Bloomfield, Zhenqiang Wu, Lai Chan, Janak R de Zoysa

ABSTRACT

AIMS: To use two frailty tools to assess frailty prevalence in a cohort of Aotearoa New Zealand haemodialysis (HD) patients and determine factors associated with frailty and frailty’s association with adverse health outcomes.

METHODS: Frailty was measured using the Fried score and Edmonton Frail Scale (EFS) in HD patients dialysing at dependent or satellite clinic sites in Waitematā District Health Board, Auckland. Linear regression models were used to explore factors associated with frailty measurements. Logistic regression models were used to assess associations between frailty and mortality and hospitalisations.

RESULTS: 138 participants. Mean (SD) age: 61.5 (13.5) years. 70 females (51%). 51 (37%) were frail by Fried score. 51 (37%) were frail by EFS (overlap of 32 participants). Age, marital status, smoking status and albumin were independently associated with both measures of frailty. Medication number was additionally associated with Fried score. Pacific ethnicity and Charlson Comorbidity Index were associated with EFS score. After adjusting for covariables, only Fried frailty was associated with hospitalisations at six months.

CONCLUSIONS: Pacific ethnicity was independently associated with increased risk of EFS frailty. Fried frailty was associated with hospitalisations at six months. Given the paucity of literature on the New Zealand population, further work within these ethnic groups is warranted.

Frailty is a syndrome of reduced physiological reserve that increases the risk of adverse health outcomes, such as hospitalisation, increasing dependency, residential care placement and death. Frailty occurs along a spectrum, with evidence of bi-directional fluctuations. Therefore, there is the potential to improve frailty status with appropriate management or intervention. Frailty is a better predictor of mortality than age or comorbidities, and in some conditions there is evidence of a superior ability to predict adverse outcomes compared to traditional risk models.

Renal insufficiency potentially accelerates the ageing process. For example, rates of frailty are greater in patients with early-stage chronic kidney disease (CKD) than in those without. This is likely to be due to disease-related and disease-associated conditions in patients with CKD, such as protein-energy wasting and inflammation, which is consistent with the idea of a shared or overlapping phenotype with the frailty syndrome. Based on international studies, the prevalence of frailty in haemodialysis (HD) patients ranges widely. However, a systematic review reported a pooled prevalence of 34%. There are no published reports of frailty prevalence within Aotearoa New Zealand CKD, dialysis or renal transplant populations. Higher rates of mortality, hospitalisations, increasing dependence and fractures have been reported in both frail non-dialysis CKD and dialysis patients, with evidence of increased falls, poor quality of life and vascular access failure also documented in the latter. The risk of these
adverse outcomes increases with frailty severity.

There is a high, and increasing, incidence of renal replacement therapy (RRT) in patients aged 65–74 years (388 per million) and 75–84 years (242 per million) in Aotearoa New Zealand. This is placing greater importance on the understanding of geriatric syndromes like frailty. Given the ageing population, different thresholds to initiate dialysis in older adults between countries and the ethnic diversity within Aotearoa New Zealand, it is important that we understand frailty within our own clinical context. Identification of frail individuals may assist with clinical decision-making, targeting at-risk individuals with appropriate intervention, such as exercise, dietary supplementation, de-prescribing and facilitating advance care planning, and potentially reducing adverse outcomes.

The aims of this study were to assess the prevalence of frailty in an Aotearoa New Zealand cohort of HD patients; to assess factors associated with frailty at baseline; to assess the association of frailty with hospitalisations at six months and mortality at one, two and three years; and to compare the overall predictive performance and discrimination of frailty measured by the Fried score and the Edmonton Frail Scale (EFS) for predicting the above healthcare outcomes.

Methods

This was a prospective study of frailty among HD patients at facility haemodialysis units in Waitematā District Health Board (WDHB) between August and December 2016. All patients were invited to participate in the study at the time of their dialysis session. Participants were assessed during dialysis session. Mobility measurements were taken either immediately before or after dialysis. Patients with acute kidney injury (AKI) not established on chronic dialysis or a diagnosis of significant cognitive impairment, and non-English speakers without the presence of an interpreter and those unwilling to participate, were excluded. Due to study constraints, home HD patients were not included.

Frailty was assessed with the simplified Fried score and EFS (see Appendix) by one of two assessors. Scoring was calculated by one assessor. Fried score (range 0–5) was calculated by counting the presence of the following items: weight loss, exhaustion, low walking speed, low grip strength and physical inactivity (using self-reported abbreviated items). “Frail” was defined as a Fried score ≥ 3, “pre-frail” as a score of 1–2 and “non-frail” as a score of 0.

The EFS (range from 0–17) assesses the following nine domains: cognition, general health status, functional independence, social support, medication usage, nutrition, mood, continence, functional performance. “Frail” was defined as an EFS ≥ 8, “vulnerable” as an EFS of 6–7 and “fit” as an EFS of 0–5.

The following characteristics were documented from participants and hospital records at baseline: age, gender, ethnicity, marital status, residence (home, aged residential care), smoking status, medications, comorbidities (with calculation of Charlson Comorbidity Index (CCI)), renal diagnosis, haemoglobin (Hb), albumin, Kt/V and duration of time since starting dialysis. Electronic hospital records were interrogated for the outcomes in the follow-up period (primary outcome: mortality at three years; secondary outcomes: hospitalisations at six months and mortality at one year).

Univariable and multivariable linear regression models with mean difference (MD) and 95% confidence intervals (CIs) were performed to assess factors associated with baseline frailty measurements. Associations between frailty and outcomes were explored using univariable and multivariable logistic regression models to estimate odds ratios (ORs) and 95% CIs. The discriminative ability of two frailty tools for predicting outcomes (hospitalisations or mortality) were assessed using the areas under the curve (AUC) and associated c-statistics, with a value of 0.5 indicating random prediction and a value of 1 indicating perfect prediction. The overall model performance of frailty tools was reported by Nagelkerke’s R²; with higher values indicating better model performance for predicting outcomes. All analyses were performed with SAS version 9.4. A two-sided p<0.05 was considered statistically significant.
Ethical approval was received from Northern B Health and Disability Ethics Committee 15/NTB/114/AM01. Written, informed consent was obtained from all participants.

Results

During the study period, 232 patients were undergoing HD at WDHB. Of these, 54 were home HD patients and were not approached. One hundred and seventy-eight patients were dialysing at either the dependent or the satellite sites during the study period. Eight participants received dialysis at both sites during the study period; these were only assessed once in the satellite setting. Figure 1 shows recruitment process.

One hundred patients received dialysis at satellite sites: one was excluded due to cognitive impairment and two declined to participate, leaving 97 patients. Seventy-eight patients dialysed at the dependent site only during the study period. Five were excluded due to language constraints. Seventy-three were approached to participate: 32 declined (43.8%), leaving 41 assessed. One hundred and thirty-eight patients participated in total. Mean (SD) age was 61.5 (13.5) years, and 70 (50.7%) were female. Other demographic details can be seen in Tables 1 and 2.

Frailty prevalence and associated factors

Twenty-five (18.1%) were non-frail, 62 (44.9%) were pre-frail and 51 (37.0%) were frail by the Fried score. In comparison, 39 (28.2%) were fit, 48 (34.8%) were vulnerable to frailty and 51 (37.1%) were frail by EFS. Within each category of frailty, overlap between the two methods was 13 (9.4%) non-frail, 26 (18.9%) pre-frail (Fried) or vulnerable (EFS) and 32 (23.2%) frail. Tables 1 and 2 show univariable and multivariable associations of baseline factors with each frailty tool. On multivariable analysis, both tools showed higher frailty scores independently associated with increasing age and decreasing albumin. Being an ex-smoker was associated with decreased frailty scores compared with current smoking. Both tools showed significant associations with marital status: compared to married and partner patients, patients who were divorced, widowed or separated had a lower Fried score, and patients who were single had an increased EFS. Additionally, Fried score was independently and significantly associated with the number of medications. A higher EFS was additionally associated with Pacific ethnicity and a higher CCI.

Association of frailty categories and outcomes

Fried category was significantly associated with one-, two- and three-year mortality and six-month hospitalisations in univariable analysis (p<0.01). After adjustment for co-variables, only the association with six-month hospitalisations remained (pre-frail vs non-frail, OR=3.29, 95%CI=1.01–10.74; frail vs non-frail, OR=7.31, 95% CI=1.80–29.74) (Table 3).

EFS category was significantly associated with risk of hospitalisation at six-months (p=0.01) and mortality at three years (p=0.02) in univariable analysis. After adjustment for co-variables, these associations disappeared (Table 4).

Single Fried category had higher observed predictive performance (c-statistics & R²) for primary and secondary outcomes compared to single EFS category (see Figure 2 and Table 5). However, this was not statistically significant between the two tools.

Discussion

This study is the first to report the prevalence of frailty in Aotearoa New Zealand HD patients. Thirty-seven percent of the cohort were identified as frail by both methods. Age and albumin were independently associated with Fried score and EFS. Importantly, we found Pacific people were independently associated with higher EFS. The latter is a new finding and warrants further investigation. In addition, after adjusting for covariables, Fried category was independently associated with the risk of six-month hospitalisations.

A wide range of prevalence of frailty (6–82%) has been reported in HD patients. In part, this largely relates to study population differences, including indications for dialysis, and methods used to measure frailty. The frailty prevalence in this Aotearoa New Zealand cohort is high but comparable to a recently reported pooled rate of 34%. To put this in context, approx-
**Figure 1:** Patient recruitment.

