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Frank Frizelle

This editorial outlines what is likely to be the health policy of the incoming government. This is based on the pre-election policy statements of the parties that are likely to make up the new government under our mixed-member proportional representation (MMP) system.

Inequities in colonoscopy access: a retrospective audit of accepted referrals in Te Whatu Ora Counties Manukau

Luke Paterson, Emma Espiner, Elana Curtis, Chao Li, Maree Weston, Sarah-Jane Paine

People who have colorectal cancer diagnosed early have a much better rate of survival. Colonoscopies are the best way of diagnosing colorectal cancer early. Our paper shows Māori patients who have been referred to have a colonoscopy are much less likely to have the colonoscopy performed.

Non-small cell lung cancer chemotherapy treatment outcomes and ethnicity: a twenty-year single-centre patterns of care study

Ha Nguyen, Rawiri Keenan, Ian Kennedy, Chunhuan Lao, Ross Lawrenson

This study investigates the treatment of patients with advanced-stage non-small cell lung cancer (NSCLC) over a 20-year period in a single New Zealand centre with reference to the use of Systemic Anti-Cancer Chemotherapy (SACT), and explores ethnic disparities in treatment and outcomes. Our SACT database includes 1,057 patients diagnosed with advanced NSCLC during 2000–2021, with 30% identified as Māori and 53% treated with SACT. Significant ethnic difference between Māori and non-Māori exists for both survival and receipt of second line SACT.

Trends in the primary healthcare nursing workforce in managing diabetes from two sample surveys in 2006–2008 and 2016 in Auckland, New Zealand

Barbara M Daly, Bruce Arroll, Robert K Scragg

Practice nurses have significantly increased their knowledge and capacity in the community management of diabetes. Nurses are more likely to carry out diabetes annual reviews and follow-up patients independently of a doctor. Designated diabetes nurses are increasingly incorporated into the traditional model of care provided in general practice.

Co-design of youth appropriate services for young people with rheumatic fever/rheumatic heart disease in Counties Manukau District

Lucy Wong, Agnes Wong, Lynne M Maher, Bridget Farrant, Kate Palmer-Neels, Fofoa Pio, Philippa Anderson, Belinda Paku

Young people and their whānau/aiga and health professionals who care for them were invited to participate in both identifying the challenges with healthcare through their journey with rheumatic fever and rheumatic heart disease, and identification of potential improvements. Care includes a

monthly medication (Bicillin) injection that has to be delivered by a nurse, alongside clinic appointments, heart scans and sometimes other medications. Concerns were raised that care can be frustrating and fragmented, with a lack of communication and understanding. Improvements suggested to help improve services included systems to support communication and consistency between health services, patient, whānau/aiga and health professional education resources and development of a more youth friendly culturally appropriate model of care for young people on monthly Bicillin injections.

Increasing rates of referrals for investigation of primary aldosteronism at a tertiary centre

William Park, Patricia Whitfield, Brian Corley, Simon Harper, Joe Feltham, Richard Carroll

Hypertension (high blood pressure) is sometimes caused by an underlying medical condition (secondary hypertension), the most common cause being primary aldosteronism (PA). PA is becoming increasingly recognised as an important cause of hypertension, but most people with PA are unaware that they have PA because of a low rate of testing and diagnosis. Our study showed that the number of patients referred to specialists in our region to investigate PA increased between 2016 and 2021, but the number is still much lower than expected. Diagnosing PA is important because treatment differs from other causes of hypertension, and our patients with PA generally received effective and safe treatment with medication or surgery. However, the main medication used to treat PA (spironolactone) had a high rate of minor side effects in our patients, so it would be beneficial for the second-line medication (eplerenone) to be funded for these patients in Aotearoa New Zealand.

Investigations and treatment after non-ST segment elevation acute coronary syndrome for patients presenting to rural or urban hospitals in Aotearoa New Zealand: ANZACS-QI 75

Rory Miller, Garry Nixon, Robin M Turner, Tim Stokes, Rawiri Keenan, Corina Grey, Yannan Jiang, Susan Wells, Wil Harrison, Andrew Kerr

This national study looked at whether there was a difference in the care that patients who had a heart attack between January 2014 and December 2019 depending on the rural–urban category of the hospital they were first admitted to. Three hospital categories were considered—large urban interventional hospitals, smaller urban non-interventional hospitals and rural hospitals. Patients who presented to rural or urban non-interventional hospitals experienced delays in receiving angiography (an important investigation and possible treatment for heart attacks) and were less likely to receive echocardiography (a heart ultrasound) compared to patients that presented to urban interventional hospitals. Delays to angiography disproportionally impacted Māori, who were more likely to live in the catchments of rural and non-interventional hospitals. Prescribing rates of secondary prevention medications were the same across all three types of hospital.

Call to action—the urgent need for a heart health plan in New Zealand

Gerry Devlin, Collin Tukuitonga, Corina Grey, Mark Richards, Anna Rolleston, Rob Doughty, Malcolm Legget, Jim Mann

Cardiovascular diseases (heart disease and stroke) are the leading cause of health loss in Aotearoa New Zealand. Almost one in four deaths caused by heart disease and stroke are premature and avoidable, meaning that they happened before the age of 75 and could potentially have been avoided through prevention and access to timely healthcare. The burden is especially high for Māori and Pacific people. Aotearoa New Zealand urgently needs an action plan to focus on reducing the avoidable and inequitable burden of heart disease. Health system reforms are a critical opportunity to address the lack of coherent strategy for heart health and bring together clinicians, health planners, policy makers, communities, Māori and Pacific health leaders to develop a roadmap for better outcomes.

No fixed abode: a case report highlighting the complexities of schizophrenia and homelessness in the context of diminishing access to psychiatric rehabilitation

Matthew Tennant, Cameron Lacey

This case report describes a Māori man who had 5 years of untreated psychosis perpetuated by homelessness. It describes the barriers to him receiving adequate mental health care. Often our most vulnerable people do not have a political voice. This man gave permission for me to share his story in the hope that more support would be available for people like him in the future.

Increasing isolation of non-toxigenic Corynebacterium diphtheriae in Aotearoa New Zealand

Shivani Fox-Lewis, Sharmini Muttaiyah, Sally Roberts

This letter describes the trends over the past 11 and a half years in Aotearoa New Zealand in the isolation of *Corynebacterium diphtheriae*, the main organism that causes diphtheria. The most severe forms of disease are due to strains that produce toxin. Toxigenic strains are rare here, with no increase seen over the study period. However, we have seen an increase in non-toxigenic strains, especially from skin samples. These could have important implications, and we need to remain vigilant to diagnosing these and conducting appropriate risk assessments for patients who may have acquired skin lesions due to *Corynebacterium diphtheriae*.

What might we expect as health policy with the new government?

Frank Frizelle

This editorial outlines what I think is likely to be the health policy of the incoming government. This opinion is based on the pre-election policy statements of the parties that are likely to make up the new government under our mixed-member proportional representation (MMP) system.[1–3]

By the time this is published we might have a new government, or we might not. At the time of writing, the National Party, ACT New Zealand and New Zealand First are most likely to form the new government. I have not examined the Green Party health policy as they appear unwilling or unable to work with the more centre-right parties, perhaps reflecting the heterogeneity of its membership and/or the origin of the Green Party in New Zealand. Their behaviour does, however, distract from the benefits that might be gained by partnership under our MMP system.

The incoming government would appear to have the financial situation foremost in its mind. The National Party have a stated aim to reduce government spending and debt. The present monetary and fiscal situation does appear challenging on a background with large and increasing government debt, and pre-election promises of tax relief. Below are graphs showing the increase in government debt (Figures 1 and 2) and taxation (Figures 3 and 4) both in (US) dollar terms (Figures 1 and 3) and as a portion of the GDP (Figures 2 and 4).[4–7] What this essentially means is there won't be as much money to introduce new policy initiatives.

With this economic backdrop, one can assume that the health policy will be constrained, and this will impact on any politician's aspirational desires for change in the health sector for a while.

Figure 1: New Zealand government debt (in US dollars).[4]

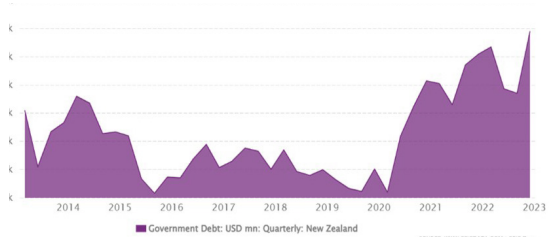

Figure 2: New Zealand government debt as a proportion of the GDP.[5]

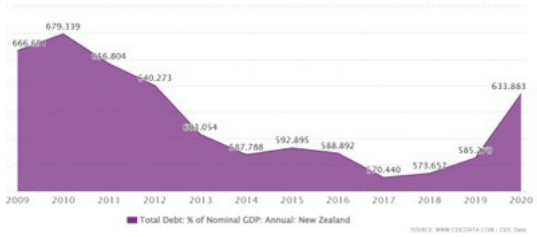

Figure 3: New Zealand tax intake (US dollars).[6]

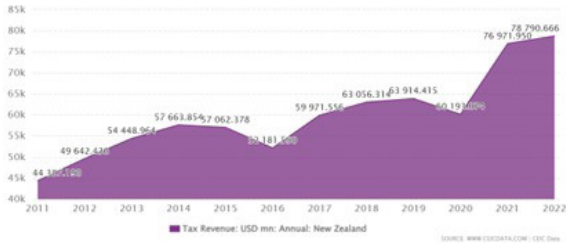

Figure 4: New Zealand tax intake as percentage of the GDP.[7]

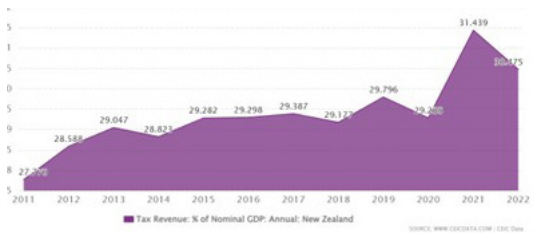

Table 1: Probable policies.

Policy	National	ACT	New Zealand First
Structure of Te Whatu Ora – Health New Zealand	Possible Reduce bureaucracy	Possible Reduce bureaucracy Public/private partnerships	Yes Abolish the Māori Health Authority
Workforce	Yes	Yes	Yes
Health targets	Yes	Nothing stated	Nothing stated
Primary care	Yes	Yes	Yes
Mental health	Yes	Yes	Nothing stated
Elective surgery	Yes	Yes	Yes
Pharmac	Yes	Yes	Yes
Cancer treatment	Yes—targeted programmes, no systemic change	Not directly (elective surgery and Pharmac)	Not directly (elective surgery and Pharmac)

With regard to working out what sort of health policy we might have, as stated above I have made the assumption that this might be in line with the likely three coalition partners' pre-election policies;[1–3] however, as we are all aware, there can be a large gap between policy and actual delivery.

Where the same policy has been mooted by all three parties I would assume these are likely to occur; however, where there are marked differences in policies I am assuming they are unlikely to be implemented, unless pushed hard by the proposing party.

Some of the proposed policies are a bit nebulous, so I have focussed on action points where there is clarity about what we might see, rather than broad concepts where action points are more opaque. There are many areas that overlap (e.g., cancer treatment and Pharmac or elective waiting lists and staffing). Where this happens, I have elected to outline it in the most relevant area so as not to repeat myself.

Substantial structural change of the recently established Te Whatu Ora – Health New Zealand is unlikely, though we may see some resignment of priorities given the huge investment and disruption in getting it where it is. We may see minor changes such as decentralisation of control, so Te Whatu Ora is more in line with the concepts in the Simpson report, and this change would deal with one of the major criticisms of the present system.

The National Party policy document does not comment on any structural change to the present system, other than their desire to reduce bureaucracy.[1] ACT is keen for private/public partnerships to arrange and fund increased infrastructure.[2] New Zealand First have stated they wish to abolish the Māori Health Authority, and other race-based initiatives.[3] While this would likely be acceptable to ACT, I suspect the National Party may not be so keen to push this with the present equity focus of the health system reflecting the current values of New Zealand society; however, National may have to accept this policy may well be part of the price required to become the government.

The **workforce** issue has been taken up by all three parties, all of whose policies are similar and reflect the issues raised in the Te Whatu Ora report of workforce.[8] The *New Zealand Medical Journal* has previously commented on this report and the workforce issues.[9] None of the policies by any of the parties really bring anything new to the discussion. These policies include increased inflow of overseas-trained health professionals, increased training of our own workforce and increased retention of staff. Increased overseas recruitment is around altering immigration priorities, faster registration and permanent residence.

Training more healthcare professionals is supported by all three parties. The National Party have stressed their intention to increase the training of doctors (with 50 places already announced and another 50 to follow), as well as proposing a Waikato Medical School (120 places), leading to a proposed total of 220 new training posts for doctors.[1] This would involve, of course, Auckland Medical School relocating its medical students out of Waikato Hospital and the surrounding hospitals the Waikato Medical School would use.

The National Party Health Policy also states that this new medical school in Waikato will have a specific focus on training doctors for primary care and the rural community.[1] The National Party policy document also states that the capital establishment cost for a third medical school is expected to be $380 million, with the Crown contributing up to $280 million (pending a final business case) and the remainder being raised by Waikato University.[1] This, of course, does not include the running costs for resources such as staff—which I have been unable to find any estimates of—but, if in line with other similarly sized medicals schools in New Zealand, will be at least $25–30 million a year.

Nursing is another healthcare profession also in short supply, and various measures have been suggested to increase nursing numbers. The National Party have suggested a loan repayment bonus and 5 years of bonding being introduced.[1] Such bonding is not new and has previously been used for teachers with some success and with doctors for rural areas with limited success, so it will be interesting to see how this goes in the modern era.

Health targets were a feature of the last National Government's health policy, and they were successful in addressing various issues, especially in cancer treatment waiting times. These look like they will be making a reappearance. The National Party policy document states:[1]

1. Shorter stays in emergency department—95% of patients to be admitted, discharged or transferred from an emergency department within 6 hours.
2. Faster cancer treatment—85% of patients to receive cancer management within 31 days of the decision to treat.
3. Improved immunisation—95% of two-year-olds receiving their full age-appropriate immunisations.
4. Shorter wait times for first specialist assessment—a meaningful reduction in the number of people waiting more than 4 months to see a specialist (target to be set in government).
5. Shorter wait times for surgery—a meaningful reduction in the number of people waiting more than 4 months for surgery (target to be set in government).

While neither ACT nor New Zealand First have any specific comments about targets, it would appear to complement their policies, so they are likely to reappear soon.[2,3]

Primary care is in crisis, as outlined by a recent editorial in the *New Zealand Medical Journal* by Bryan Betty et al.[10] All three parties make reference to the need to support the workforce and increase funding. The National Party policy document states: "*A recent report from Sapere addressed this and included a number of recommendations for improvement. National will work with the sector to explore implementation of these recommendations in our first year in office. In the interim, National will make $52 million in funding available to GPs through incentive payments for clinics that can lift immunisation rates for children, under 18s and over 65s among their enrolled patients*."[1]

ACT and New Zealand First state that they will increase general practitioner (GP) numbers,[2,3] and ACT says that it will increase GP funding by 13%: the equivalent of 2.5 million GP visits per year.[2] ACT has also said it will enable physician assistants to take on less complex tasks in order to take pressure off GPs.[2]

While a considerable amount of work previously undertaken by GPs is already undertaken by other healthcare professionals, such as nurse specialists, increased recruitment and retention of doctors into general practice are essential. Increasing local training will be of long-term benefit; however, there is a significant time lag from increasing student numbers to seeing an increase number of GPs (10–14 years) so it is of limited short-term benefit. When competing internationally for staff, income counts, which is an aspect that will need addressing.

Mental health has been a declared focus for the previous Labour Government, who spent over $1 billion on this; however, the challenging situation was well outlined in the recent *New Zealand Medical Journal* editorial by Foulds et al.[11] The National Party policy has been that it will improve the delivery of mental health

services and to be accountable for this by establishing a minister for mental health.[1] They have also suggested investing in community providers who can demonstrate they are delivering better mental health outcomes for more New Zealanders. This is to be facilitated through a Mental Health Innovation Fund (MHIF) of $20 million to match funds distributed to community mental health organisations.[1] National have stated that they will increase the number of psychiatrist registrar places to 50 a year on average (from a current average of around 37) and double the number of clinical psychologists being trained each year from 40 to 80 over the next 4 years.[1]

ACT also recognises the significance of mental health issues in the community and have a policy that states it will establish an organisation called Mental Health and Addiction New Zealand (MHANZ), a standalone agency on a national scale, empowering patients to choose between a range of providers rather than simply accepting what their district health board offers.[2]

New Zealand First does not mention mental health issues in its policy document.[3]

With the National Party and ACT both coming out strongly in support for some sort of reorganisation of the provision of mental health services and the suggested funding model to support community delivery it is likely that this will occur in some form. I look forward to seeing who is appointed as minister of mental health.

Provision of elective surgery was problematic prior to the COVID-19 pandemic; now it is worse. The primary issues have been delays in treatment and presentation of illness over the COVID-19 pandemic, and the failure of Te Whatu Ora to be able to resource the services to manage the bloated waiting lists. This issue of the large number of people waiting for elective surgery (managed care) is acknowledged by all three parties in their polices.

The National Party have this embedded their health targets.[1]

a. Shorter wait times for first specialist assessment—a meaningful reduction in the number of people waiting more than 4 months to see a specialist (target to be set in government).
b. Shorter wait times for surgery—a meaningful reduction in the number of people waiting more than 4 months for surgery (target to be set in government).

The ACT policy appears to want to use the private sector to fill the gap in the public capacity.[2] They have suggested that the government should help fund common elective surgeries in private hospitals through competitive tender. This links also with their policy of public–private partnerships, which would allow lease-back and building arrangements with large infrastructure investment groups for the refurbishment of existing public healthcare infrastructure and the construction of new facilities.

The New Zealand First policy is to create a GP-controlled waitlist reduction fund of $925 million available each year for GPs to buy approved specialist appointments and operations.[3]

All parties appear to recognise that more capacity is needed to deliver elective surgery (planned care) and the issue is how to do this. It is likely, given the constraints in infrastructure in the public sector, that the only elastic capacity available is in the private sector—though this is limited as well.

Pharmac is a target for criticisms from all parties and its benefit is seldom acknowledged. Pharmac has saved New Zealand billions of dollars and made healthcare in New Zealand more affordable. To the outsider, the decision process appears ponderous and opaque. As such, it is a target for critics. The National Party policy is to effect greater transparency around how Pharmac makes its investment decisions while exploring new mechanisms, including ring-fenced funding, to better accommodate rare disorders.[1]

ACT would like an independent review of Pharmac's operating model for greater transparency and timeliness in decision making, a more strategic focus and a productivity perspective based on real lives.[2] New Zealand First would be likely to replace Pharmac with a new buying agency and increase its funding from the last budget of $1.2 billion, with an additional $1.3 billion for life-changing medicines.[3]

The other relevant policy issue of New Zealand First is that of their desire to repeal the *Therapeutic Products Act 2023* prioritising New Zealand, not global, interests and end MedSafe waste, and instead commit New Zealand to enter into mutual recognition agreements, so that any medicine becomes registered here when approved by any two peer regulators such as: the United States Food and Drug Administration; the European Medicines Agency; the United Kingdom Medicines and Healthcare products Regulatory Agency; Health Canada; the Singapore Health Sciences

Authority; or Australia's Health Administration.[3]

My take on all this is that Pharmac is likely to be reviewed, and will have to explain and speed up its processes. Increased transparency of process will likely become part of the normal outcome for assessment of medications.

Cancer treatment has only been touched on very superficially by all parties in their policies despite being an important aspect of healthcare that is common, and where New Zealand is increasingly falling behind countries we would like to align ourselves with, such as Australia. The National Party policies are the most extensive. They have said they will increase access to life-saving and life-extending cancer medicines by investing $280 million over 4 years to fund 13 treatments for solid cancers with "significant clinical benefit"—available in Australia but not in New Zealand—and they will require the Cancer Control Agency to complete the same pharmaceutical cancer gap analysis for myeloma, leukaemia and other non-solid cancers.[1] They have also made some policy for specific cancer streams, e.g., screening changes for breast (increasing the upper age of screening) and bowel cancer (lowering the age of screening), and investing in treatment pathways for ovarian and prostate cancer.[2]

Neither ACT or New Zealand First have any specific cancer-related polices, though many items do overlap (e.g., staffing, medication access, waiting times).[2,3]

No party has made any commitment to addressing the systemic issues of cancer treatment provision, such as following the international trend of developing of a comprehensive cancer centre network in New Zealand as previously discussed in the *New Zealand Medical Journal*.[12]

There is a remarkable number of **odds and ends** that have ended up in the health polices of various parties, especially the National Party policy. Many of these seem to be, more appropriately, minor operational issues in the health system, rather than government policy issues (e.g., the National Party policy to increase security in accidents in emergency departments[1]). There are a number of issues that have likely gotten on the National Party policy as they appeal to sectors of society that support the National Party, such as action on youth vaping, continuous glucose monitors and increased post-natal hospital time.[1] These are, even collectively, relatively insignificant budgetary issues and are likely to be enacted during the next term.

There is also in the National Party policy document an interim expenditure for Dunedin Hospital infrastructure, until a new hospital can be built. This does make me wonder, however, if there are further delays about to be announced in this major building project.[1]

What is not mentioned in the health policies that may be addressed relates to access to dentistry. The various parties that said they would increase access to affordable dental care gained a lot of support. I expect, prior to the next election cycle, we may see some further policy and possible action in this sector.

In summary, whoever makes up the new government is unlikely to be in a financial position to make significant change in the healthcare sector. These health policies are not inspirational. There is a small gap spanning from this policy to where we are today, so delivery should occur. Hopefully, they will work on some more aspirational polices for implementation after the longer term (assuming the government is re-elected), by which time I suspect we will be in a better financial position.

COMPETING INTERESTS
Frank Frizelle is the Editor-in-Chief of the *New Zealand Medical Journal*.

CORRESPONDING AUTHOR INFORMATION
Frank Frizelle: Editor-in-Chief *NZMJ*; Professor of Surgery; Clinical Director of General Surgery; Department of Surgery, University of Otago Christchurch, New Zealand. E: Frank.Frizelle@cdhb.health.nz

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Inequities in colonoscopy access: a retrospective audit of accepted referrals in Te Whatu Ora Counties Manukau

Luke Paterson, Emma Espiner, Elana Curtis, Chao Li, Maree Weston, Sarah-Jane Paine

ABSTRACT

AIM: Māori are more likely to have colorectal cancer (CRC) diagnosed in the emergency setting.[1] CRC patients diagnosed in the emergency setting have a higher stage, increased surgical complications and worse survival than those diagnosed elsewhere.[2] Access to colonoscopy is crucial to diagnosing CRC prior to an emergency presentation. This study aims to assess inequities in access to symptomatic and surveillance colonoscopies.

METHODS: A retrospective audit of all accepted referrals for symptomatic and surveillance colonoscopies made in Te Whatu Ora Counties Manukau in 2018 (n=7,184) with analysis by multivariate logistic regression.