232 HD patients total: 54 Home HD patients (not approached)

178 HD patients

78 Dependent HD patients

Excluded: 5 language, 32 declined

41 participants

100 community satellite HD patients

Excluded: 1 cognitive impairment, 2 declined

97 participants

138 HD participants

Haemodialysis (HD)
Table 1: Univariate and multivariate association of baseline factors with Fried score.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%) / mean (SD)</th>
<th>Univariate</th>
<th>Univariate</th>
<th>Multivariate</th>
<th>Type 3 test</th>
<th>Multivariate</th>
<th>Type 3 test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Age (year)</td>
<td>61.5 (13.5)</td>
<td>0.04 (0.02, 0.05)</td>
<td>&lt;0.001</td>
<td>0.04 (0.02, 0.06)</td>
<td>&lt;0.001</td>
<td>0.04 (0.02, 0.06)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>0.18</td>
<td></td>
<td>0.24</td>
<td></td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68 (49.3)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>70 (50.7)</td>
<td>0.32 (-0.15, 0.79)</td>
<td>0.18</td>
<td>0.25 (-0.17, 0.68)</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnic groups</td>
<td></td>
<td>0.64</td>
<td></td>
<td>0.18</td>
<td></td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>45 (32.6)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>0.56</td>
<td>0.06</td>
</tr>
<tr>
<td>Māori</td>
<td>31 (22.4)</td>
<td>0.32 (-0.33, 0.98)</td>
<td>0.33</td>
<td>0.56 (-0.02, 1.14)</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific peoples</td>
<td>51 (37.0)</td>
<td>-0.01 (-0.58, 0.56)</td>
<td>0.97</td>
<td>0.27 (-0.23, 0.77)</td>
<td>0.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>11 (8.0)</td>
<td>-0.21 (-1.14, 0.73)</td>
<td>0.66</td>
<td>-0.22 (-1.00, 0.56)</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>0.10</td>
<td></td>
<td>0.06</td>
<td></td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Married/partner</td>
<td>89 (64.5)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>-0.60</td>
<td>0.02</td>
</tr>
<tr>
<td>Divorced/widowed</td>
<td>20 (14.5)</td>
<td>-0.33 (-0.92, 0.26)</td>
<td>0.27</td>
<td></td>
<td>0.60</td>
<td>(-1.09, -0.11)</td>
<td>0.02</td>
</tr>
<tr>
<td>Single</td>
<td>29 (21.0)</td>
<td>-0.71 (-1.39, -0.03)</td>
<td>0.04</td>
<td>-0.07 (-0.75, 0.61)</td>
<td>0.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td>0.34</td>
<td></td>
<td>0.03</td>
<td></td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Never smoker</td>
<td>61 (44.2)</td>
<td>0</td>
<td></td>
<td></td>
<td>0.60</td>
<td>(-0.48, -0.05)</td>
<td>0.03</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>62 (44.9)</td>
<td>0.48 (-0.32, 1.28)</td>
<td>0.23</td>
<td>-0.48 (-0.92, -0.05)</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>15 (10.9)</td>
<td>-0.11 (-0.61, 0.39)</td>
<td>0.66</td>
<td>0.21 (-0.46, 0.88)</td>
<td>0.54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 1: Univariate and multivariate association of baseline factors with Fried score (continued).

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%) / Mean (SD)</th>
<th>Univariate</th>
<th>Type 3 test</th>
<th>Multivariate</th>
<th>Type 3 test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Aetiology of ESKD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>67 (48.6)</td>
<td>0</td>
<td>0.46</td>
<td>0</td>
<td>0.22</td>
</tr>
<tr>
<td>Hypertension</td>
<td>12 (8.7)</td>
<td>0.34 (-0.53, 1.21)</td>
<td>0.44</td>
<td>0.76 (0.01, 1.50)</td>
<td>0.05</td>
</tr>
<tr>
<td>Combination</td>
<td>7 (5.1)</td>
<td>-0.07 (-1.18, 1.03)</td>
<td>0.89</td>
<td>-0.15 (-1.06, 0.76)</td>
<td>0.74</td>
</tr>
<tr>
<td>Other</td>
<td>52 (37.7)</td>
<td>-0.31 (-0.82, 0.21)</td>
<td>0.44</td>
<td>0.19 (-0.31, 0.69)</td>
<td>0.44</td>
</tr>
<tr>
<td>Albumin</td>
<td>32.0 (4.7)</td>
<td>-0.13 (-0.17, -0.08)</td>
<td>&lt;0.001</td>
<td>-0.09 (-0.14, -0.05)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>110.3 (13.1)</td>
<td>0.02 (-0.04, -0.002)</td>
<td>0.03</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Kt/V</td>
<td>1.4 (0.2)</td>
<td>-0.49 (-1.56, 0.58)</td>
<td>0.37</td>
<td>-0.58 (-1.54, 0.37)</td>
<td>0.23</td>
</tr>
<tr>
<td>Log(months on dialysis)*</td>
<td>3.6 (1.1)</td>
<td>-0.11 (-0.32, 0.10)</td>
<td>0.29</td>
<td>0.29</td>
<td>0.99</td>
</tr>
<tr>
<td>CCI</td>
<td>4.1 (1.4)</td>
<td>0.21 (0.05, 0.38)</td>
<td>0.01</td>
<td>0.07 (0.11, 0.24)</td>
<td>0.46</td>
</tr>
<tr>
<td>No. of medications</td>
<td>11.8 (3.0)</td>
<td>0.17 (0.10, 0.25)</td>
<td>&lt;0.001</td>
<td>0.15 (0.09, 0.22)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Natural logarithm of months on dialysis; number of medications was included as it’s not a component of Fried score.
ESKD: End stage kidney disease. Combination: combination of diabetes and hypertension. CCI: Charlson Comorbidity Index.
Table 2: Univariate and multivariate association of baseline factors with EFS.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%) / mean (SD)</th>
<th>Univariate</th>
<th>Type 3 test</th>
<th>Multivariate</th>
<th>Type 3 test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
<td>Coefficient (95%CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Age (year)</td>
<td>61.5 (13.5)</td>
<td>0.05 (0.01, 0.08)</td>
<td>0.004</td>
<td>0.06 (0.03, 0.10)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>0.01</td>
<td></td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68 (49.3)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>70 (50.7)</td>
<td>1.05 (0.23, 1.87)</td>
<td>0.01</td>
<td>0.67 (-0.13, 1.46)</td>
<td>0.10</td>
</tr>
<tr>
<td>Ethnic groups</td>
<td></td>
<td>0.07</td>
<td></td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>45 (32.6)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>31 (22.4)</td>
<td>1.00 (-0.13, 2.13)</td>
<td>0.08</td>
<td>0.55 (-0.49, 1.71)</td>
<td>0.27</td>
</tr>
<tr>
<td>Pacific peoples</td>
<td>51 (37.0)</td>
<td>1.27 (0.27, 2.26)</td>
<td>0.01</td>
<td>1.37 (0.42, 2.32)</td>
<td>0.005</td>
</tr>
<tr>
<td>Asian</td>
<td>11 (8.0)</td>
<td>0.30 (-1.34, 1.93)</td>
<td>0.72</td>
<td>0.05 (-1.43, 1.52)</td>
<td>0.27</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>0.90</td>
<td></td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Married/partner</td>
<td>89 (64.5)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Divorced/widowed</td>
<td>20 (14.5)</td>
<td>0.16 (-0.90, 1.22)</td>
<td>0.77</td>
<td>0.02 (-0.90, 0.94)</td>
<td>0.96</td>
</tr>
<tr>
<td>Single</td>
<td>29 (21.0)</td>
<td>-0.18 (-1.40, 1.05)</td>
<td>0.77</td>
<td>1.49 (0.20, 2.78)</td>
<td>0.02</td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td>0.05</td>
<td></td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Never smoker</td>
<td>61 (44.2)</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>62 (44.9)</td>
<td>-0.87 (-1.75, &lt;0.01)</td>
<td>0.05</td>
<td>-1.23 (-2.05, -0.42)</td>
<td>0.003</td>
</tr>
<tr>
<td>Current smoker</td>
<td>15 (10.9)</td>
<td>0.55 (-0.85, 1.95)</td>
<td>0.44</td>
<td>0.39 (-0.87, 1.65)</td>
<td>0.54</td>
</tr>
</tbody>
</table>
Table 2: Univariate and multivariate association of baseline factors with EFS (continued).

| Variable                  | N (%) / mean (SD) | Univariate | | | Multivariate | | | Type 3 | P value | Coefficient (95%CI) | | | Type 3 | P value | Coefficient (95%CI) |
|---------------------------|-------------------|------------|-------------|---|-------------|---|-------------|---|-------------|---|-------------|---|-------------|
| Aetiology of ESKD        |                   |            | 0.004       |   |              |   |              |   |               |   |               |   |               |
| Diabetes                  | 67 (48.6)         | 0          | 0.004       |   | -0.32       |   |              |   |              |   |              |   |              |
| Hypertension              | 12 (8.7)          | -0.87 (-2.36, 0.62) | 0.25       |   | -0.10 (-1.51, 1.31) |   |              |   |              |   |              |   |              |
| Combination               | 7 (5.1)           | -1.54 (-3.42, 0.35) | 0.11       |   | -1.50 (-3.21, 0.20) |   |              |   |              |   |              |   |              |
| Other                     | 52 (37.7)         | -1.60 (-2.47, -0.72) | <0.001     |   | -0.48 (-1.44, 0.45) |   |              |   |              |   |              |   |              |
| Albumin                   | 32.0 (4.7)        | -0.16 (-0.25, -0.08) | <0.001     |   | -0.16 (-0.25, -0.07) |   |              |   |              |   |              |   |              |
| Haemoglobin               | 110.3 (13.1)      | -0.01 (-0.04, 0.03) | 0.74       |   | 0.01 (-0.02, 0.04) |   |              |   |              |   |              |   |              |
| Kt/V                      | 1.4 (0.2)         | -0.18 (-2.08, 1.71) | 0.85       |   | 0.12 (-1.68, 1.91) |   |              |   |              |   |              |   |              |
| Log(months on dialysis) * | 3.6 (1.1)        | -0.03 (-0.40, 0.34) | 0.86       |   | -0.03 (-0.36, 0.30) |   |              |   |              |   |              |   |              |
| CCI                       | 4.1 (1.4)         | 0.54 (0.25, 0.82) | <0.001     |   | 0.43 (0.11, 0.75) |   |              |   |              |   |              |   |              |

*Natural logarithm of months on dialysis; number of medications was not included as it’s a component of EFS.
ESKD: End stage kidney disease. Combination: combination of diabetes and hypertension. CCI: Charlson Comorbidity Index.
### Table 3: Risk of adverse outcome by Fried categories.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of events by Fried categories</th>
<th>Unadjusted odds ratio (95%CI), p</th>
<th>Adjusted* odds ratio (95%CI), p</th>
<th>Type 3 test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (n=25)</td>
<td>1 (n=62)</td>
<td>2 (n=51)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 vs 0</td>
<td>2 vs 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality at three years</td>
<td>4 (16.0)</td>
<td>18 (29.0)</td>
<td>29 (56.9)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.15 (0.65, 7.14), 0.21</td>
<td>6.92 (2.08, 23.07), 0.002</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.47 (0.56, 10.95), 0.23</td>
<td>3.90 (0.78, 19.48), 0.10</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Secondary outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality at two years</td>
<td>3 (12.0)</td>
<td>10 (16.1)</td>
<td>21 (41.2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.41 (0.35, 5.62), 0.24</td>
<td>5.13 (1.40, 19.39), 0.02</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.06 (0.23, 4.91), 0.94</td>
<td>2.19 (0.42, 11.49), 0.35</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Mortality at one year</td>
<td>1 (4.0)</td>
<td>4 (6.5)</td>
<td>14 (27.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.66 (0.18, 15.58), 0.66</td>
<td>9.08 (1.12, 73.62), 0.002</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.97 (0.08, 11.40), 0.98</td>
<td>2.52 (0.20, 32.43), 0.48</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>Hospitalisations at six months</td>
<td>7 (28.0)</td>
<td>34 (54.8)</td>
<td>40 (78.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.12 (1.14, 8.54), 0.03</td>
<td>9.35 (3.12, 28.06), &lt;0.001</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.29 (1.01, 10.74), 0.05</td>
<td>7.31 (1.80, 29.74), 0.006</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

*Adjusted for age, gender, ethnicity, marital status, smoking status, aetiology of renal disease, albumin, haemoglobin, Kt/V, natural logarithm transformed months on dialysis.