RESULTS: Of the 751 Māori patients, 33.4% were removed off the waiting list and therefore did not have their colonoscopy performed, compared to 24.1% of the 4,047 NZ European patients.

Māori patients were significantly more likely to be removed off the waiting list than NZ European patients, with an adjusted odds ratio of 1.68 (95% confidence interval [CI] 1.40–2.02). Pasifika patients were significantly more likely to be removed off the waiting list than NZ European patients, with an adjusted odds ratio of 2.30 (95% CI 1.92–2.75).

CONCLUSIONS: Māori have significantly less access to colonoscopies than NZ Europeans. We suggest improvements to referral systems locally and nationally to facilitate equitable access.

Colorectal cancer (CRC) is the third most common cause of death from cancer for Māori and, while it is more common among non-Māori, the incidence and mortality rates are increasing more rapidly for Māori than non-Māori.[3]

Bowel cancer survival rates are low for Māori compared to non-Māori.[4] The 5-year risk of death from bowel cancer is 59% for Pasifika and 47% for Māori compared to 38% for non-Māori and non-Pasifika.[1] Māori are more likely to have CRC diagnosed in the emergency setting. Māori are also more likely to present with bowel obstruction or perforation and require emergency surgery.[5] Patients who have CRC diagnosed in the emergency setting have poorer outcomes, with a higher stage at presentation, increased surgical complications and decreased survival.[1,6,7] Inequities observed in the Bowel Screening Programme (BSP) with the use of an inappropriate eligible age range for Māori may have also contributed to these outcomes.[8]

This evidence of inequity in CRC outcomes highlights the need to scrutinise all pathways into health services for Māori with an equity lens to determine how structural barriers are contributing to the greater burden of harm from CRC experienced by Māori.

Access to diagnostic colonoscopy is crucial to finding CRC earlier and at a less advanced stage to decrease the associated morbidity and mortality. Inequity in access to outpatient diagnoses, with the knowledge that acute diagnoses are associated with worse outcomes, may be a major contributing factor in the higher burden of CRC mortality among Māori. Inequity in accessing colonoscopies therefore has serious implications.

At Te Whatu Ora Counties Manukau (CM) during our study period (January to December 2018), patients referred for colonoscopy were required to organise their appointment with the Gastroenterology Department following an accepted referral. As of 2023 this system remains unchanged. Patients classified as urgent were contacted via phone and a procedure time was negotiated. For patients with non-urgent and surveillance colonoscopies a text or letter was sent to the patient. The patient then had 10 working days to make contact with CM to negotiate their procedure time. If no contact was made then the patient was removed from the waiting list and a letter sent to the patient and their general

practitioner (GP) to inform them they have been "removed off the waiting list" (ROWL). If after this second contact the patient did initiate contact with CM, they were able to negotiate a time for their procedure. If still no contact was made in the next 5 working days, the patient was then advised by letter to see their GP for a re-referral for a colonoscopy.

We hypothesise that part of the reason Māori have a lower survival rate than non-Māori is due to decreased access to colonoscopy. This results in an increased rate of diagnoses being made in the acute setting where the stage is more advanced and rates of complications are increased, resulting in poorer survival outcomes.

This study aims to quantify any difference between Māori and non-Māori in access to colonoscopy at CM.

Methods

Positioning

This study incorporates an Indigenous Kaupapa Māori Research (KMR) positioning. This is reflected through inclusion of Māori leadership within the research team, putting Māori at the centre of the research question/objectives, rejection of cultural-deficit or victim-blame analyses and use of a conceptual framework that incorporates a structural determinants approach to critique issues of power, racism and privilege at a system (versus individual) level.[9]

Patients and variables

The data were obtained from CM Gastroenterology Department internal records and provided to the research team following local ethics approval from the Auckland Health Research Ethics Committee. A total of 7,184 patients had an accepted referral for a colonoscopy made to CM in 2018.

Descriptive variables included gender (recorded as male/female) and age (<25years, 5-year age bands and >85years). Prioritised ethnicities included in the referrals were grouped into Māori, Pacific, Asian, Other and NZ European as per the New Zealand Ethnicity Data Protocols.[10] Domicile codes were used to classify each patient's level of deprivation into quintiles using the New Zealand Deprivation Index 2013 (NZDep2013; Quintile 1 being least deprived to Quintile 5 being most deprived).[11] All referrals when accepted were graded by referral priority as urgent (aim to complete within 2 weeks), semi-urgent (aim to complete within 8 weeks) and surveillance (2 years). Referral sources were recorded as internal (referrals from within CM) and external (referrals from primary healthcare).

Outcome variables included: colonoscopy performed or ROWL with reason listed as "unable to contact". No other reasons for ROWL were recorded.

There were 159 patients excluded due to incomplete data; 155 patients had missing ethnicity data and another four were missing deprivation data. Therefore, a total of 7,025 patients were included in the univariate and multivariate analyses.

Statistics

Univariate analysis was used to determine the predicted odds ratio (OR) for an accepted colonoscopy referral to result in the patient being removed off the waiting list due to being classified as unable to be contacted by gender, age, ethnicity, deprivation quintile, referral priority and referral source.

Logistic multivariate analysis was used to determine the odds of removal off the waiting list per accepted referral by ethnicity with adjustment for gender, age, deprivation, priority and referral source.

The median number of days for a patient to be removed from the waiting list was compared by ethnicity, with p-values of less than 0.05 being taken as statistical significance.

Results

Overall patient and referral characteristics

In 2018, there were a total of 7,184 accepted referrals for colonoscopies in CM. There were 1,989 patients (27.7%) who were removed off the waiting list, with the reason for removal classified as "unable to contact". There was no record of patients being removed from the waiting list for other reasons. Table 1 shows the outcome of these colonoscopy referrals grouped by gender, age, ethnicity, deprivation quintile, referral priority and referral source. This shows that 33.4% of Māori patients were removed off the waiting list compared to 24.1% of NZ European patients.

Univariate analysis

Māori patients were significantly more likely to be removed off the waiting list than NZ European patients (OR 1.5, 95% confidence interval [CI] 1.34–1.87) (Table 2). Pasifika and Asian patients were also more likely to be removed off the waiting list

Table 1: Outcomes of accepted colonoscopy referrals, by patient and referral characteristics.

	Overall n=7,184	**Colonoscopy performed n= 5,195 (%)**	**Removed off waiting list n= 1,989 (%)**
Gender			
Male	3,485	2,478 (71.1)	1,007 (28.9)
Female	3,669	2,697 (73.5)	972 (26.5)
Age			
<25	91	65 (71.4)	26 (28.6)
25–34	309	220 (71.2)	89 (28.8)
35–44	560	388 (69.3)	172 (30.7)
45–54	1,240	892 (71.9)	348 (28.1)
55–64	1,767	1,261 (71.4)	506 (28.6)
65–74	1,1811	1,337 (73.8)	474 (26.2)
75–84	1,241	911 (73.4)	330 (26.6)
>84	165	121 (73.3)	44 (26.7)
Ethnicity			
Māori	751	500 (66.6)	251 (33.4)
Pasifika	840	521 (61.9)	321 (38.1)
Asian	1,221	865 (70.8)	356 (29.2)
NZ European	4,047	3,073 (75.9)	976 (24.1)
Other	166	124 (74.7)	42 (25.3)
Unknown	155	112 (72.3)	43 (27.7)
Deprivation quintile			
Q1 (least deprived)	1,225	950 (75.0)	316 (25.0)
Q2	1,372	1,053 (74.7)	356 (25.3)
Q3	913	700 (75.2)	231 (24.8)
Q4	1,039	750 (70.6)	313 (29.4)
Q5 (most deprived)	2,476	1,740 (69.3)	771 (30.7)
Unknown	4	2 (50.0)	2 (50.0)
Referral priority			
Urgent	636	634 (99.7)	2 (0.3)
Semi-urgent	4,668	3,416 (71.6)	1,354 (28.4)

Table 1 (continued): Outcomes of accepted colonoscopy referrals, by patient and referral characteristics.

Surveillance	1,721	1,131 (64.1)	633 (35.9)
Referral source			
Internal	1,625	1,153 (69.6)	503 (30.4)
External	5,400	4,042 (73.1)	1,486 (26.9)

Table 2: Predicted odds ratio of removal off the waiting list, by ethnicity, gender, deprivation quintile and referral source.

	Odds ratio	**95% confidence interval**	**P-value**	**Adjusted odds ratio***	**95% confidence interval**	**P-value**
Ethnicity						
NZ European	1.00 (reference)			1.00 (reference)		
Māori	1.58	1.34–1.87	<0.001	1.68	1.40–2.02	<0.001
Pasifika	1.94	1.66–2.27	<0.001	2.30	1.92–2.75	<0.001
Asian	1.30	1.12–1.49	<0.001	1.39	1.20–1.61	<0.001
Other	1.07	0.75–1.52	0.724	1.06	0.74–1.54	0.736
Gender						
Male	1.00 (reference)					
Female	0.89	0.80–0.99	0.026			
Deprivation quintile						
Q1 (least deprived)	1.00 (reference)					
Q2	1.02	0.85–1.21	0.856			
Q3	0.99	0.82–1.21	0.937			
Q4	1.25	1.04–1.51	0.015			
Q5 (most deprived)	1.33	1.14–1.55	<0.001			
Referral source						
Internal	1.00 (reference)					
External	0.84	0.75–0.95	0.005			

*Adjustment for gender, age, deprivation, referral priority and referral source.

Table 3: Waiting days to removal due to being uncontactable, by ethnicity.

	Median waiting days	Median difference	95% confidence interval	P-value
NZ European	56	0 (reference)		
Māori	48	8	4–12	<0.001
Pasifika	51	5	2–8	0.002
Asian	51	5	2–8	0.001
Other	50	6	-3–15	0.187

compared to NZ European (OR 1.94, 95% CI 1.66–2.27 and OR 1.30, 95% CI 1.12–1.49 respectively).

Women were statistically less likely to be removed off the waiting list than men (OR 0.89, 95% CI 0.80–0.99). There was no statistically significant difference between age groups, x^2 (7, N=7,184) = 4.75, p>0.05.

The patients residing in the most deprived quintile were significantly more likely to be removed off the waiting list than those patients residing in the least deprived quintile (Q1) (OR 1.33, 95% CI 1.14–1.55). Patients with external referrals were less likely to be removed off the waiting list than those referred internally (OR 0.84, 95% CI 0.75–0.95).

Multivariate analysis

After adjustment for gender, age, deprivation, referral priority and referral source, Māori patients were significantly more likely to be removed off the waiting list than NZ European patients (OR 1.68, 95% CI 1.40–2.02). Of note, the inequity between Māori and NZ Europeans increased when controlling for all variables in multivariate compared to univariate analysis (OR 1.68 vs 1.58 respectively). Similarly, inequities are seen for Pasifika and Asian patients compared to NZ Europeans (OR 2.30, 95% CI 1.92–2.75 and OR 1.39, 95% CI 1.20–1.61 respectively).

Median time to ROWL

The overall median time between a referral being received and a patient being removed off the waiting list due to being uncontactable was 52 days. We note that this is significantly longer than the 15 working days (equivalent to 21 days) that the department used as its guideline for managing accepted referrals.

The median time for NZ European patients was 56 days, compared to 48 days for Māori patients (Table 3). Māori patients have a statistically significantly shorter median time (8 fewer days) to arrange an appointment compared to NZ European patients (p<0.001).