### Table 4: Risk of adverse outcome by EFS categories.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of events by EFS categories</th>
<th>Unadjusted odds ratio (95%CI), p</th>
<th>Adjusted* odds ratio (95%CI), p</th>
<th>Type 3 test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (n=39)</td>
<td>1 (n=48)</td>
<td>2 (n=51)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 vs 0</td>
<td>2 vs 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality at three years</td>
<td>8 (20.5)</td>
<td>17 (35.4)</td>
<td>26 (51.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.13 (0.80, 5.64), 0.13</td>
<td>4.03 (1.56, 10.44), 0.004</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.32 (0.37, 4.62), 0.67</td>
<td>2.21 (0.60, 8.19), 0.23</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>Secondary outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality at two years</td>
<td>8 (20.5)</td>
<td>8 (16.7)</td>
<td>18 (35.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.78 (0.26, 2.30), 0.65</td>
<td>2.11 (0.80, 5.57), 0.13</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.29 (0.07, 1.14), 0.08</td>
<td>0.85 (0.22, 3.25), 0.81</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Mortality at one year</td>
<td>4 (10.3)</td>
<td>5 (10.4)</td>
<td>10 (19.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.02 (0.25, 4.08), 0.98</td>
<td>2.13 (0.62, 7.41), 0.23</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.36 (0.06, 2.23), 0.27</td>
<td>0.57 (0.08, 4.01), 0.57</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Hospitalisations at six months</td>
<td>18 (46.2)</td>
<td>25 (52.1)</td>
<td>38 (74.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.27 (0.54, 2.96), 0.58</td>
<td>3.41 (1.40, 8.31), 0.007</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00 (0.36, 2.82), 1.00</td>
<td>2.29 (0.72, 7.34), 0.16</td>
<td>0.28</td>
<td></td>
</tr>
</tbody>
</table>

*Adjusted for age, gender, ethnicity, marital status, smoking status, aetiology of renal disease, albumin, haemoglobin, Kt/V log(months on dialysis).
Figure 2: Primary outcome: mortality at three years.

Table 5: C-statistic and pseudo-R² estimates for mortality and hospitalisations.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Fried category</th>
<th>EFS category</th>
<th>C-statistics between two tools (95%CI), p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>95%CI</td>
<td>C</td>
</tr>
<tr>
<td>Primary outcome</td>
<td></td>
<td></td>
<td>C-statistics between two tools (95%CI), p</td>
</tr>
<tr>
<td>Mortality at three years</td>
<td>0.68 (0.60, 0.77)</td>
<td>0.11</td>
<td>0.64 (0.55, 0.73)</td>
</tr>
<tr>
<td>Secondary outcome</td>
<td></td>
<td></td>
<td>C-statistics between two tools (95%CI), p</td>
</tr>
<tr>
<td>Mortality at two years</td>
<td>0.67 (0.58, 0.77)</td>
<td>0.08</td>
<td>0.62 (0.51, 0.72)</td>
</tr>
<tr>
<td>Mortality at one year</td>
<td>0.72 (0.61, 0.83)</td>
<td>0.09</td>
<td>0.59 (0.46, 0.73)</td>
</tr>
<tr>
<td>Hospitalisations at six months</td>
<td>0.70 (0.61, 0.78)</td>
<td>0.13</td>
<td>0.63 (0.54, 0.72)</td>
</tr>
</tbody>
</table>
imately 10% of community-dwelling adults >65 years are thought to be frail based on international data.\(^2\) WDHB serves over half a million people, with people 65-years old and older expected to make up 20% of the total population by 2034.\(^18\) WDHB is also the district health board with the highest life expectancy in Aotearoa New Zealand at 85.1 years.\(^19\) The trend of older adults starting RRT in Aotearoa New Zealand has plateaued.\(^19\) Similarly, the number of comorbid conditions that Aotearoa New Zealand patients are starting RRT with has also appeared to have stabilised since the start of the decade.\(^19\)

Although the concept of frailty is accepted, there is no consensus with regard to its operationalisation,\(^1\) with multiple frailty tools in existence. The Fried, or phenotypic, model has been widely used in research, is based on physical measure of frailty\(^4\) and has been the most commonly used tool to assess HD populations. Studies supplementing physical measures of grip strength and gait speed for self-reported questionnaires have found over estimation of frailty, which likely accounts for some of this variation.\(^20\) In contrast, the EFS addresses the multi-dimensional nature of frailty, with domains including mobility, functional independence, social support and quality of life, among others. It is less studied in this population. In the largest EFS-HD study, with a Spanish cohort of 277 patients (median age 65 years), approximately 30% were frail and frailty was associated with increased hospitalisations and mortality.\(^21\) Other smaller studies report prevalence rates of 38–46%.\(^22–23\)

Despite both tools reporting the same prevalence of 37%, they appear to be assessing differing aspects of the syndrome of frailty and identifying different participants, highlighting these tools are likely measuring different dimensions of frailty. There are few studies comparing Fried to EFS in HD patients,\(^22,24\) and to the best of our knowledge, this is the largest. The Fried method has been shown to correlate with sarcopenia, likely due to the physical measurements within this tool.\(^25\) It is possible that ethnic-specific differences in muscularity may explain why no differences in frailty were seen between ethnicities with the Fried method.\(^26\) A small study assessing sarcopenia in liver transplant candidates in Hawai‘i demonstrated the presence of ethnic differences with less sarcopenia found in the “Hawaiian and other Pacific people” group, which is consistent with this hypothesis.\(^27\)

Although the Fried tool was associated with hospitalisations in this study, there are disadvantages with its use clinically. As well as requiring specific equipment, the categorical Fried tool does not provide a range of severity in scoring. Given the high prevalence of frailty in the HD population, a tool providing a greater range of frailty severity, or one that is continuous, is likely to be more useful. Larger future studies in this population could include other frailty screening tools, such as the Clinical Frailty Scale or the five-point FRAIL scale, which are clinically user-friendly and show promise in this area.\(^22\)

There are marked variations in end stage kidney disease in Aotearoa New Zealand based on ethnicity, with Pacific people having the highest rate (494 per million population (pmp)), compared to Māori (244 pmp) Asian (65 pmp) and European/Other ethnicities (72 pmp). Of concern, the rates in Pacific people are steadily growing while the mean age of Pacific people starting RRT is younger than other ethnic groups.\(^19\) Thus the finding that Pacific people were at increased risk of EFS is an important one. There are very few publications reporting objective measures of frailty in Māori or Pacific people, and in non-CKD studies only.\(^28,29\)

This is again particularly relevant considering the wider health inequities present for Māori and Pacific people in Aotearoa New Zealand, and these differences should be explored further in a larger study. Unlike (non-CKD) publications that find Māori\(^28,29\) and Pacific people\(^23\) are more likely to be frail with multi-dimensional frailty assessments, we found no significant association in this cohort, which perhaps reflects the small cohort. Non-white ethnicity is associated with frailty in HD populations internationally.\(^30\)

Several other demographic and clinical factors previously known to be associated with frailty were also identified in this study: age, smoking status, number of medications, hypoalbuminaemia and comorbidities.\(^30\) Contrary to other studies, we did not find an association with haemoglobin or gender (despite female gender
showing strong associations in HD-frailty and general frailty literature). Interestingly, both tools found marital status significantly associated with frailty, although not in the same direction. We are unaware of other HD-frailty studies reporting significant associations with marital status, and the cause of these findings is unclear. This suggests wider social characteristics may influence frailty. Other factors identified in previous studies associated with frailty status include unemployment, lower education, certain comorbidities, such as cardiovascular disease and depression, and testosterone levels.

The relationship between frailty and outcomes is less clear in this study in comparison to the HD-frailty literature. Many studies have shown frailty is associated with falls, vascular access outcomes, hospitalisations and mortality.30 After adjusting for confounders, only the Fried category was associated with adverse outcomes, in terms of six-month hospitalisation rate. This possibly relates to small study numbers. However this could reflect other factors in the Aotearoa New Zealand population that have not previously been interrogated. Particular differences may be due to the ethnic groups in this study, or they could reflect differing practices of patient selection for dialysis between countries. Most frailty studies do not report severity of frailty, and perhaps participants in our studies are less frail than others, which may influence results. Assessing whether the same adverse health effects are seen with frailty in a larger study in this population is required.

There are several limitations to this study, including small overall numbers. Despite good recruitment from community dialysis centres, 35% of those dialysing as inpatients declined participation. This likely caused under-representation of frailty in the total group and has possibly influenced outcome data. It is probable some of these patients declined due to acuity of medical illness or being newly initiated to dialysis. It should also be noted that results do not reflect overall HD population, as we elected not to include those on home-HD, who are possibly less frail. This decision was made due to potential difficulties recruiting this group in the short study time-period available. To reduce the burden of questions on patients undergoing dialysis, we used a simplified Fried tool rather than the formal and time-consuming methods measures used in original Fried study. Measurements were taken at the time of dialysis and recent evidence suggests this may also affect results in comparison to interdialytic measurements.31 Other than specified outcomes, we did not study hospital notes of participants from baseline. Frailty is known to be dynamic; fluctuations and improvements are possible. It is possible that further appropriate management of patients, such as receiving kidney transplant, improved frailty levels and affected outcome data.

Despite these limitations, this study reports important findings of HD frailty in Aotearoa New Zealand and includes ethnic populations not previously studied in CKD-frailty before. Overall, similar rates of frailty were detected by both EFS and Fried measurements, with Fried category independently associated with six-month hospitalisations. Frailty measurements allow the identification of individuals who may warrant further clinical attention: for example physiotherapist or dietician input for exercise and nutrition components of frailty management, or clinical pharmacist input for deprescribing options.1 Importantly, as frailty measurement identifies those at risk of adverse health outcomes, such recognition potentially enhances open communication between health providers, patients and whānau about the potential risks and benefits of any significant health intervention, such as surgery or advance care planning discussions. Recognising frailty allows us to advise patients who may have poor outcomes if they were to start dialysis and aid discussions in whether continuing RRT is appropriate. Therefore, further frailty work in the Aotearoa New Zealand dialysis populations is required, ideally including all dialysis modalities, pre-dialysis patients and more specifically longitudinal measurement of frailty in incident dialysis patients.
Competing interests:
Nil.

Acknowledgements:
Thank you to all participants, Sharon Dixon, Janice Kirkpatrick, Sonya Banks and all other Waitāmatā District Health Board dialysis centre staff. Funding obtained from the University of Auckland Performance Based Research Funding.