Discussion

This study, using 1 year of referral data from CM, shows that Māori have significantly less access to colonoscopy services than NZ European patients. For each accepted referral Māori are less likely to have a colonoscopy performed. Differences in gender, age, deprivation, referral priority and referral source between NZ European and Māori patients do not explain the inequities in colonoscopy access; rather, they appear to make the inequity worse. Furthermore, Māori patients have less of an opportunity to negotiate a colonoscopy appointment time as they are classified as "unable to be contacted" and removed off the waiting list on average 8 days sooner than NZ European patients. This suggests that there is a bias in the current system that systematically worsens access to colonoscopies for Māori patients assessed clinically as requiring this intervention. In addition to other known access barriers for Māori (e.g., unmet need in primary care),[12] it is possible that colonoscopy access inequities are also contributing to disproportionate CRC-associated morbidity and mortality for Māori.

To achieve equity in CRC outcomes, every point along the diagnosis and treatment pathways must have equity embedded in their design. As the gold standard diagnostic tool for bowel cancer, colonoscopy is a key part of the outpatient diagnostic pathway. Based on the findings of this study, improvements are required to enable equitable access for Māori to colonoscopies.

Factors associated with how patients are removed off waiting lists for colonoscopies need further exploration to ensure that the system prioritises Māori for investigation, rather than de-prioritising them via early removal from waiting lists. This will require a significant shift away from potential *victim-blame* approaches that stigmatise patients who are unable to make contact (i.e., as being lazy or less worthy of ongoing follow-up).[13] Rather, a lack of contact should be seen as a marker of structural inequities requiring a greater investment of time and energy from health services to achieve the desired outcome (i.e., coordination and arrangement for colonoscopy access at a time that works for the patient).

In addition, the current system appears to be privileging NZ Europeans while inadequately serving Māori, Pasifika and Asian ethnicities. The fact that all non-NZ European ethnicities are being disadvantaged by the current system implies that there is structural privilege for NZ Europeans, rather than issues intrinsic to any specific minoritised ethnic grouping, causing this inequity. Understanding how both *racism* and *privilege* operate within health system delivery to create ethnic inequities in healthcare, including cancer care, outcomes is required.[14]

The Crown, and all its agencies, are obligated to achieve equity for Māori. This obligation reflects Māori Indigenous rights reaffirmed by Te Titiri o Waitangi and the United Nations Declaration on the Rights of Indigenous Peoples.[15] One of the three purposes of the *Pae Ora (Healthy Futures) Act 2022* (Pae Ora) is to "*achieve equity in health outcomes among New Zealand's population groups, including by striving to eliminate health disparities, in particular for Māori*".[16] Under Pae Ora, Te Whatu Ora is required to design, deliver and arrange services to achieve this purpose.

Intrinsic challenges to outpatient colonoscopy access will need to be overcome. A review of barriers and enablers to the access of hospital services for Māori found practical barriers were more pronounced for Māori than non-Māori, owing to the greater experience of socio-economic deprivation among Māori, as well as barriers relating to experiences of racism in the health system and a lack of culturally safe settings, services and practitioners.[17] In the context of outpatient colonoscopies, practical barriers include the need to take time off work, arrange childcare, arrange transport to and from the procedure and arrange post-procedure support. In scheduling, the current system relies on patients speaking English and having access to a phone with credit to call back on. The pre-procedure change in diet, withholding of regular medications and bowel preparation ideally require careful explanation and an opportunity for patients to have queries and concerns addressed in a culturally safe way. These factors are likely to impact on the Māori outcomes observed and may also explain the large inequities observed for Pasifika compared to NZ Europeans in our findings. A Pasifika-led analysis of these factors is recommended.

We believe that clinical nurse specialists may contribute to improving equity for patients requiring a colonoscopy. Clinical nurse specialists can improve outcomes by providing information, service coordination and psychological support for patients.[18] Clinical nurse specialists are able to call patients, negotiate colonoscopy times, utilise interpreter services, check patients have received bowel preparation, reiterate the bowel preparation instructions, explain the indication and be available to take calls from patients if they have any further questions.

The current system at CM puts the onus on the patient to initiate contact and make time for a colonoscopy. This can lead to blame being put on the patients themselves for their limited access. The service attempts to absolve itself of its responsibility by notifying GPs of a patient's removal from the waiting list, rather than opening a dialogue with the patient to understand their individual needs and barriers. Therefore, we recommend changes to the booking process itself with all patients to be contacted via a phone call, and the option for these calls to be made outside of usual working hours (9am to 5pm). Where contact is still not made despite calls, texts and letters, a protocol of escalation, including contacting the patient's next-of-kin, the referrer and their GP, needs to be established. Regular auditing is also required to review the time between a referral being received and first contact with the patient, to ensure that patients are being contacted and colonoscopies are scheduled in a timely manner. Given the known under-count of Māori within health and disability sector data,[19] ethnicity data auditing to ensure the collection of ethnicity data is aligned to best practice and the HISO 10001:2017 Ethnicity Data Protocols should also be undertaken.[20]

The BSP has made progress with 10.1% of CRC diagnoses in Aotearoa New Zealand being made via the screening programme in 2019.[6] However, the BSP initially failed Māori by privileging NZ Europeans in its approach to screening eligible

age.[8] One of the National Screening Unit's (NSU) criteria for a screening programme is that "*the health care system will be capable of supporting all necessary elements of the screening pathway, including diagnosis, follow-up and programme evaluation*".[21] To ensure that Te Whatu Ora districts do have adequate resources, the BSP has target waiting times for symptomatic colonoscopies that districts must achieve to partake in the BSP. The current system of removing people off the waiting list is artificially deflating the number of colonoscopies required. This results in the proxy measure of capacity and waiting time targets being artificially achieved while the system further perpetuates inequalities. The BSP does not require Te Whatu Ora districts to achieve and publish the proportion of accepted referrals by ethnicity that result in colonoscopies being performed. We suggest that adding a target here, with consequences for non-performativity, could be a mechanism by which the BSP can support achieving equity for Māori. In addition, the inequities observed for Pasifika in this study also deserve increased investigation.

We have shown that Māori, Pasifika and Asian people are more likely to be removed from a colonoscopy waiting list compared to NZ Europeans. We suggest that this inequitable access may be one of the causes for the higher mortality rates seen for Māori and Pasifika people with CRC. We suggest changes to the referral system to improve access.

COMPETING INTERESTS
Nil.

AUTHOR INFORMATION
Luke Paterson, MBChB: Te Whatu Ora, Te Tai Tokerau, New Zealand.
Emma Espiner, MBChB, BA: Te Whatu Ora, Counties Manukau, New Zealand.
Elana Curtis, NZCPHM, MD, MPH, MBChB, BHB: Associate Professor, Te Kupenga Hauora Māori, The University of Auckland, New Zealand.
Chao Li: COMPASS, The University of Auckland, New Zealand.
Maree Weston, FRACS, MBChB: General Surgeon, Te Whatu Ora, Counties Manukau, New Zealand.
Sarah-Jane Paine, PhD: Associate Professor, Te Kupenga Hauora Māori and Faculty of Medical and Health Sciences, The University of Auckland, New Zealand.

CORRESPONDING AUTHOR
Luke Paterson: Te Whatu Ora, Te Tai Tokerau, New Zealand. E: luke.paterson@northlanddhb.org.nz

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Non-small cell lung cancer chemotherapy treatment outcomes and ethnicity: a twenty-year single-centre patterns of care study

Ha Nguyen, Rawiri Keenan, Ian Kennedy, Chunhuan Lao, Ross Lawrenson

ABSTRACT

AIM: To investigate the treatment of patients with advanced-stage non-small cell lung cancer (NSCLC) over a 20-year period in a single Aotearoa New Zealand centre with reference to the use of systemic anti-cancer chemotherapy (SACT) and to explore ethnic disparities in treatment and outcomes.

METHOD: Using a SACT database maintained by the Oncology Department at Waikato Hospital, Hamilton, Aotearoa New Zealand from 2000 to 2021 we derived summary statistics for patient factors and SACT regimens by ethnicity (Māori and non-Māori). We investigated Kaplan–Meier all-cause survival by ethnicity and SACT. Logistic regression was used to estimate the odds ratios of surviving 12 months and receiving first and second SACT.

RESULTS: One thousand and fifty-seven patients with advanced NSCLC were included, with 30% identified as Māori and 53% treated with SACT. The median survival for non-Māori and Māori receiving SACT was 11.9 and 8.5 months respectively (unadjusted odds ratio of surviving 12 months: 1.968; 95% CI: 1.352–2.865; p<0.001). Non-Māori receiving SACT were 86.2% more likely to survive 12 months than Māori. There were no ethnic disparities in the proportion of patients receiving first-line SACT; however, non-Māori were 1.5 times more likely to receive a second SACT than Māori.

CONCLUSION: Significant ethnic difference between Māori and non-Māori exists for both survival and receipt of second-line SACT.

Lung cancer is the commonest cause of cancer death in Aotearoa New Zealand.[1] Most patients with non-small cell lung cancer (NSCLC) will have advanced disease at diagnosis. The prognosis for these patients is poor with an estimated historical 5-year survival of less than 10%.[2,3] Indeed, the 5-year overall survival for lung cancer across all stages in Aotearoa New Zealand in 2014 was only 15.5%, with just a 4% improvement from 1999.[4] Of particular concern has been the finding that Māori, the Indigenous people of Aotearoa New Zealand, have a 30% greater mortality from lung cancer compared to non-Māori.[3] Previous research has revealed ethnic disparity in cancer treatment—for instance, Māori with breast cancer are less likely to receive radiotherapy or long-term adjuvant endocrine therapy,[5] and Māori with colorectal cancer are less likely to receive chemotherapy.[6–10] There is scant research into ethnic differences in NSCLC treatment and its impacts on survival outcomes in Aotearoa New Zealand patients; hence, we sought to investigate possible differences in the use of systemic anti-cancer chemotherapy (SACT) in Māori and non-Māori.

Methods

Data source

This is a retrospective study based on a comprehensive dataset collected prospectively using a purpose-built SACT prescribing and database system from 1 January 2000 to 31 December 2021. We obtained patient-level data for individuals with a first diagnosis of advanced NSCLC referred to the Medical Oncology Unit Waikato Hospital. Waikato Hospital is the regional cancer centre for the central region of the North Island of Aotearoa New Zealand and provides care for approximately 800,000 people, of whom 30% identify as Māori. We collected information on the following variables: age, gender, ethnicity (Māori or non-Māori), date/year of lung cancer diagnosis, stage at diagnosis, SACT regimens prescribed and survival. We included only those patients with Stage 3 and 4 NSCLC. We excluded patients enrolled in clinical trials (22) and patients with epidermal growth factor receptor (EGFR) mutated lung cancer (95).

Analysis

We reviewed the characteristics and SACT regimens of lung cancer patients with advanced NSCLC. We investigated ethnic differences in patient factors and SACT regimens in those receiving first and second SACT regimens, and those not receiving SACT. We used Chi-squared tests to compare categorical variables and Student's *t*-Tests for continuous variables.

Using the Kaplan–Meier method, we calculated all-cause survival after diagnosis of lung cancer for patients with and without SACT by ethnicity. We also analysed the all-cause survival in those receiving different SACT regimens (carboplatin plus pemetrexed, carboplatin plus gemcitabine, cisplatin plus gemcitabine, carboplatin plus paclitaxel, and other regimens) as their first-line treatments. Using logistic regression models, we examined the odds ratios (OR) of surviving 12 months in the entire cohort, adjusting for age, gender, ethnicity, year of diagnosis and SACT regimens. Then, we estimated the OR of surviving 12 months in the group receiving their first SACT regimen adjusting for age, gender, ethnicity, year of diagnosis and SACT regimens. OR of receiving first-line SACT or moving from first- to second-line SACT were also calculated, adjusting for age, gender, ethnicity and year of diagnosis. All analyses were carried out using Stata 15 (StataCorp LLC, Texas, United States).