Author information:
Katherine Bloomfield: Senior Lecturer/Geriatrician; Department of Medicine, University of Auckland, Auckland, Aotearoa New Zealand; Waitāmatā District Health Board, Auckland, Aotearoa New Zealand.
Zhengiang Wu: Statistician/Research Fellow; Department of Medicine, University of Auckland, Auckland, Aotearoa New Zealand.
Lai Chan: Renal Physician; Waikato District Health Board, Hamilton, Aotearoa New Zealand.
Janak R de Zoysa: Associate Professor/Renal Physician; Department of Medicine, University of Auckland, Auckland, Aotearoa New Zealand; Waitāmatā District Health Board, Auckland, Aotearoa New Zealand.

Corresponding author:
Dr Katherine Bloomfield, Waitāmatā Clinical Campus, North Shore Hospital, PO Box 93 503, Takapuna, Auckland 0740, Aotearoa New Zealand, +64 9 4868920/42414 (phone), +64 9 4427166 (fax) katherine.bloomfield@waitematadhb.govt.nz

URL:

REFERENCES


18. Waitematā District Health Board [Internet]. Waitematā District Health Board population profile – 2015. Available at: https://www.waitematadhb.govt.nz/assets/Documents/population-profile/WDHB2015PopulationHealthProfileWDHB.pdf


Hidden figures and misnomers: a case for disaggregated Asian health statistics in Aotearoa New Zealand to improve health outcomes

Sherly Parackal, Kirsten Coppell, Carlos Lam Yang, Trudy Sullivan, Rathan M Subramaniam

ABSTRACT

People of Asian ethnicity in Aotearoa New Zealand currently constitute 15% of the population. The majority are migrants. The current sources of data to monitor Asian health in New Zealand are routine population surveys and administrative data. This article highlights the effect of “masking” due to the use of a single “Asian” category for reporting health indicators. Issues regarding the use of the “Other Asian” category in administrative data are also discussed. This discourse provides an impetus to raise questions on how we should be developing policies, strategies and investments to make visible the hidden figures of Asian health statistics in New Zealand. Given that Asian population will become the second largest ethnic group in New Zealand, practical steps need to be taken to strengthen the New Zealand health strategy and enable equitable investment in Asian health.
Table 1: Projected population by ethnicity, median projection, 30 June 2020–2043.\(^1\)

<table>
<thead>
<tr>
<th>June year</th>
<th>Māori</th>
<th>Pacific</th>
<th>European/other</th>
<th>Asian</th>
<th>MELAA*</th>
<th>Chinese</th>
<th>Indian</th>
<th>Samoan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>854,500</td>
<td>430,800</td>
<td>3,529,300</td>
<td>867,300</td>
<td>90,300</td>
<td>300,000</td>
<td>296,300</td>
<td>205,900</td>
</tr>
<tr>
<td>2021</td>
<td>874,800</td>
<td>440,100</td>
<td>3,556,800</td>
<td>876,800</td>
<td>92,000</td>
<td>302,200</td>
<td>299,800</td>
<td>210,600</td>
</tr>
<tr>
<td>2022</td>
<td>891,300</td>
<td>449,000</td>
<td>3,579,300</td>
<td>902,000</td>
<td>94,700</td>
<td>310,400</td>
<td>307,200</td>
<td>215,100</td>
</tr>
<tr>
<td>2023</td>
<td>906,900</td>
<td>457,900</td>
<td>3,599,700</td>
<td>934,300</td>
<td>98,500</td>
<td>319,600</td>
<td>319,400</td>
<td>219,700</td>
</tr>
<tr>
<td>2024</td>
<td>922,600</td>
<td>466,800</td>
<td>3,619,800</td>
<td>966,500</td>
<td>102,200</td>
<td>328,900</td>
<td>331,600</td>
<td>224,300</td>
</tr>
<tr>
<td>2025</td>
<td>938,300</td>
<td>475,800</td>
<td>3,639,700</td>
<td>998,800</td>
<td>105,900</td>
<td>338,200</td>
<td>343,700</td>
<td>229,000</td>
</tr>
<tr>
<td>2026</td>
<td>954,200</td>
<td>484,900</td>
<td>3,659,100</td>
<td>1,030,900</td>
<td>109,600</td>
<td>347,600</td>
<td>355,700</td>
<td>233,700</td>
</tr>
<tr>
<td>2027</td>
<td>970,100</td>
<td>494,000</td>
<td>3,678,000</td>
<td>1,063,100</td>
<td>113,400</td>
<td>356,900</td>
<td>367,600</td>
<td>238,400</td>
</tr>
<tr>
<td>2028</td>
<td>986,100</td>
<td>503,100</td>
<td>3,696,400</td>
<td>1,095,100</td>
<td>117,100</td>
<td>366,100</td>
<td>379,500</td>
<td>243,200</td>
</tr>
<tr>
<td>2029</td>
<td>1,002,300</td>
<td>512,300</td>
<td>3,714,200</td>
<td>1,127,000</td>
<td>120,800</td>
<td>375,400</td>
<td>391,300</td>
<td>248,000</td>
</tr>
<tr>
<td>2030</td>
<td>1,018,600</td>
<td>521,600</td>
<td>3,731,300</td>
<td>1,158,900</td>
<td>124,500</td>
<td>384,500</td>
<td>403,100</td>
<td>252,900</td>
</tr>
<tr>
<td>2031</td>
<td>1,035,000</td>
<td>530,900</td>
<td>3,747,700</td>
<td>1,190,700</td>
<td>128,100</td>
<td>393,600</td>
<td>414,800</td>
<td>257,900</td>
</tr>
<tr>
<td>2032</td>
<td>1,051,500</td>
<td>540,400</td>
<td>3,763,300</td>
<td>1,222,500</td>
<td>131,800</td>
<td>402,600</td>
<td>426,600</td>
<td>262,900</td>
</tr>
<tr>
<td>2033</td>
<td>1,068,100</td>
<td>549,900</td>
<td>3,778,300</td>
<td>1,254,200</td>
<td>135,600</td>
<td>411,500</td>
<td>438,400</td>
<td>268,000</td>
</tr>
<tr>
<td>2034</td>
<td>1,084,900</td>
<td>559,400</td>
<td>3,792,600</td>
<td>1,285,900</td>
<td>139,300</td>
<td>420,300</td>
<td>450,200</td>
<td>273,100</td>
</tr>
<tr>
<td>2035</td>
<td>1,101,800</td>
<td>569,100</td>
<td>3,806,100</td>
<td>1,317,600</td>
<td>143,000</td>
<td>429,000</td>
<td>462,100</td>
<td>278,200</td>
</tr>
<tr>
<td>2036</td>
<td>1,118,800</td>
<td>578,800</td>
<td>3,819,100</td>
<td>1,349,400</td>
<td>146,800</td>
<td>437,700</td>
<td>474,100</td>
<td>283,500</td>
</tr>
<tr>
<td>2037</td>
<td>1,135,900</td>
<td>588,600</td>
<td>3,831,400</td>
<td>1,381,200</td>
<td>150,600</td>
<td>446,300</td>
<td>486,300</td>
<td>288,700</td>
</tr>
<tr>
<td>2038</td>
<td>1,153,200</td>
<td>598,500</td>
<td>3,843,100</td>
<td>1,413,100</td>
<td>154,400</td>
<td>454,800</td>
<td>498,500</td>
<td>294,000</td>
</tr>
<tr>
<td>2039</td>
<td>1,170,600</td>
<td>608,500</td>
<td>3,854,300</td>
<td>1,445,200</td>
<td>158,200</td>
<td>463,400</td>
<td>510,900</td>
<td>299,400</td>
</tr>
<tr>
<td>2040</td>
<td>1,188,200</td>
<td>618,500</td>
<td>3,865,000</td>
<td>1,477,400</td>
<td>162,100</td>
<td>471,900</td>
<td>523,400</td>
<td>304,900</td>
</tr>
<tr>
<td>2041</td>
<td>1,205,900</td>
<td>628,700</td>
<td>3,875,100</td>
<td>1,509,700</td>
<td>166,000</td>
<td>480,500</td>
<td>536,100</td>
<td>310,400</td>
</tr>
<tr>
<td>2042</td>
<td>1,223,700</td>
<td>638,900</td>
<td>3,884,600</td>
<td>1,542,200</td>
<td>170,000</td>
<td>489,000</td>
<td>549,000</td>
<td>316,000</td>
</tr>
<tr>
<td>2043</td>
<td>1,241,600</td>
<td>649,300</td>
<td>3,893,500</td>
<td>1,574,900</td>
<td>174,000</td>
<td>497,600</td>
<td>562,000</td>
<td>321,600</td>
</tr>
</tbody>
</table>

* Māori: Middle Eastern/Latin American/African
disease among those who migrated to the UK compared with their siblings who remained in India. In New Zealand, the health of the Asian ethnic group is not well understood. Although much progress has been made since 2006 to address Asian health issues, a number of challenges persist. Current sources of data for monitoring Asian health in New Zealand include routinely collected population surveys and administrative data. Nevertheless, there are several important issues regarding how data are collected and reported for New Zealand Asians, which is the focus of this article. The arguments raised in this article are based on available health statistics for the South Asian people in New Zealand and use certain health indicators as examples, but the same arguments will hold for other health issues and for East and South East Asians who are at higher risk for other disorders, such as certain cancers.

Asian health indicators from population surveys

The continued use of the single “Asian” category when reporting data from population health surveys, such as the New Zealand Health Survey (NZHS), obscures a true description of the health of this diverse population group. In fact, due to the effect of averaging, this practice grossly masks subgroup differences in health indicators, risk factors and disease prevalence. For example, the prevalence of obesity was 16% for Asians in both the 2011–2013 and 2019/20 NZHSs. In addition to not using the World Health Organization (WHO) ethnic specific body mass index (BMI) categories to define obesity, these surveys did not disaggregate the Asian ethnic group. A secondary analysis of the 2011–2013 data clearly showed the effect of “masking.” When “Asian” was subdivided and ethnic specific BMI categories were used to define obesity, the prevalence of obesity among adults was 57% in South Asians, 25% in Chinese and 33% in the “Other” Asian group.

In the 2008/09 Adult Nutrition Survey, data for Asians were not reported at all, but combined with the “European/Other” category. However, secondary analysis of these data clearly showed subgroup differences in the prevalence of overweight/obesity and diagnosed diabetes within the Asian ethnic group. Asians were sub-categorised as “South Asians” (people from India, Sri Lanka, Pakistan, Afghanistan, Nepal, Bangladesh, Fiji Indians) and “East and South East Asians” (people from China, Hong Kong, Malaysia, Singapore, Indonesia, Vietnam, Cambodia, Philippines, Thailand, Korea, Japan, Myanmar, Tibet). The prevalence of obesity was 66% and 56% in South Asian men and women, respectively, compared to 37% and 22% in East and South East Asian men and women. The prevalence of diagnosed diabetes was 23% and 21% in South Asian men and women, respectively, in contrast to less than 1% in East and South East Asian men and women.

Data from the NZHS series also show that the prevalence of “unmet need for primary health care” among Asians has increased over the last decade from 21.1% to 24.2%, with a significantly marked increase among Asian men (15.3% to 22.6%). Disaggregated data from the 2011–12 and 2012–13 NZHSs (combined) for Asian subgroups indicate that a lower proportion of South Asians (88%), Chinese (87%) and Other Asian (82%) had a health practice or service to access, if unwell. Poor access to healthcare was even more evident among new Asian migrants (those resident in New Zealand for less than five years), of whom only 62% reported being enrolled in a primary health organisation (PHO), in contrast to 91% of those who had lived in New Zealand for between 5 and 10 years and 93% of those who had lived in New Zealand for over 10 years. These statistics suggest that new Asian migrants have a poor understanding of the New Zealand health system. This is compounded by cultural differences and poor English language proficiency, which in itself is a risk factor for the loss of the healthy migrant status enjoyed by new migrants. Hence understanding health issues using high-quality ethnicity data for Asians is imperative.

Asian health indicators from administrative data

As discussed above, grouping Asians together (level 1 ethnicity code) reduces prevalence estimates of disease for some groups. Using level 2 ethnicity codes can also mask disease prevalence in certain Asian subgroups. Healthcare administrative data usually record main ethnic groups only.
For example, PHO enrolment forms include ethnicity but only provide options for the largest Asian subgroups, namely Indian, Chinese and “Other Asian.” The “Other Asian” category is a mixed group of South Asians, East Asians and South East Asians. Indians make up 87% of South Asians, and as noted above, South Asians have a high prevalence of obesity and diabetes. This means that the high rates of obesity and diabetes among the other 13% of South Asians (Sri Lanka, Pakistan and Bangladesh) are obscured in PHO data, as they are captured as part of the “Other Asian” category.

Examples of studies using administrative data include the papers reporting cardiovascular disease incidence and mortality rates and publications from the PREDICT study. In a recent PREDICT publication, Indians made up 8% of the 475,241 adults in the New Zealand primary care study population, and 10% were “Other Asians.” The prevalence of diabetes among Indians was higher (33% in women and 24% in men) than that of “Other Asians” (21% in women and 15% in men), which included South Asians from Sri Lanka, Pakistan and Bangladesh, who have a similar prevalence of diabetes to Indians, and people from Japan, Korea and other East and South East Asian countries, among whom diabetes is relatively uncommon.

The use of the “Indian” group to make inferences for the South Asian group as a whole is an emerging practice, which has led to the inappropriate use of the category “South Asian” in making international comparisons. For instance, in 2017 Rabanal et al. used the data from the New Zealand PREDICT study, which has information on “Indians” only, to make comparisons with South Asians in Norway. Further, the ethnicity classification used in Norway for South Asian is not consistent with that used in New Zealand. For example, in Norway people from Myanmar are considered South Asian, whereas in New Zealand they are considered South East Asian. Such inconsistent definitions of South Asian in New Zealand and other migrant-receiving countries pose a challenge for international comparisons. The use of the term “South Asian” to represent just one ethnicity, for example Indian, should be avoided to reduce ambiguity in interpreting research findings. Having a well-defined “South Asian” ethnic category to report health data in New Zealand will perhaps stimulate similar thinking and action in other migrant-receiving countries, such as the UK, Norway, USA and Canada, and improve international comparisons of health indicators.

The case for disaggregated Asian health statistics

By combining all Asians into one group, the overall poor metabolic health of South Asians is obscured. For example, in a secondary analysis of the NZHS data, South Asians were found to have a five- to six-fold increased risk of being on treatment for diabetes. Similar findings have been observed in the USA, Canada, UK and Norway, where migrants from Sri Lanka and Pakistan (predominant South Asians in Norway) have a more than five-fold higher risk of diabetes and cardiovascular disease compared with the majority population and other migrant groups world-wide. International multi-ethnic studies have also found the prevalence of diabetes to be higher in younger (20–29-year-old) South Asians compared to other minority (Chinese, African American and Hispanic) and majority (European) ethnic groups. In addition, national hospitalisation and mortality data in New Zealand suggest that Indians have a higher prevalence and incidence of cardiovascular disease when compared to NZ Europeans. Cardiovascular disease mortality rates are significantly higher among people of Indian ethnicity compared to New Zealand Europeans and other Asian subgroups in New Zealand, such as Chinese people. Among New Zealand women who had been screened for gestational diabetes and birthed at National Women’s Health, the prevalence of gestational diabetes was reported to be the highest among Indian women (20%) compared to “Other Asian” (18%), Pacific (12%), Māori (8%) and European (4%) women. Non-alcoholic fatty liver disease is also an emerging issue for the South Asian population. The examples provided in this discourse provide strong evidence that New Zealand is inadequately addressing Asian health by using a “broad-brush” approach via its level 1 and 2 ethnicity classifications. These high-
level categories ignore the subtleties and nuances seen in different Asian cultures, which from a health perspective may under-recognise and under-address certain conditions in some groups leading to greater harm. One can argue ethnicity classifications are developed based on the size of the population groups in a country. South Asians currently make up 6% of the total New Zealand population, and East and South East Asians make up 9%. These figures are similar for New Zealand Pacific Peoples, who currently make up 8% of the New Zealand population, and provide the rationale for disaggregated level 1 ethnicity codes for the “Asian” group as “South Asians” and “East and South East Asians”. This will enable unmasked reporting of health statistics, which will pave the way to equitable health outcomes for New Zealand Asians.

The health disparity observed for South Asians is a serious concern for New Zealand. While South Asian migrants are healthier than the resident population on arrival, their subsequent poor health lowers their overall wellbeing and productivity. An early loss of their healthy migrant status is therefore counterproductive towards the main objective of migration and poses an increased burden on individuals, families and the health system. Government and policy response to New Zealand Asians has been sporadic and limited at best. The current New Zealand Health Strategy (2017–2027) acknowledges this limitation but has no road map to address it. This provides the impetus to raise questions on how we should be developing policies, strategies and investments to make visible the hidden figures of Asian health statistics in New Zealand. Given that Asians are nearly the second largest ethnic group in New Zealand, practical steps need to be taken to strengthen the New Zealand Health Strategy to enable equitable investment into Asian health. Developing appropriate level 1 and 2 ethnicity codes for Asians and reporting health statistics in a disaggregated form would be a pragmatic way forward. To improve the visibility of health issues, the collection of disaggregated health survey data for Asian subgroups will better enable policies and programmes to address unmet health needs. In addition, using more detailed ethnicity codes (level 3 or 4) for patient enrolment forms in primary and secondary healthcare would be critical for capturing health information to inform actions to address the health needs of Asians in New Zealand.

In conclusion, equitable health outcomes for New Zealand Asians are only possible by identifying and developing appropriate, cost-effective and ethnic-specific health-promoting approaches. Using revised ethnicity codes and disaggregated health statistics to understand post-migration health trajectories and associated risk factors of Asian subgroups would be critical to achieve this. It would also provide much needed information for informing policies and programmes both for research and health promotion initiatives to address Asian health in New Zealand in a pragmatic, translational manner and to reduce health disparity for this fast-growing population in New Zealand.
Competing interests: Nil.

Acknowledgements: The authors would like to acknowledge researchers, health professionals, non-government organisations, volunteers and community leaders both past and present who have advocated and worked to improve the health of Asian New Zealanders.

Author information: Sherly Parackal: Senior Research Fellow, Preventive and Social Medicine, Dunedin School of Medicine, University of Otago. Kirsten Coppell: Public Health Physician and Research Associate Professor, Edgar Diabetes and Obesity Research, Department of Medicine, Dunedin School of Medicine, University of Otago, Dunedin. Carlos Lam Yang: GP Consultant and Urgent Care Physician, Botany Junction Medical Centre, Flat Bush, Auckland 2016. Trudy Sullivan: Senior Lecturer and Health Economist, Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago. Rathan Subramaniam: Dean, University of Otago Medical School, Consultant Radiologist and Nuclear Medicine Physician, Dunedin Hospital, Southern District Health Board.

Corresponding author: Dr Sherly Parackal, Senior Research Fellow, Preventive and Social Medicine, Dunedin School of Medicine, University of Otago; 18 Frederick Street, Dunedin Central, Dunedin 9016; +64 3 479 7278, +64 210686973 sherly.parackal@otago.ac.nz


REFERENCES
9. Agyemang C, van den Born BJ. Non-communicable


29. C.Ke P, Sohal H, Qian H, Quan, Khan NA.


Pyroglutamic acidosis: an under-recognised cause of high anion gap metabolic acidosis

Tom Crisp, Peter Sizeland, Stephen Du Toit, Lai Wan Chan

Pyroglutamic acidosis is a rare and underdiagnosed high anion gap metabolic acidosis (HAGMA) caused by accumulation of 5-oxoproline associated with commonly used medications such as paracetamol and antibiotics. We report a case exhibiting the common risk factors of pyroglutamic acidosis and the clinical approach to diagnosis.

Case report

A 74-year-old female presented with abdominal pain, ascites, fever and reduced appetite. Her background included cholecystectomy and Caesarean section. She was initially treated with 13 days of cefuroxime and metronidazole (which was later changed to tazocin following clinical deterioration), paracentesis and analgesia. A CT scan showed paracolic abdominal masses later confirmed as liposarcomata.

After 13 days she developed worsening kidney impairment, malnutrition and HAGMA (Table 1). Various common causes of HAGMA were excluded in the setting of normal lactate and ketones. Medication review found regular paracetamol use calculated at a dose of 76 grams over 19 days, which raised the suspicion that 5-oxoproline had accumulated and was contributing to HAGMA. Paracetamol was stopped and intravenous bicarbonate was given, with brief clinical improvement.

Urine organic acid screen, performed using gas chromatography-mass spectrometry after liquid-liquid extraction, showed marked pyroglutamate excretion (>5,000µmol/mmol creatinine). Treatment with N-acetylcysteine (NAC) was considered. However, she continued to deteriorate and diagnostic laparoscopy found extensive carcinomatosis. Treatment was refocused towards palliation.

Discussion

Pyroglutamic acidosis is an underdiagnosed form of HAGMA caused by excess pyroglutamate due to inhibition of negative feedback of the gamma-glutamyl cycle (Figure 1) via depletion of glutathione¹,² associated with chronic paracetamol use and certain antibiotics.³

Our patient had risk factors. She was elderly with prolonged paracetamol use, sepsis, malnutrition, liver dysfunction (impairing synthesis and regeneration of glutathione) and kidney failure (preventing pyroglutamate clearance). Other risk factors for pyroglutamic acidosis include chronic alcohol excess, pregnancy and use of certain antibiotics, such as flucloxacillin, which inhibits breakdown of pyroglutamate by 5-oxoprolinase.²,³

Diagnosis requires clinical suspicion based on raised anion gap, exclusion of more common causes and the presence of relevant risk factors.³ Formal diagnosis of pyroglutamic acidosis requires a urine organic acid screen.