Results

After excluding trial patients (22) and those with EGFR-mutated lung cancer (95), we identified 1,057 cases who had been referred to oncology with advanced-stage NSCLC. Table 1 shows that 562 (53%) were treated with SACT. The key factor associated with the likelihood of receiving SACT was the patient's age, with older patients being less likely to be treated. Of those with NSCLC, 316/1,057 (30%) had been identified as Māori and there was no difference in the proportion of Māori and non-Māori who received SACT. Māori who received SACT were on average 1 year younger than non-Māori (mean age 62 years compared to 63 years in non-Māori, p=0.04). Non-Māori who did not receive SACT were older than Māori who did not receive SACT (mean 68 vs 61 years, p<0.01). The proportion of referred patients receiving treatment increased from 49% (65/133) in 2000–2004 to 55% (222/401) in 2015–2021 (Table 1). There was also an increase in the proportion receiving a second or subsequent SACT regimen from 11% (15/133) to 16% (64/401).

Table 2 shows the frequency of various regimens used as SACT. Of these, carboplatin plus gemcitabine and carboplatin plus paclitaxel were the most common, accounting for over half the chosen first-line regimens. A total of 166/562 (30%) patients received a second-line SACT regimen. Vinorelbine (51/166, 31%) and docetaxel (38/166, 23%) were the commonest second-line choices.

Of those treated with SACT, median survival for non-Māori was 11.9 months and for Māori 8.5 months. Overall median survival in those not treated was 4.7 months (Table 1). Kaplan–Meier survival analysis (Figure 1) showed that patients with advanced NSCLC had a poor prognosis with a 5-year survival of less than 10%. Outcomes were poorer for Māori in both those treated with and without SACT. Patients not receiving SACT had a 1-year survival of approximately 20%, while patients treated with SACT had a 1-year survival of approximately 40%. After 3 years, there was no difference in survival between those with and without SACT.

Table 3A demonstrates that patients treated with first-line SACT regimens were 2–3 times significantly more likely to survive 12 months than those not receiving SACT regimens (p<0.001) after adjustment for age, gender, ethnicity and year of diagnosis. As expected, there was no significant difference in survival between different first-line SACT regimens in those receiving SACT (Table 3B). For the entire cohort, non-Māori were 68.8% more likely to survive 12 months than Māori (Table 3A). Non-Māori receiving SACT were 86.2% more likely to survive 12 months than Māori (Table 3B). There was no ethnic difference in the proportion of patients receiving first-line SACT (adjusted OR: 1.096; 95% confidence interval [CI]: 0.833–1.443; p>0.05); however, non-Māori were significantly more likely than Māori to change from a first to a second SACT (adjusted OR: 1.536; 95% CI: 1.015–2.325; p<0.05, Table 4).

Discussion

Our study provides valuable insights into the treatment and survival outcomes of patients with advanced NSCLC based on an Aotearoa New Zealand SACT dataset derived over 20 years. Of patients with advanced NSCLC, 53% received first-line SACT, and 30% had second-line treatment. This proportion of advanced NSCLC patients treated with SACT is higher than in the United Kingdom (40%) but less than that in in Belgium, Norway and Portugal (75%).[11]

Table 1: Summary statistics.

Factors		Patients receiving first SACT				Patients receiving second SACT				Patients not receiving SACT				All patients
		Non-Māori	Māori	Total	P-value	Non-Māori	Māori	Total	P-value	Non-Māori	Māori	Total	P-value	Total
		N=390	N=172	N=562		N=125	N=41	N=166		N=351	N=144	N=495		N=1,057
Age group	<50	39 (10.0%)	16 (9.3%)	55 (9.8%)	0.02	14 (11.2%)	3 (7.3%)	17 (10.2%)	0.03	17 (4.8%)	21 (14.6%)	38 (7.7%)	<0.01	93 (8.8%)
	50–54	31 (7.9%)	21 (12.2%)	52 (9.3%)		6 (4.8%)	7 (17.1%)	13 (7.8%)		16 (4.6%)	17 (11.8%)	33 (6.7%)		85 (8.0%)
	55–59	49 (12.6%)	34 (19.8%)	83 (14.8%)		16 (12.8%)	11 (26.8%)	27 (16.3%)		34 (9.7%)	17 (11.8%)	51 (10.3%)		134 (12.7%)
	60–64	68 (17.4%)	38 (22.1%)	106 (18.9%)		26 (20.8%)	10 (24.4%)	36 (21.7%)		64 (18.2%)	38 (26.4%)	102 (20.6%)		208 (19.7%)
	65–69	90 (23.1%)	30 (17.4%)	120 (21.4%)		29 (23.2%)	4 (9.8%)	33 (19.9%)		62 (17.7%)	15 (10.4%)	77 (15.6%)		197 (18.6%)
	70–74	72 (18.5%)	16 (9.3%)	88 (15.7%)		23 (18.4%)	4 (9.8%)	27 (16.3%)		54 (15.4%)	25 (17.4%)	79 (16.0%)		167 (15.8%)
	75–79	33 (8.5%)	15 (8.7%)	48 (8.5%)		8 (6.4%)	2 (4.9%)	10 (6.0%)		60 (17.1%)	7 (4.9%)	67 (13.5%)		115 (10.9%)
	≥80	8 (2.1%)	2 (1.2%)	10 (1.8%)		3 (2.4%)	0 (0.0%)	3 (1.8%)		44 (12.5%)	4 (2.8%)	48 (9.7%)		58 (5.5%)
Age (years)	Mean ± SD	63 (10)	62 (9)	63 (10)	0.04	63 (10)	60 (8)	62 (10)	0.10	68 (10)	61 (10)	66 (10)	<0.01	64 (10)
Gender	Male	194 (49.7%)	81 (47.1%)	275 (48.9%)	0.56	60 (48.0%)	21 (51.2%)	81 (48.8%)	0.72	198 (56.4%)	62 (43.1%)	260 (52.5%)	<0.01	535 (50.6%)
	Female	196 (50.3%)	91 (52.9%)	287 (51.1%)		65 (52.0%)	20 (48.8%)	85 (51.2%)		153 (43.6%)	82 (56.9%)	235 (47.5%)		522 (49.4%)

Table 1 (continued): Summary statistics.

Factors		Patients receiving first SACT				Patients receiving second SACT				Patients not receiving SACT				All patients
		Non-Māori	Māori	Total	P-value	Non-Māori	Māori	Total	P-value	Non-Māori	Māori	Total	P-value	Total
		N=390	N=172	N=562		N=125	N=41	N=166		N=351	N=144	N=495		N=1,057
12-month survival	Yes	190 (48.7%)	56 (32.6%)	246 (43.8%)	<0.01	91 (72.8%)	29 (70.7%)	120 (72.3%)	0.80	81 (23.1%)	24 (16.7%)	105 (21.2%)	0.11	351 (33.2%)
Median survival	Months	11.9	8.5	10.7		18	17.1	17.5		5.4	3.3	4.7		7.6
Year	2000–2004	47 (12.1%)	18 (10.5%)	65 (11.6%)	0.55	15 (12.0%)	0 (0.0%)	15 (9.0%)	0.05	51 (14.5%)	17 (11.8%)	68 (13.7%)	0.37	133 (12.6%)
	2005–2009	67 (17.2%)	32 (18.6%)	99 (17.6%)		21 (16.8%)	5 (12.2%)	26 (15.7%)		80 (22.8%)	25 (17.4%)	105 (21.2%)		204 (19.3%)
	2010–2014	128 (32.8%)	48 (27.9%)	176 (31.3%)		46 (36.8%)	15 (36.6%)	61 (36.7%)		99 (28.2%)	44 (30.6%)	143 (28.9%)		319 (30.2%)
	2015–2021	148 (37.9%)	74 (43.0%)	222 (39.5%)		43 (34.4%)	21 (51.2%)	64 (38.6%)		121 (34.5%)	58 (40.3%)	179 (36.2%)		401 (37.9%)

Table 2: SACT regimens.

Regimens	Patients receiving first SACT			Patients receiving second SACT		
	Non-Māori	Māori	Total	Non-Māori	Māori	Total
	N=390	N=172	N=562	N=125	N=41	N=166
Carboplatin + gemcitabine	131 (33.6%)	75 (43.6%)	206 (36.7%)	13 (10.4%)	3 (7.3%)	16 (9.6%)
Carboplatin + paclitaxel	116 (29.7%)	35 (20.3%)	151 (26.9%)	8 (6.4%)	0 (0.0%)	8 (4.8%)
Carboplatin + pemetrexed	44 (11.3%)	23 (13.4%)	67 (11.9%)	5 (4.0%)	3 (7.3%)	8 (4.8%)
Vinorelbine	18 (4.6%)	12 (7.0%)	30 (5.3%)	40 (32.0%)	11 (26.8%)	51 (30.7%)
Cisplatin + gemcitabine	54 (13.8%)	19 (11.0%)	73 (13.0%)	4 (3.2%)	0 (0.0%)	4 (2.4%)
Cisplatin + etoposide	3 (0.8%)	1 (0.6%)	4 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cisplatin + vinblastine	2 (0.5%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Gemcitabine	8 (2.1%)	4 (2.3%)	12 (2.1%)	13 (10.4%)	8 (19.5%)	21 (12.7%)
Docetaxel	3 (0.8%)	0 (0.0%)	3 (0.5%)	30 (24.0%)	8 (19.5%)	38 (22.9%)
Carboplatin + etoposide	8 (2.1%)	3 (1.7%)	11 (2.0%)	1 (0.8%)	0 (0.0%)	1 (0.6%)
Pemetrexed	1 (0.3%)	0 (0.0%)	1 (0.2%)	2 (1.6%)	1 (2.4%)	3 (1.8%)
Carboplatin + pemetrexed + pembrolizumab	2 (0.5%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Carboplatin + docetaxel	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	1 (2.4%)	2 (1.2%)
Carboplatin + vinorelbine	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.4%)	1 (0.6%)
Docetaxel + gemcitabine	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (1.6%)	0 (0.0%)	2 (1.2%)
Pembrolizumab	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	0 (0.0%)	1 (0.6%)
Paclitaxel	0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (4.0%)	5 (12.2%)	10 (6.0%)

Figure 1: Kaplan–Meier survival analysis.