After the appropriate respiratory compensation has been confirmed, the anion gap can be measured by subtracting measured cations from anions (AG=Na-Cl-HCO₃ with reference interval of 10–14).⁴ Serum proteins also contribute to the anion gap. Therefore, any significant change in serum albumin needs to be accounted for using the formula cAG=AG+0.25×(40-albumin in g/L).⁵
Not doing so in a malnourished patient may underestimate the anion gap.\textsuperscript{3,4} This is especially important in pyroglutamic acidosis, as malnutrition is common. This may have contributed to delayed recognition of our patient’s condition.

There can be co-existing acid base abnormalities, which are investigated using the delta gap (Δ-Δ=(ΔAG)-(ΔHCO3)). A delta gap between -5 and +5 indicates a pure HAGMA. Results outside this range suggests a concomitant acid-base disturbance.\textsuperscript{4}

After confirming a pure HAGMA, other causes, such as high lactate or ketones, are excluded. The GOLDMARK mnemonic is helpful in recalling causes of a HAGMA (Table 2).\textsuperscript{5}

Treatment involves stopping causative medications, bicarbonate administration, moderating acidosis and NAC that replenishes glutathione. Pyroglutamate is cleared renally, and dialysis has been used in severe cases.\textsuperscript{5,6}

In conclusion, pyroglutamic acidosis is a rare and under-recognised cause of HAGMA that can be precipitated by prescription of simple analgesia or common antibiotics in individuals at risk. A high clinical suspicion is required to make the diagnosis and initiate targeted treatment.
### Table 1: Significant laboratory results.

<table>
<thead>
<tr>
<th>Day of admission</th>
<th>Day 1</th>
<th>Day 13</th>
<th>Day 19</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full blood count</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemoglobin (115–155g/L)</td>
<td>133</td>
<td>146</td>
<td>114</td>
</tr>
<tr>
<td>Platelets (150–400x10^9/L)</td>
<td>586</td>
<td>1,173</td>
<td>943</td>
</tr>
<tr>
<td>White blood cells (4–11x10^9/L)</td>
<td>12.98</td>
<td>25.42</td>
<td>15.84</td>
</tr>
<tr>
<td>Neutrophils (1.9–7.5x10^9/L)</td>
<td>9.14</td>
<td>20.60</td>
<td>11.99</td>
</tr>
<tr>
<td><strong>Urea and electrolytes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium (135–145mmol/L)</td>
<td>139</td>
<td>128</td>
<td>131</td>
</tr>
<tr>
<td>Potassium (3.5–5.2mmol/L)</td>
<td>4.3</td>
<td>4.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Creatinine (&lt;90µmol/L)</td>
<td>58</td>
<td>178</td>
<td>188</td>
</tr>
<tr>
<td>Urea (3.2–7.7mmol/L)</td>
<td>4.3</td>
<td>8.1</td>
<td>12.4</td>
</tr>
<tr>
<td><strong>Liver function tests</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilirubin (0–24µmol/L)</td>
<td>4</td>
<td>3</td>
<td>&lt;2</td>
</tr>
<tr>
<td>ALP (40–130IU/L)</td>
<td>190</td>
<td>151</td>
<td>330</td>
</tr>
<tr>
<td>ALT (0–45IU/L)</td>
<td>18</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>GGT (0–50IU/L)</td>
<td>77</td>
<td>66</td>
<td>143</td>
</tr>
<tr>
<td>Albumin (32–48g/L)</td>
<td>35</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td><strong>CRP (0–5mg/L)</strong></td>
<td>120</td>
<td>200</td>
<td>73</td>
</tr>
<tr>
<td><strong>Venous blood gas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH (7.35–7.45)</td>
<td>-</td>
<td>7.17</td>
<td>7.30</td>
</tr>
<tr>
<td>pCO₂ (4.7–6.0kPa)</td>
<td>-</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Bicarbonate (22–28mmol/L)</td>
<td>-</td>
<td>10.4</td>
<td>12.2</td>
</tr>
<tr>
<td>Sodium (135–145mmol/L)</td>
<td>-</td>
<td>129</td>
<td>129</td>
</tr>
<tr>
<td>Chloride (95–110mmol/L)</td>
<td>-</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Lactate (&lt;2mmol/L)</td>
<td>-</td>
<td>2.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Ketones (&lt;1mmol/L)</td>
<td>-</td>
<td>-</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Anion gap (corrected for albumin) (10–14)</td>
<td>-</td>
<td>24.85</td>
<td>28.05</td>
</tr>
<tr>
<td>Δ-Δ (-5–+5)</td>
<td>-</td>
<td>-0.75</td>
<td>+4.25</td>
</tr>
</tbody>
</table>
Figure 1: The gamma-glutamyl cycle, displaying inhibition via negative feedback mechanism using glutathione. Image created on Biorender.com.

Table 2: GOLDMARK mnemonic showing causes for a high anion gap metabolic acidosis.

<table>
<thead>
<tr>
<th>G</th>
<th>Glycols</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>5-oxoproline (Pyroglutamic acid)</td>
</tr>
<tr>
<td>L</td>
<td>L-lactate</td>
</tr>
<tr>
<td>D</td>
<td>D-lactate</td>
</tr>
<tr>
<td>M</td>
<td>Methanol</td>
</tr>
<tr>
<td>A</td>
<td>Aspirin</td>
</tr>
<tr>
<td>R</td>
<td>Renal failure</td>
</tr>
<tr>
<td>K</td>
<td>Ketones</td>
</tr>
</tbody>
</table>
Competing interests:
Nil.

Author information:
Tom Crisp: Emergency Department Registrar, Southern District Health Board, Dunedin.
Peter Sizeland: Renal Physician, Waikato District Health Board, Hamilton.
Lai Wan Chan: Renal Physician, Waikato District Health Board, Hamilton.

Corresponding author:
Dr Lai Wan Chan, Renal Physician, Waikato District Health Board, Hamilton
Laiwan.chan@waikatodhb.health.nz

URL:

REFERENCES


Diabetic myonecrosis presenting as unilateral thigh pain and swelling

Ha Eun (Grace) Kim, Rahul Gandhi, George Waterworth, Yesim Morice

A 56-year-old woman presented with a two-week history of atraumatic left thigh pain and swelling. She had a background of poorly controlled type 2 diabetes with a recent HbA1C of 134mmol/mol (normal <40mmol/mol). She was afebrile and the rest of her vital signs were normal. Her left thigh was swollen and tender. There were no abnormal skin findings. Laboratory evaluation showed a normal white blood cell count. There was elevation of both CRP at 86mg/L (normal <5mg/L) and CK at 343U/L (normal 22–198U/L). Ultrasound and CT of the left thigh revealed a well-defined intramuscular fluid collection in the vastus lateralis. MRI findings are shown in Figure 1.

The considered differential diagnoses were diabetic myonecrosis, infectious myositis, necrotic neoplasm or abscess.

Discussion

In the setting of this clinical presentation of a patient with poorly controlled diabetes without fever or leucocytosis, and supportive MRI findings, we made a diagnosis of diabetic myonecrosis. The diagnosis was reaffirmed by spontaneous clinical improvement and decreasing inflammatory markers without antibiotic treatment but only tighter glycaemic control. Therefore, we felt a biopsy was not indicated as it would not change management and would expose the patient to unnecessary risk of infection and haematoma. Outpatient follow-up at two weeks confirmed complete clinical resolution, and an ultrasound examination showed no residual collection and improved muscle architecture.

Diabetic myonecrosis, or diabetic muscle infarction, is a rare complication of diabetes. This diagnosis should be considered in patients with poorly controlled diabetes presenting with acute onset of pain and swelling of the lower limbs, particularly in the thigh. The pathogenesis is uncertain, but it has been attributed to microvascular thrombosis and ischaemia caused by endothelial damage. Muscle biopsy is typically not required unless there is uncertainty regarding the diagnosis. Short-term prognosis is good, but long-term prognosis is poor, which reflects the underlying severity of arteriopathy in these patients. Estimated mortality from a major vascular event within two years after an episode of diabetic myonecrosis is reported to be 10%. Treatment is conservative with a focus on diabetes control, analgesia and rest.
Figure 1: Coronal post-contrast T1 fat saturated MRI of the left thigh shows a hyperintense fluid collection and diffuse surrounding enhancement within the oedematous vastus lateralis muscle and subfascial fluid collection along the lateral surface.
Competing interests:
Nil.

Author information:
Ha Eun (Grace) Kim: Department of General Medicine, Wellington Regional Hospital, Wellington, New Zealand.
Rahul Gandhi: Department of General Medicine, Wellington Regional Hospital, Wellington, New Zealand.
George Waterworth: Department of Radiology, Wellington Regional Hospital, Wellington, New Zealand.
Yesim Morice: Department of General Medicine, Wellington Regional Hospital, Wellington, New Zealand.

Corresponding author:
Ha Eun (Grace) Kim, Department of General Medicine, Wellington Regional Hospital, Wellington, New Zealand
gracekim521@gmail.com

URL:

REFERENCES
St John Ambulance has and will continue to treat and transport all patients throughout the COVID-19 outbreaks in New Zealand

Kris Gagliardi

In a recent article in the New Zealand Medical Journal by authors Nixon et al1 about rural doctors and COVID-19, there is an incorrect statement about St John Ambulance policy which, having now been reported elsewhere, has propagated confusion and misinformation. The authors reported that one of their interviewees stated:

“...[St John] was initially just saying that they weren’t going to transport anyone where there was a respiratory problem... anyone who’s needing any kind of respiratory support... I know it was raised at a national level, because it was St John’s policy. I think one of the things that was very difficult was that this was unilaterally declared by St John to the DHB and to us all, so there was no balancing of risks, it didn’t seem to us”

This is incorrect. St John Ambulance has and will continue to treat and transport all patients throughout COVID-19 outbreaks in New Zealand, including individuals with respiratory problems, COVID-19-positive patients and those with symptoms of the virus. It has never been St John’s policy to refuse to treat and transport patients. All St John ambulance personnel are trained in infection control practice and regularly treat patients with infectious diseases all year round. To limit the risk of infection and to protect the public and St John staff, frontline ambulance personnel follow specific clinical guidelines and take universal precautions, including routinely wearing Ministry of Health-recommended personal protective equipment (PPE) and changing these between patients.

Kris Gagliardi, St John Assistant Clinical Director.
Competing interests: Nil.

Author information: Kris Gagliardi: St John Assistant Clinical Director.

Corresponding author: Kris Gagliardi
media@stjohn.org.nz.