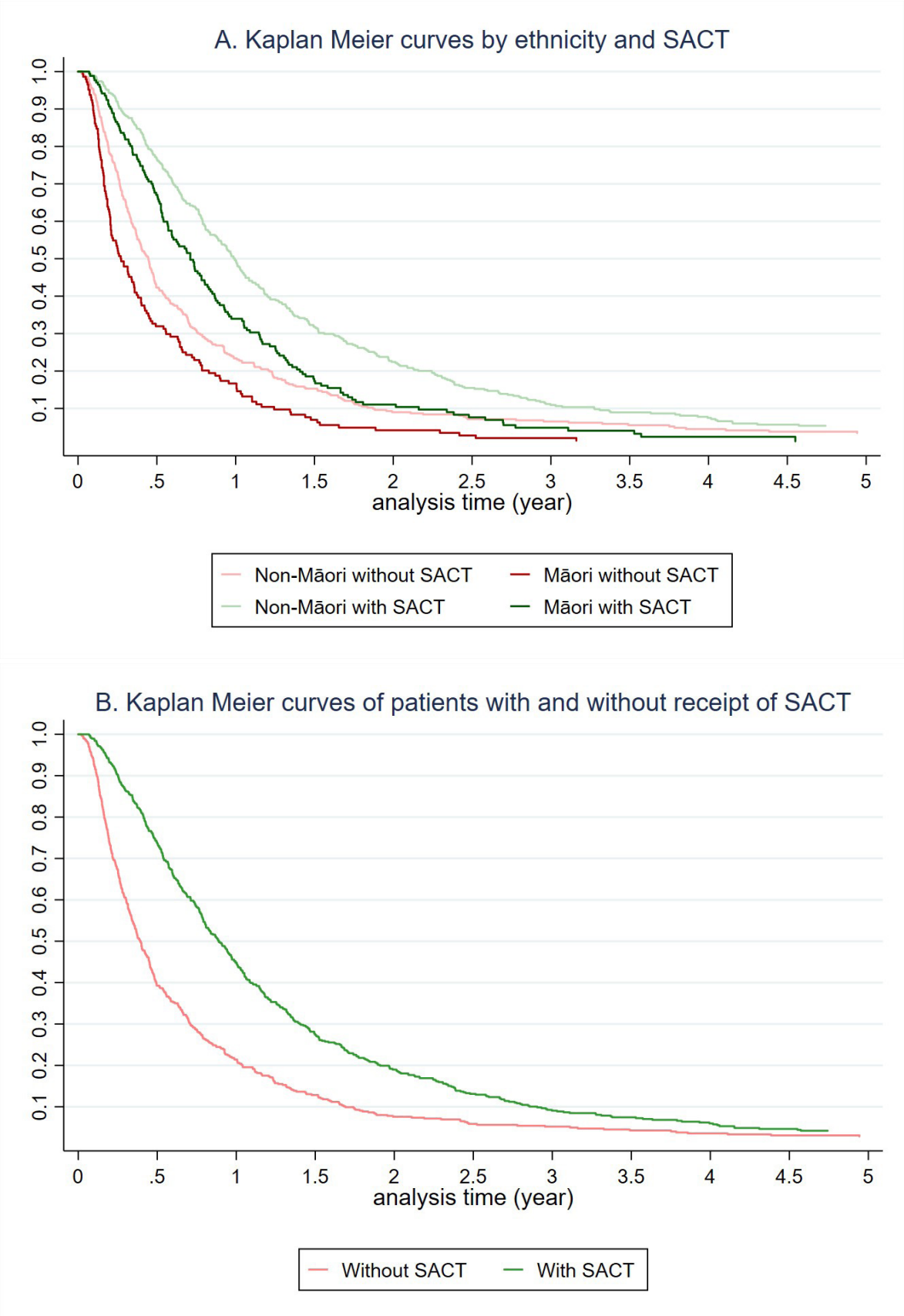

Table 3: The odds ratio of surviving 12 months.

A. Odds ratio of surviving 12 months in all patients				
Variables	**Unadjusted OR**	**95% CI**	**Adjusted OR**	**95% CI**
Age (years)	1.007	0.994–1.020	1.014	0.999–1.028
Gender				
Male	1		1	
Female	1.083	0.838–1.399	1.108	0.846–.449
Ethnicity				
Māori	1		1	
Non-Māori	1.701***	1.267–2.283	1.688***	1.238–2.300
Year of diagnosis				
2000–2004	1		1	
2005–2009	0.823	0.514–1.318	0.811	0.483–1.363
2010–2014	1.172	0.764–1.796	1.118	0.665–1.878
2015–2021	0.981	0.647–1.489	0.955	0.565–1.615
Regimen				
No IV SACT regimen	1		1	
Carboplatin + gemcitabine	2.609***	1.836–3.707	2.719***	1.873–3.947
Carboplatin + paclitaxel	3.385***	2.303–4.976	3.581***	2.392–5.360
Carboplatin + pemetrexed	2.667***	1.568–4.536	2.840***	1.601–5.036
Cisplatin + gemcitabine	2.899***	1.741–4.828	3.347***	1.859–6.024
Other	2.992***	1.753–5.106	3.084***	1.793–5.304
B. Odds ratio of surviving 12 months in the group receiving their first line SACT				
Variables	**Unadjusted OR**	**95% CI**	**Adjusted OR**	**95% CI**
Age (years)	1.018*	1.001–1.036	1.019	1.000–1.038
Gender				
Male	1		1	
Female	0.982	0.704–1.371	1.032	0.733–1.454
Ethnicity				
Māori	1		1	
Non-Māori	1.968***	1.352–2.865	1.862**	1.270–2.729

Table 3 (continued): The odds ratio of surviving 12 months.

Variables	Unadjusted OR	95% CI	Adjusted OR	95% CI
Year of diagnosis				
2000–2004	1		1	
2005–2009	1.101	0.586–2.069	1.124	0.547–2.311
2010–2014	1.207	0.680–2.140	1.181	0.539–2.589
2015–2021	0.884	0.505–1.547	0.875	0.387–1.978
Regimen				
Carboplatin + gemcitabine	1		1	
Carboplatin + paclitaxel	1.297	0.850–1.980	1.193	0.743–1.914
Carboplatin + pemetrexed	1.022	0.584–1.788	1.132	0.615–2.082
Cisplatin + gemcitabine	1.111	0.648–1.905	1.126	0.510–2.489
Other	1.147	0.654–2.012	1.064	0.591–1.917

Note: *** p<0.001, ** p<0.01, * p<0.05. Odds ratio = OR; confidence interval = CI.

Table 4: Adjusted odds ratio of receiving first and second SACT.

Variables	With the first-line SACT treatment (vs without)	95% CI	Transition from the first- to second-line SACT treatment (vs without transition)	95% CI
Age (years)	0.966***	0.953–0.978	0.986	0.967–1.006
Gender				
Male	1		1	
Female	1.075	0.840–1.377	0.977	0.675–1.413
Ethnicity				
Māori	1		1	
Non-Māori	1.096	0.833–1.443	1.536*	1.015–2.325
Year of diagnosis				
2000–2004	1		1	
2005–2009	1.063	0.682–1.658	1.224	0.587–2.552
2010–2014	1.510	0.996–2.289	1.881	0.968–3.655
2015–2021	1.597*	1.063–2.399	1.494	0.773–2.889

Note: *** p<0.001, ** p<0.01, * p<0.05. Confidence interval = CI.

Patients receiving SACT had better survival than those that did not. Median survival of patients treated with first SACT, second SACT and without SACT was 10.7, 17.5 and 4.7 months, respectively. A retrospective study of patients with advanced NSCLC in Portugal showed that patients not receiving SACT had a median survival of 1.8–2.3 months while those treated had a median survival of 10.3–12.6 months.[12]

The proportion of Māori and non-Māori patients treated with SACT were 54% and 53% respectively. We found no ethnic difference in receiving first-line SACT treatment. Randomised studies show a modest but statistically significant survival advantage of approximately 2 months for receipt of second-line chemotherapy compared to best supportive care.[13] It is therefore noteworthy that we found Māori patients with advanced NSCLC were less likely to receive second-line SACT. In addition, Māori receiving SACT were also less likely to survive 12 months than non-Māori. The reasons underlying ethnic disparities in cancer treatment and outcomes are complex. Social deprivation has a resultant influence on income, employment, housing and access to care, which are known key determinants of health. Over 60% of Māori patients live in localities that fall within the three most deprived deciles of the NZDep2001 Index of Deprivation.[14] Additionally, patient-level factors, treatment process factors and health system factors play a part.[15–18] As an example of patient-level factors, Māori are more likely to have comorbidities than non-Māori.[17] It has been reported that compared to non-Māori, Māori have a greater tendency to decline treatment,[19] but our study did not show a difference in uptake of first-line SACT. This may, however, be a factor in the lower transition to second-line SACT. As an example of treatment process factors, Māori have been reported as being more likely than other groups to experience a delay of 8 weeks or more before starting chemotherapy.[15] We did not investigate treatment delay, but this is an important measure for future research in the management of lung cancer.

Aotearoa New Zealand has lagged behind other OECD nations with respect to subsidised access to immunotherapy treatments. The Aotearoa New Zealand drug-buying agency has only recently announced a decision to fund pembrolizumab and atezolizumab for the treatment of lung cancer.[20] Real-world data indicate that this is likely to improve median survival, especially for younger patients, by up to 5 months.[21] In Aotearoa New Zealand this long overdue announcement will lead to improved survival of lung cancer patients in general. It remains to be seen if this will also help close the survival gap between Māori and non-Māori.

A strength of this research is that our SACT database contains 20 years of complete and continuous data regarding individuals with lung cancer including age, gender, ethnicity, cancer stage, SACT regimens and date of death. As a limitation, our SACT dataset does not provide data on other risk factors including smoking status, comorbidities or socio-economic status, which may influence the pattern of cares and survival outcomes of advanced NSCLC patients.

Conclusion

Fifty-three percent of patients seen in our regional oncology centre with advanced NSCLC were treated with SACT. Patients that receive SACT have greater 1-year survival than those that do not. While the proportion of Māori commencing first-line treatment was the same as for non-Māori, there was less uptake of second-line treatment for Māori over non-Māori. Survival for Māori was consistently inferior to that of non-Māori.

COMPETING INTERESTS
There were no conflicts of interests.

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AUTHOR INFORMATION
Ha Nguyen: Medical Research Centre, University of Waikato, Hamilton, New Zealand.
Rawiri Keenan: Medical Research Centre, University of Waikato, Hamilton, New Zealand.
Ian Kennedy: Te Whatu Ora – Health New Zealand, Waikato, New Zealand.
Chunhuan Lao: Medical Research Centre, University of Waikato, Hamilton, New Zealand.
Ross Lawrenson: Medical Research Centre, University of Waikato, Hamilton, New Zealand; Te Whatu Ora – Health New Zealand, Waikato, New Zealand.

CORRESPONDING AUTHOR
Ha Nguyen: Medical Research Centre, University of Waikato, Hamilton, New Zealand.
E: ha.nguyen@waikato.ac.nz

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Trends in the primary healthcare nursing workforce in managing diabetes from two sample surveys in 2006–2008 and 2016 in Auckland, New Zealand

Barbara M Daly, Bruce Arroll, Robert K Scragg

ABSTRACT

AIM: To examine trends in the primary healthcare nursing workforce and their community management of diabetes.

METHOD: Two representative surveys were carried out in 2006–2008 and 2016 among all primary healthcare nurses in Auckland. Nurses were randomly selected, and 26% (n=287) and 24% (n=336) completed a self-administered questionnaire and telephone survey. Biographical information, knowledge of diabetes, how valued nurses felt and diabetes care for patients was provided.

RESULTS: Between surveys, numbers of practice nurses have significantly increased, and specialist nurse numbers decreased, while district nurse numbers remained the same. In 2016, practice nurses were younger, more ethnically diverse, more likely to undertake education and had increased knowledge of diabetes and diabetes-related complications (including stroke) compared to nurses in 2006–2008. More nurses consulted patients, conducted foot examinations, addressed serum glucose, medication management, tobacco use and followed up care independently of doctors. In 2016, only 37% of nurses felt sufficiently knowledgeable to discuss medications with patients, <20% could state that hypertension, smoking and dyslipidaemia were major risk factors for complications, and less nurses felt valued.

CONCLUSION: Practice nurses have increased their capacity in diabetes management following global trends and require more support in meeting the complex healthcare needs of people with diabetes.