REFERENCES
Reduced excision of benign skin lesions through tiered practitioner, general practitioner with a special interest in skin cancer and dermatologist clinical review within New Zealand integrated family healthcare

Louise Reiche, Adrian Macquet, Anna Skinner, Sarah Fursdon

International best evidence study data state that accuracy in diagnosing skin cancers, invasive melanoma and atypical intra-epidermal melanocytic variants is higher for in-person dermatologist diagnosis compared to image-based evaluations and compared to other trained professionals.1–5

Because of the lag phase between sun exposure and skin cancer development, and despite SunSmart interventions, New Zealand skin cancer rates are predicted to continue to increase over the next decade or so.6 Non-melanoma skin cancers have not been adequately recorded, masking problem severity.7 New Zealand has both an ageing and workforce medical shortage issue, including dermatologists and general practitioners.8 Medical workforce deficiencies and a growing New Zealand population compound pressures on future health services, which inspires innovative approaches to optimise early skin cancer detection and efficient management practices.9 Reducing unnecessary surgical excision of benign lesions and reducing missed cancers is desired. Both are achievable with appropriate training.10,11

MidCentral District Health Board (DHB) public hospital skin lesion referrals are rejected without an accompanying clinical image and may take four to six months to be seen, which can be shortened by the inclusion of melanoma biopsy histology.

We propose a pragmatic efficient clinical triage approach to straddle need and service mismatch.

Kauri HealthCare, New Zealand’s largest MidCentral DHB public health organisation and an integrated family healthcare practice of over 20,000, (21,193), features both a general practitioner with a special interest in skin cancer (GPwSISC) clinic and a dermatologist. The GPwSISC has completed two six-month Skin Cancer College Australasia courses: (1) Dermoscopy and (2) Advanced Skin Cancer Surgery and Medicine. The practice provides rotations for both nursing and medical students and early graduates.

Referrals to the GPwSISC come from other practitioners within the practice and directly from the practice patient population.

Twice-weekly sessions of three 5–10-minute appointments were provided for patients who referrers believed were unable to afford private dermatology care, during the study period. Appointments were booked directly by general practitioners, nurse practitioners or junior medical staff (collectively, “other practitioner”). Practitioners attended with the patient,
presented the history, sought clarification of uncertainties, recorded information and facilitated recommended investigations or therapies, and simultaneously received both a specialist dermatology opinion and practical and academic teaching. Additional ad lib mini electronic referrals were made via the practice confidential intranet but not included.

MidCentral DHB Ethics and Research Office granted approval for this study. Over 30 months (April 2017–September 2019), 701 dermatology opinions were sought. Of these, 121 face-to-face consultations were for skin lesions (as opposed to rashes or other dermatological issues) that practitioners were uncertain about. Eighty-three were from GPwSISC and 38 from other practitioners. More than one lesion was assessed in many of these consultations, so the total lesions clinically reviewed face to face was 141 (GPwSISC) and 92 (other practitioner), providing a collective total of 233. The average patient age was 57 years with a standard deviation of 19 years. Fifty-eight percent were female (and 42% male).

Socioeconomic deprivation, as measured by area-based composite indices, inversely correlates with measures of health status. Amalgamating each two of the original decile scoring provides a quintile score, whereby quintile 1 represents the least and quintile 5 the highest group of socioeconomic deprivation and thus likelihood of health needs. In this review, analysis for dermatology referrals matched the quintile breakdown for the practice population served. But referrals for opinions regarding skin lesions showed an inverse deprivation trend (Table 1).

Ethnicity analysis of Kauri HealthCare's population compared to those referred for lesion review shows a disproportional referral bias towards New Zealand European and Asian ethnicities and under-representation of Māori, Pacific and Middle Eastern peoples (Table 2). NZ European typically have fairer skin colour and are over-represented in the New Zealand skin cancer prevalence data. Quintile analysis (not shown) of our population has revealed that 52% of our Māori, and 58% of our Pasifika, are in quintile 4 and 5. Among other features associated with deprivation quintile assignment is inverse health literacy, communication means (telephone access) and transport, which all inhibit access to early (preventative) healthcare.

Referred lesions subsequently clinically diagnosed as benign (ie, non-malignant) (eg, seborrheic keratosis, benign naevi, wart) or inflammatory (eg, prurigo, acne, eczema, tinea, granuloma annulare) exceeded clinically diagnosed malignant or precursor lesions, as shown in Table 3. Clinically diagnosed squamous cell carcinoma or melanoma were confirmed histologically but not lesions that were clinically benign or that could be managed readily by topical therapy (ie, biopsy/surgery was not otherwise indicated). Patients were encouraged to return should “benign” lesions progress after review, but none did so during this study period. Two lesions in Māori patients were clinically diagnosed as basal cell carcinoma (BCC), and one atypical, pigmented lesion suspicious of melanoma in a Chinese woman was histologically a compound naevus. All other cutaneous

<table>
<thead>
<tr>
<th>Quintile number</th>
<th>Quintile % for Kauri HealthCare</th>
<th>Quintile % for lesion referrals</th>
</tr>
</thead>
<tbody>
<tr>
<td>quintile 1</td>
<td>23%</td>
<td>26%</td>
</tr>
<tr>
<td>quintile 2</td>
<td>18%</td>
<td>19%</td>
</tr>
<tr>
<td>quintile 3</td>
<td>23%</td>
<td>24%</td>
</tr>
<tr>
<td>quintile 4</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>quintile 5</td>
<td>15%</td>
<td>14%</td>
</tr>
</tbody>
</table>
malignancies were seen in those who classified themselves as European ethnicity.

Because all clinically confirmed or suspicious melanomas and squamous cell carcinomas required surgical excision, these were all histologically confirmed. Higher numbers of actinic keratoses were seen, and fewer squamous cell carcinoma in situ.

The ratio of lesions reviewed that no longer required a biopsy after dermatology review versus those that needed a biopsy (either for diagnostic exclusion or to remove a malignancy) (ie, benign to malignant) ratios were 2:1 for GPwSISC compared to 5:1 for other practitioners (Table 5).

“Biopsy justified / required to clarify possible malignancy” was seen in a higher percentage of referrals from GPwSISC (33%) compared to other practitioners (16%) to eliminate secondary dermatologist clinical diagnosis doubt and represents a greater proportion of “grey/uncertain diagnoses.” There was a markedly better seborrhoeic keratosis diagnosis rate for GPwSISC: 2.1% versus 19.6%. Seborrhoeic keratoses are common changing, frequently pigmented, benign lesions, concerning patients and doctors. Extra dermatoscopic experience and training that GPwSISC and dermatologists have compared to other practitioners improves their accurate clinical diagnosis. However, over time the greater proportion of seborrhoeic keratoses were referred by incoming junior medical staff and more newly qualified practitioners compared to those who had used the service previously (data not shown).

The numbers of squamous cell carcinoma were close to those for melanoma in this review, and the GPwSISC brought more cases of melanoma compared to squamous cell carcinoma for clinical review. This may reflect a greater concern by patients and practitioners to miss an early diagnosis of melanoma than squamous cell carcinoma or this relatively young population (average age 57 years), as squamous cell carcinomas are seen more frequently in older and immunosuppressed populations.

Confident diagnoses of benign and malignant lesions did not require dermatology review referral. Although many patients are referred by other practitioners to the GPwSISC, the figures discussed in this review pertain to lesions all practitioners were uncertain about. The populations between the comparative groups may therefore differ, and it is possible that lesions more suspicious of skin malignancy had been selectively referred (by other practitioners) to the GPwSISC, but there is no data to refute or confirm this. Following extended professional interactions among these practitioner groups, the dermatologist observed a superior skin lesion clinical and dermatoscopic knowledge and skill and interpretation by the GPwSISC (figures not shown in this review).

McGeoch et al eloquently demonstrated apprentice style surgical skill education provided by secondary care to primary care resulted in increased access to care, reduced waiting times and reduced the number of visits to hospital for skin cancer

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Percentage Kauri HealthCare population</th>
<th>Percentage Skin lesion referral</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>73%</td>
<td>86%</td>
</tr>
<tr>
<td>Māori</td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>Pacific Peoples</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Asian</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>8%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 2: Kauri HealthCare background ethnicity percentage compared to those referred for skin lesion review.
Table 3: Table showing total skin lesion referrals grouped into malignant, non-malignant or inflammatory categories and their respective commonest (greater than 1%) dermatologist clinical diagnosis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Dermatologist clinical diagnosis</th>
<th>Percentage (total 233)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malignant skin lesions 30%</strong></td>
<td>Basal cell carcinoma (BCC)</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Melanoma</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Squamous cell carcinoma (SCC)</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Malignant precursor 14%</strong></td>
<td>Actinic keratosis</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Benign lesions 23%</strong></td>
<td>Seborrheic keratosis</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Naevi</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Wart</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Molluscum contagiosum</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Inflammatory lesions 33%</strong></td>
<td>Ecema</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Acne</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Granuloma annulare</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Prurigo</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Tinea</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Other (each &lt;1%)</td>
<td>28%</td>
</tr>
</tbody>
</table>

Table 4: Comparison of commonest benign, premalignant and malignant keratinocyte and pigmented lesion diagnoses between a general practitioner with a special interest in skin cancer (GPwSISC) and other practitioners.

<table>
<thead>
<tr>
<th>Clinical diagnosis</th>
<th>General practitioner with a special interest in skin cancer (GPwSISC)</th>
<th>Other practitioner</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial basal cell carcinoma (BCC)</td>
<td>2</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Basal cell carcinoma (BCC)</td>
<td>19</td>
<td>8</td>
<td>9%</td>
</tr>
<tr>
<td>Squamous cell carcinoma in situ</td>
<td>0</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Squamous cell carcinoma (SCC)</td>
<td>8</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Melanoma</td>
<td>13</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Actinic keratosis</td>
<td>18</td>
<td>21</td>
<td>23%</td>
</tr>
<tr>
<td>Other suspicious malignancy (eg, Merkel’s, lymphoma, amelanotic melanoma)</td>
<td>6</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Naevi</td>
<td>12</td>
<td>6</td>
<td>7%</td>
</tr>
<tr>
<td>Lentigo</td>
<td>7</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Seborrheic keratosis</td>
<td>3</td>
<td>18</td>
<td>20%</td>
</tr>
<tr>
<td>Other benign lesions</td>
<td>53</td>
<td>25</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Total lesions</strong></td>
<td>141</td>
<td>92</td>
<td>100%</td>
</tr>
</tbody>
</table>
management. That programme was supported by hospital management and funders, but in common with this review, it was also patient focused and resulted from initiation and cooperation by primary and secondary care clinicians. Both showed that training is time consuming for the vocational specialists concerned, but because more primary care practitioners were upskilled, reduced and more appropriate referrals to public secondary care services resulted.

McGeoch et al’s study relied on electronic referral and clinical photograph triage and showed an increased number of total excised lesions (benign and malignant). This review differs by improving skin lesion clinical diagnosis, thus reducing the need to biopsy many benign lesions, which is an additional important step towards improved regional skin cancer management improvement and health resource use. Face-to-face joint consultations provide more opportunity for interactive learning, reinforcing strengths and addressing clinical uncertainties. In the short term, this is more time consuming for specialists, but longer term it increases overall health system efficiency compared to electronic and clinical photograph triage referral (as shown by changing referral trends by increasingly trained practitioners).