The changing role of the primary care nurse has been largely driven by increasing numbers of people with chronic care conditions and escalating costs of secondary healthcare.[1] The latter has forced many countries to introduce health reforms to increase capacity in primary care, largely through developing and increasing numbers of primary or family care nurses, and shifting tasks from general practitioners (GPs) to nurses.[2] In New Zealand, practice nursing originated in 1970 following a government subsidy scheme to partially fund salaries to incentivise GPs to provide primary care in rural areas, extended to urban areas in 1974 by popular demand.[3,4] Based on the primary care model in the United Kingdom, practice nurses (PNs) were employed by GPs but centrally funded[5] to carry out administrative duties and perform tasks such as immunising children. A key difference in New Zealand is that general practices are private enterprises and charge a fee-for-service.[6]

Several health reforms, which usually involved the centralisation or decentralisation of funding, have occurred in New Zealand since the adoption of a free public healthcare system in 1938[5] to improve equity and access of primary care for all New Zealanders.[5,7] The first major reform in 1983 included a population-based funding formula and the establishment of 14 regional Area Health Boards.[5] In 1993, these were reduced to four Regional Health Authorities and then reconstructed into 23 regional Crown Health Enterprises with a separate public health agency.[8] A major health reform in 2001 encouraged general practices to join a not-for-profit Primary Health Organisation (PHO) to initiate a new model of primary healthcare (PHC), improve access for all and reduce health inequities.[9] Funding was provided for PNs to undertake education and training to develop expertise and reimburse general practices for nurse consultations.[5,9] This funding was expected to encourage more autonomy, extend nursing roles (including prescribing for nurse specialists and nurse practitioners), increase

capacity in managing people with long term conditions and reduce the burden on secondary healthcare services.[9]

A recent reform in 2022 aimed to recentralise administration under Te Whatu Ora – Health New Zealand and work in partnership with the newly established Te Aka Whai Ora – Māori Health Authority to re-establish a people-centred, equitable, accessible and cohesive national healthcare system.[10,11] A public health agency and locality networks have been formed to shape policy, oversee the provision of PHC, reduce inequities in funding and ensure that the health needs of Māori communities are met.[11] Improvements are expected in utilising local community health services and digital technology with electronic patient record sharing between all healthcare providers and patients to support self-management and better serve communities by providing more flexibility and increasing consulting hours.[11]

The aims of the two surveys were to examine trends between 2006–2008 and 2016 by comparing numbers of PHC nurses, their education and knowledge of diabetes, assessments and care provided during diabetes consultations and how valued nurses felt in their management of diabetes patients.

Methods

Two representative cross-sectional surveys were carried out in 2006–2008 and 2016 among PHC nurses in Auckland to document demographic, educational and work-related characteristics, and to describe their role in the community management of diabetes.

Participants

Lists of all practice, district and specialist nurses who provide general practice and community

Figure 1: Total population[12] and numbers of primary healthcare nurses and people with diabetes in Auckland,[13] New Zealand in 2008 and 2016.

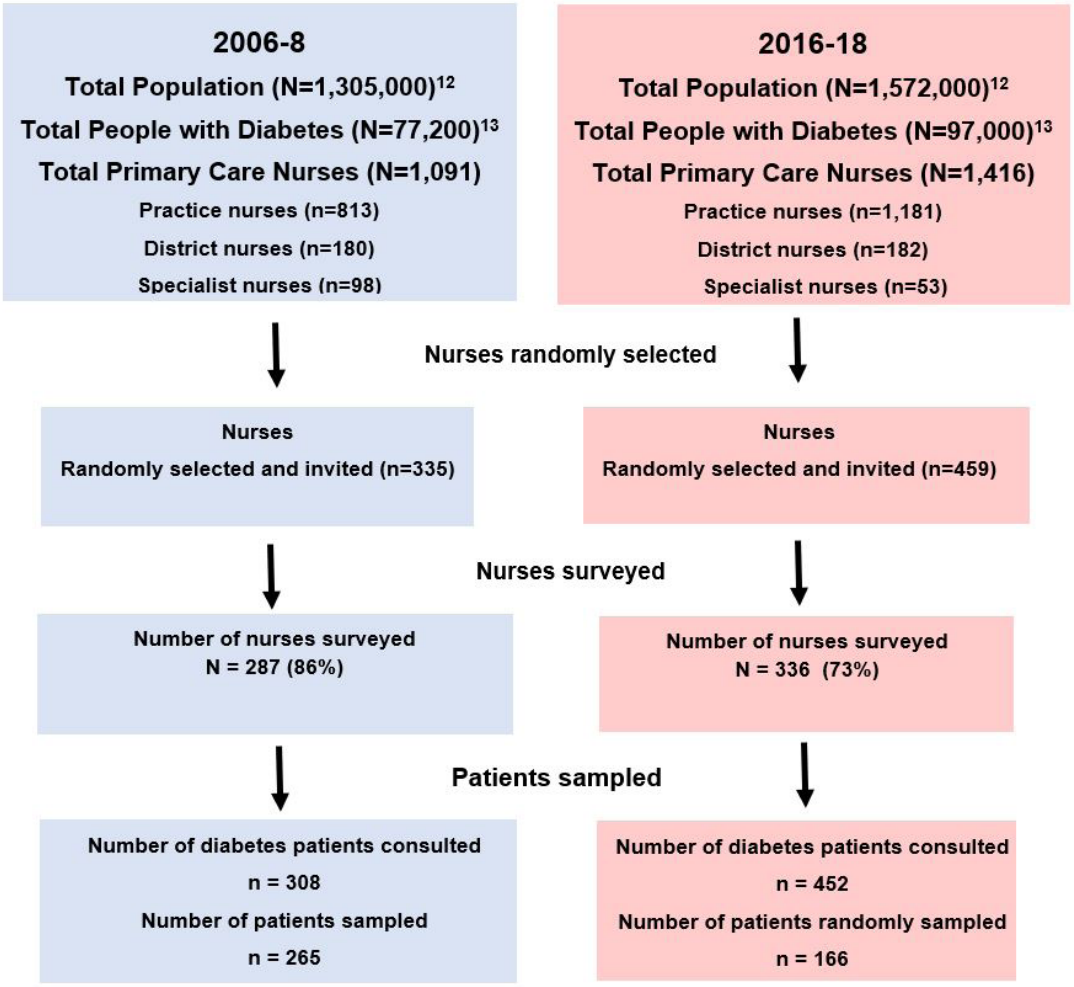


Table 1: Comparison of demographic and work characteristics, diabetes knowledge and guideline use in the primary healthcare nursing workforce between 2006–2008 and 2016 in Auckland, New Zealand.

Variable and level	Total surveyed in 2007 n=287 N	Total surveyed in 2016 n=336 N	Total weighted by sampling probabilities		
			Survey 2007 n=1091 %	Survey 2016 n=1349* %	Wald P-value#
Demographic characteristics					
Nurse group	287	336			
Practice nurses	210	274	75	88	<0.0001
Home nurses	49	30	17	9	
Specialist nurses	28	32	9	4	
Female	281	325	98	97	0.31
Male	6	11			
Age (years)					
<40	57	101	20	32	0.001
>40	223	228	80	68	
Ethnicity					
NZ European	209	193	74	59	
Asian	20	74	7	23	<0.0001
Māori/Pacific Island	25	35	9	10	
Other	30	30	11	8	
Post-registration qualification/s					
Yes	140	213	49	62	0.001
No	144	119			
Work details					
General practice/A&E/Outpatients	233	298	83	91	0.003
Home consultations	51	34	17	9	
Number of doctors in Practice					
<4	179	172	64	53	0.008
>4	100	151	36	47	

Table 1 (continued): Comparison of demographic and work characteristics, diabetes knowledge and guideline use in the primary healthcare nursing workforce between 2006–2008 and 2016 in Auckland, New Zealand.

Number of nurses in Practice					
1	32	37	11	12	
2	64	69	23	23	0.91
3–4	82	101	29	32	
>4	104	119	36	34	
Years in current Practice					
<10	196	265	69	81	0.0005
>10	88	67	31	19	
Hours worked per week					
<16	25	27	9	9	
17–24	48	50	17	15	0.27
25–39	117	162	41	49	
>40	94	93	33	27	
Hours of diabetes education					
0	56	65	20	20	
<5	50	43	18	14	
5–10	53	58	19	19	0.63
11–20	43	59	15	19	
>20	82	106	29	29	
Administrative space					
Own office	104	211	37	62	<0.0001
Shared space/car/patient's home	182	125	64	38	
Internet access	236d	290	82	86	0.24
Able to email patients	128	271	45	80	<0.0001
Knowledge of diabetes					
Knowledge of best practice					
Excellent/very good/good	262	293	92	87	0.04
Fair/poor	24	43			
Awareness of and use of national guidelines	199	259	69	76	0.06
Always/often/sometimes	100	194	50	74	
Rarely/never	99	64	50	26	<0.0001

Table 1 (continued): Comparison of demographic and work characteristics, diabetes knowledge and guideline use in the primary healthcare nursing workforce between 2006–2008 and 2016 in Auckland, New Zealand.

Knowledge to:					
Discuss laboratory results	258	319	92	97	0.01
Advise on lifestyle interventions	194	268	70	81	0.001
Advise on medications	81	130	29	37	0.03

*Only 115 of the total 182 district nurses were able to be included in the survey accounting for the difference between 1,349 and 1,416 (Figure 1).
#P-value showing significance of variation in percentages between surveys, from the Wald Chi-Square value.

Figure 2: Trends in the proportion of nurses who had knowledge of type 1 and type 2 diabetes in 2006–2008 and 2016.

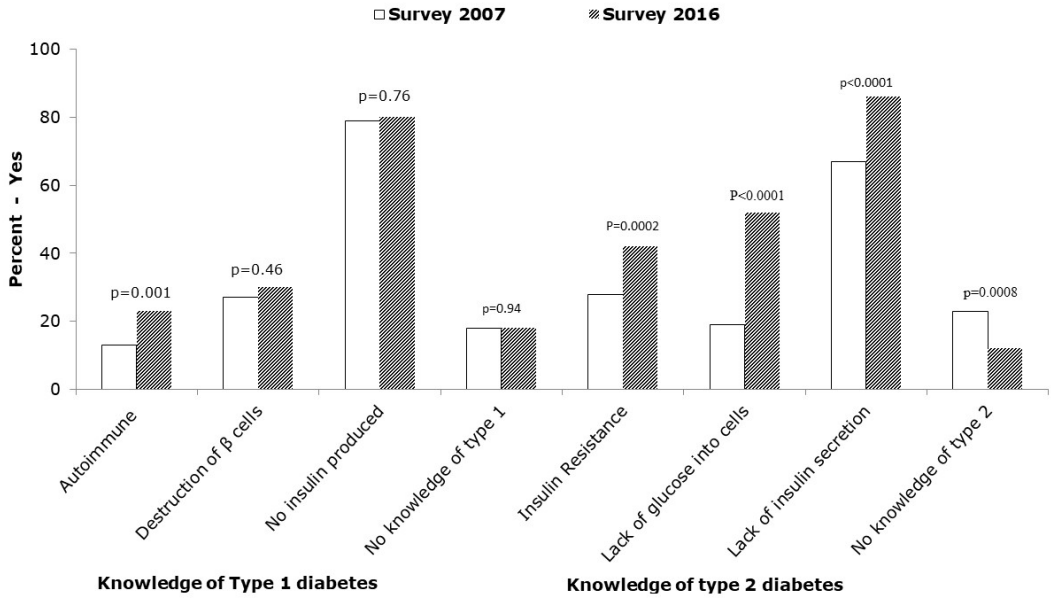


Figure 3: Trends in the care provided by nurses (%) who had consulted patients with diabetes on a randomly selected day in 2006–2008 and 2016.