In summary, the figures shown in this review showed more skin cancers in patients typically having fairer skin colour (European), a trend showing enhanced diagnostic accuracy having a GPwSISC within integrated family healthcare, and further considerable clinical diagnostic improvements from dermatologist expertise. Access to prompt expert diagnostic opinion avoided the need for secondary public hospital specialist referral and considerably reduced unnecessary biopsies, sparing patient morbidity, and it provided significantly earlier patient reassurance or treatments. Furthermore, face-to-face consultations with the attendant practitioner present facilitated active learning and may reduce future consultations. We recommend the presented model as a way that optimises general practitioner with a special interest in skin cancer (GPwSISC) and dermatologist expertise, and which could provide considerable assistance bridging the workforce shortage and pending incremental skin cancer service need.

Table 5: Comparison of a general practitioner with a special interest in skin cancer (GPwSISC) and other practitioners benign to (possible) malignant lesions requiring surgery.

<table>
<thead>
<tr>
<th></th>
<th>General practitioner with a special interest in skin cancer (GPwSISC)</th>
<th>Other practitioner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biopsy justified / required for possible or confirmed basal cell carcinoma (BCC), squamous cell carcinoma (SCC), melanoma or other malignancy</td>
<td>46 (33%)</td>
<td>15 (16%)</td>
</tr>
<tr>
<td>Biopsy not required</td>
<td>95 (67%)</td>
<td>77 (84%)</td>
</tr>
<tr>
<td>Ratio of lesions not requiring biopsy / lesions requiring surgery</td>
<td>2:1</td>
<td>5:1</td>
</tr>
</tbody>
</table>
Competition interests:
Nil.

Acknowledgements:
Kauri HealthCare general practitioners, nurse practitioners, junior medical staff, Kauri HealthCare support staff.

Author information:
Louise Reiche: Dermatologist, LR Dermatology Ltd., Kauri HealthCare, Palmerston North.
Adrian Macquet: General Practitioner with Special Interest Skin Cancer, Kauri HealthCare, Palmerston North until December 2019.
Anna Skinner: Clinical Director and General Practitioner, Kauri HealthCare, Palmerston North.
Sarah Fursdon: Executive Assistant, Kauri HealthCare, Palmerston North.

Corresponding author:
Louise Reiche, Dermatologist, LR Dermatology Ltd., Kauri HealthCare, PO Box 545, Palmerston North 4410, 06 357 4424
admin@kaurihealthcare.nz

URL:

REFERENCES
Mark was born in Nelson, on 3 November 1952, to parents, Dr John Davis and Gladys Davis.

John was a General Practitioner in Wakefield. He provided great inspiration for Mark's future career in medicine.

Mark attended Wakefield Primary School, Waimea Intermediate and Waimea College. During his school years he excelled at tennis and took an early (and lifelong) interest in golf.

In 1971 he attended the University of Otago to embark on his medical career. These were fun and productive years, with Mark further developing his interests in music, movies, poetry, meditation, yoga and spirituality. He completed his undergraduate years flatting in the idyllic seaside village of Brighton Beach, south of Dunedin. He often recalled these as some of his happiest years.

His trainee intern year saw Mark move to Wellington and graduate with Distinction in Psychological Medicine in 1976. He was awarded The Smith, Klein & French prize for top student in Psychological Medicine. House Surgeon and Psychiatric Registrar years followed in Wellington and Lower Hutt. These were hectic years with long after-hours call duties.

Mark's communication skills and good humour made him a favourite on the wards. In this context he met his future wife and lifelong soulmate, Sally Rutherford.

Mark obtained his MRCPsych after further training in Northampton and Oxford. The

Mark Davis
3 November 1952–26 April 2021

following year he became a Senior Registrar in Psychotherapy at Cassel Hospital, where he worked under Medical Director Tom Main, who had trained in psychoanalysis under Michael Balint and was supervised by Melanie Klein and Anna Freud.

Throughout the years that followed, Mark pursued knowledge of himself. Through meditation, workshops and retreats run by Ken Mellor in Victoria, Mark greatly enriched his ability to monitor both sides of the interaction between patient and doctor, an important skill in medicine and particularly psychiatry.

After returning to New Zealand and obtaining Fellowship with the Royal Australian and New Zealand College of Psychiatrists, Mark worked as a consultant in the newly established psychiatric service at Hutt Hospital until 1995. In private practice from 1990, he was still doing some work at the time of his final illness.

Mark's experience at the Cassel Hospital led to many other involvements. He was a Balint Group facilitator with Wellington region GPs and was a board member of the Balint Society. He was a psychiatrist to the Te Omanga Hospice, Member of the Medical Council of New Zealand Education Committee (1998–2003), Member of the Health Advisory Committee to the Veterinary Council of New Zealand, Member of the New Zealand Doctors’ Health Advisory Service (1993–2004) and Member of an ACC liaison advisory committee.

Mark continued learning from others while contributing his passion, curiosity and insight. He met individually and regularly with a number of his colleagues and belonged to several other peer groups which focused on psychotherapy, pain and practice issues.

Mark’s early years of working in general adult psychiatry were replaced in more recent years by medico-legal work. His intelligence and curiosity were particularly valuable in medico-legal assessments resulting in accuracy and detail. He developed expertise in the assessment of post-injury pain and assessment of the psychological factors and disorders which impair post-injury recovery. This assisted the ACC, along with many patients and their lawyers, to achieve fair outcomes. His opinions are often quoted in current ACC case law.

For over 10 years, Mark assisted coroners in reviewing suicides in psychiatric care. His expertise was used by the Medical Council and in reviews of insurance claims, war pensions and employment disputes.

Mark was forever seeking to improve his golf swing and had recently achieved the satisfaction of pushing out a 300m drive. Father and son events were his favourite. He adored his home club, the Royal Wellington Golf Club, especially the annual offal luncheons.

Mark was a gifted violinist. The violin would accompany him to medical reunions, birthdays, weddings and more. They were fun events, especially when Mark performed his Cossack dance routine. It was fitting that Mark’s memorial concluded with Ralph Williams’ “The Lark Ascending.”

Paramount to Mark was his love for family and friends.

On Monday 26 April 2021, Mark died peacefully at home, surrounded by his loving family. He is survived by wife Sally, siblings Annie and Ken and children: Juliette and partner Simon and son Nikki, Nicko and wife Michelle, twins Katie and Jess and grandchildren Theo and Lottie.
Competing interests:
Nil.

Author information:
Nicko Davis: Lawyer.
Toni Marks: Psychiatrist.
Denis Atkinson: Orthopaedic Surgeon.

Corresponding author:
Denis Atkinson, Orthopaedic Surgeon
orthohb@xtra.co.nz

URL:
www.nzma.org.nz/journal-articles/mark-davis
By F. N. Harvey, Napier, Hawke's Bay

During the last two or three years, having had several opportunities of observing the surprisingly good results which follow an injection of pituitrin and adrenalin in attacks of asthma, I was struck by the possibility of similar happy results in the treatment of acute œdema if the lungs—in the pre-œdema stages of which the symptoms are almost identical with those of an acute attack of cardiac or renal asthma.

A few days ago, at 2 p.m., I received an urgent call to a primipara who had been delivered of a still-born child, thirty hours previously. She had no albumin in a specimen tested two weeks previously, but during the last few days had had one or two fainting turns, and her legs and hands had swollen considerably. This œdema had almost all disappeared within twenty-four hours of the child's birth. The telephone message was that she had fainted while on the bed-pan.

I arrived at her house inside ten minutes, and found her propped up in bed gasping for breath, apparently in extremis. She was a ghastly livid blue colour. In comparison with her colour and dyspnœa her pulse was surprisingly good. Her condition was then almost identical with that of an acute attack of asthma. Crepitations were present all over the chest. She had had no pain in her chest of other symptom suggestive of pulmonary embolus.

I gave her a hypo of atropine sulph. gr. 1/50, morphine sulph. gr. 1/4, and strychnine gr. 1/20, followed in about ten minutes by B.W. Infundin, 1 c.c. I had no adrenalin in my bag.

By this time she had commenced to bring up the typical pink frothy fluid, and had soon soaked through half a dozen large cloths. Recovery, however, quickly took place, and the cough and expectoration entirely ceased. Within two hours her pulse was 120, and respiration 30, and except at the bases all the crepitation had vanished.

At 9 p.m. she had a second attack. The nurse gave her the same hypodermic of atropine, strychnine, pituitrin, with morphine gr. 1/6 this time, and sent out to ring me up.

The patient had a desperate struggle, and for over two hours the issue was in doubt. She commenced bringing up mouthfuls of the pink frothy fluid soon after I arrived, but eventually rallied considerably, and I felt it safe to leave for some oxygen. I had brought up some adrenalin, but did not give it owing to her recovery from the previous attack and the expectation of her repeating the performance. When I left I filled a hypodermic syringe with m. vii. adrenalin, and told the nurse to give it should anything untoward happen. Some twenty minutes later I was busy testing an oxygen cylinder when a telephone message was brought me to come back at once, as the patient was very bad. They had to telephone from a neighbour's house and so I was not able to get back till about twenty minutes after she had again relapsed. Expecting to find her dead, I was very agreeably surprised to find her smiling cheerfully and sitting up, very well indeed.

The nurse told me she had sent the husband to ring for me as she thought the patient was so desperately ill that she could not possibly live for more than a minute or two, and she wanted him out of the house. She then gave the patient the adrenalin. For some minutes the patient sank still a little more, but suddenly a miraculous change took place, and within ten minutes the patient was ever so much better than she had been at any time since the start of the first attack. Recovery afterwards was quite uneventful.

I have absolutely no doubt but that the adrenalin saved her life, and consider it should be added to the list of drugs that are recommended in pulmonary œdema.
Personally, I lacked sufficient courage to give it at the commencement of the second attack, but I thought it safer to depend upon the remedies which had proved successful in the first, and also felt that adrenalin was so potent a drug that an experiment was inadvisable. In this case, however, it proved successful where other remedies usually given, had conspicuously failed; and when their physiological action was distinctly on the wane.

So far I had not seen it recommended in connection with a case of this kind.

A catheter specimen of urine next day showed three grams of albumin per litre.

There was also a very faint mitral systolic murmur, and a fair number of crepitation at both bases.

Recovery was uncomplicated, and in three weeks the patient was able to commence some work about the house.

URL:
The NZMA publishes the e-magazine NZMJDigest 10 times a year. It contains news and views from the profession and the NZMA, including the NZMA Chair’s editorial, along with highlights from and links to the New Zealand Medical Journal.

Click on the image above to view the latest issue.

We welcome contributions from members and readers. To contribute to the NZMJDigest, please email digest@nzma.org.nz