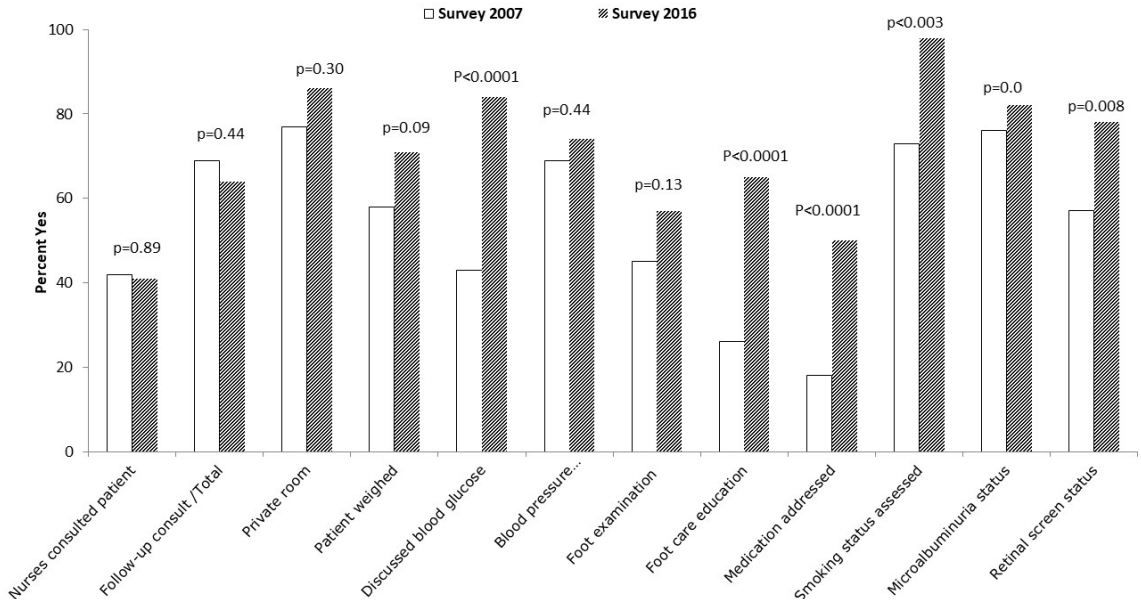
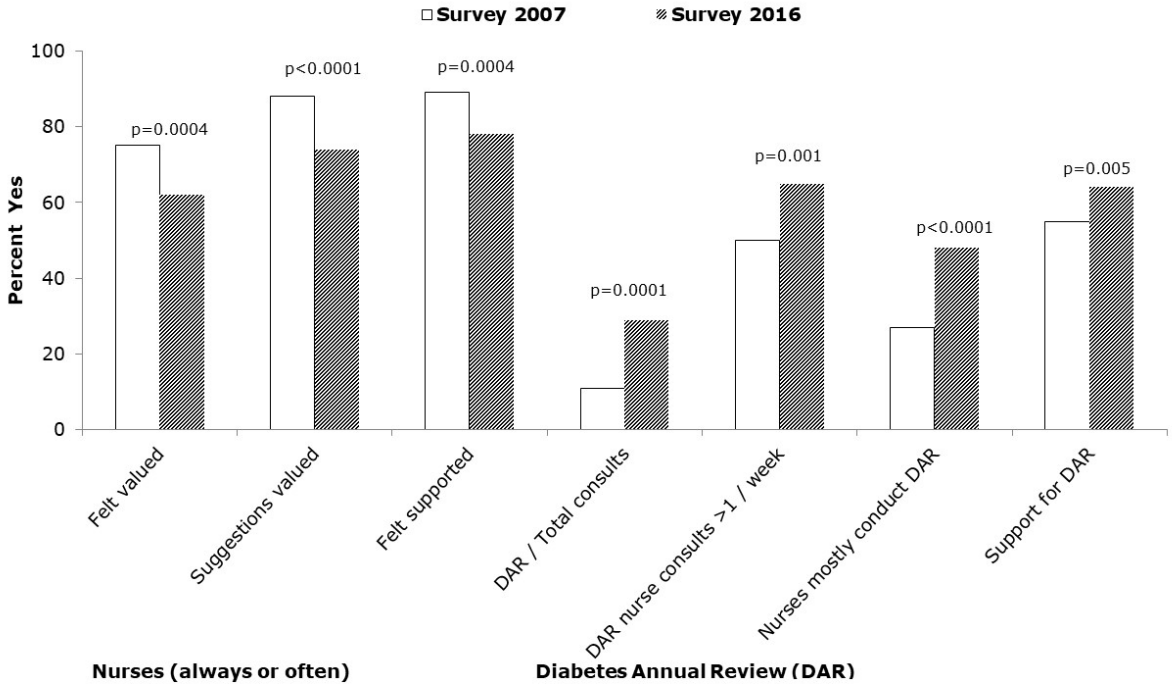


Figure 4: Trends in the proportion of nurses who felt valued in their diabetes management practices and involved in diabetes annual reviews (DAR) in 2006–2008 and 2016.



care were constructed to ensure that both surveys were representative.[14,15] Of the total nurses, 26% (n=287) and 24% (n=336) were randomly selected and agreed to participate in each survey, achieving response rates of 86% and 73%, respectively (Figure 1).

Data collection

Participants completed a self-administered questionnaire providing biographical information and general practice or clinic details about diabetes patients registered and their diabetes management processes. All nurses also completed a telephone survey that assessed their knowledge of diabetes, best management practices and their provision of diabetes care. At the end of each telephone interview, nurses provided the number of diabetes patients they had consulted on a randomly selected day they had worked over the past week, and information was ascertained about diabetes patients consulted. Information was provided for 86% of the 308 patients consulted in 2006–2008 and 166 (37%) randomly selected from the 452 patients consulted in 2016. The lower numbers and proportion of patients sampled in the latter survey was due to the large numbers of diabetes patients consulted and time constraints for participants. Participants responded to almost all the questions.

Variables and outcome measures

Between-survey comparisons included: 1) the biographical characteristics of the PHC nursing workforce, 2) diabetes knowledge held by nurses, 3) adherence to best diabetes management practices, 4) patient demographic characteristics, and 5) diabetes management and care provided during nurse consultations.

Ethical considerations

Appropriate ethics approvals were granted for each survey by the Northern Regional Ethics Committee (NTX/05/10/128) and The University of Auckland Human Participants Ethics Committee (014713) in 2006–2008 for 2016, respectively. All participants consented before the telephone interview. All information related to patient consultations was collected anonymously. Adherence to the STROBE guidelines has been followed in conducting the study and reporting findings.

Survey questionnaire

Both questionnaires were adapted and extended from a survey administered to PNs

in South Auckland in 1999.[16] New demographic questions were modelled on the five yearly New Zealand Census questionnaires. Questionnaires are included in Appendices 1 and 2. All questionnaires were piloted individually among a small number of nurses from each nurse group for face and content validity, and to ensure questions met the aims of the studies. A fixed response was required for the majority of questions that were either numerical, dichotomous, multiple choice or Likert scores, and a small number were short or open-ended. All responses to knowledge questions that differed from the pre-determined correct responses and open-ended responses were recorded in writing and systematically coded prior to analyses to decrease potential random measurement error.

Data analysis

Between-survey comparisons were made by combining all three groups of nurses sampled (practice, district and specialists) using weighted proportions to ensure representation for each group. Results mostly reflect PNs, who accounted for 75% and 88% of the total weighted proportions for each survey. All statistical analyses were carried out using SAS (SAS Institute, Cary, NC, 2013) and SUDAAN (version 11.0, Research Triangle Institute, 2012) and have been previously described.[17] For weighted survey comparisons and respective patients consulted, univariate analyses PROC FREQ and PROC UNIVARIATE were used to generate frequencies and p-values from the Wald Chi-Square value. PROC CROSSTAB and PROC REGRESS in SUDAAN were utilised to compare patient variables and management practices between surveys and to correct for clustering effects for nurses who consulted more than one patient.

Results

Trends in numbers and characteristics of primary care nurses

Over time there has been a significant increase in numbers of PNs, while the proportions of district and specialist nurses have approximately halved (Table 1). There was a significant increase in younger nurses aged ≤40 years, and although the workforce continues to be mostly female (97%), there was a significant increase in male district nurses (4% to 13%) and a small increase in male PNs (1% to 3%)—subgroup data not shown. In 2016, significantly fewer nurses were NZ European, more were Asian and similar proportions were Māori and Pacific compared with nurses in 2006–2008 (Table 1).

Practice details and management of diabetes

Significantly more nurses worked part-time in 2016 (73%) compared with 67% in 2006–2008, and 80% had attended five or more hours of specific diabetes education in the previous five years. This had not significantly changed between surveys (Table 1). Significantly more nurses in 2016 compared with 2006–2008 worked in general practice or Accident and Medical clinics (91% and 83%), in larger practices based on the number of physicians (47% and 36%), had their own room or office for administrative work (62% and 37%) and were able to email patients (80% and 45%). However, fewer nurses consulted patients at home in 2016 (9%) compared with 17% in 2006–2008 (Table 1).

Education and knowledge of diabetes

Significantly more PHC nurses in 2016 undertook post-graduation education (62%) and referred to guidelines on the management of type 2 diabetes (74%) compared with 49% and 50%, respectively, in 2006–2008. Most nurses in 2016 reported having the knowledge to discuss laboratory results (97%) and advise patients on making lifestyle changes (81%) compared with 92% and 70% of nurses, respectively, in 2006–2008. In contrast, only 37% of nurses felt sufficiently knowledgeable to offer advice to patients about their medications in 2016, although this was significantly more than the 29% of nurses surveyed in 2006–2008.

Slightly less nurses in 2016 (87%) rated their knowledge of best practice as at least "good" compared with 92% of nurses in 2006–2008 (Table 1). More nurses knew that type 1 diabetes was an autoimmune condition (23%) and understood the underlying pathology of type 2 diabetes (42%) in 2016 compared with 13% and 28% of nurses, respectively, in 2006–2008 (Figure 2).

Trends in management and care provided

Significantly more nurses addressed serum glucose levels, medications, foot care and smoking cessation and knew of patient's microalbuminuria and retinal screening status in 2016 than nurses in 2006–2008 (Figure 3). However, the proportion of nurses who provided nutritional and physical activity advice and education remained unchanged—data not shown. Significantly more

nurses in 2016 routinely consulted patients, conducted diabetes annual review (DAR) independently of doctors (48% versus 27%) and reported increased support in reviewing patients with diabetes compared with nurses in 2006–2008 (Figure 4).

Nurses feeling valued and supported

Despite the improvements in knowledge and management practices in 2016 compared with 2006–2008, fewer nurses felt valued, felt their suggestions were taken seriously or felt supported in their overall diabetes management activities (Figure 4).

Discussion

Numbers of PNs have significantly increased between surveys (Figure 1), which mirrors the national increase from 5,600 (12%) of the total nursing workforce in 2010,[18] to 7,713 (14%) in 2019.[19] The PHC nursing workforce continues to be over-represented by women (97%). Although there was a small (1%) increase in male nurses between surveys, it continues to lag behind the 8% of male registered nurses in New Zealand.[19] PNs were younger in 2016 and 32% were aged ≤40 years, compared with 20% in 2007–2008. In contrast, numbers of specialist nurses decreased between surveys, and 58% were aged over 50 years in 2016 compared with 43% in 2006–2008, reflecting a lack of recruitment. In the latter survey, more nurses had gained diabetes experience in primary care than within a hospital setting,[15] consistent with increasing numbers and size of general practices.[15,20]

Nurse education and knowledge of diabetes

Significantly more PHC nurses in 2016 had undertaken post-graduate education, attended specific diabetes educational sessions or conferences[15] and were more knowledge about the underlying pathology of type 1 and 2 diabetes compared with nurses in 2006–2008. Despite this, knowledge of type 1 diabetes among nurses remains low in New Zealand and internationally.[21] Clinically, more nurses were aware of best management guidelines for people with type 2 diabetes. Nurses who had attended specific diabetes education in the past 5 years were more likely to report feeling sufficiently knowledgeable to advise patients on their test results, required lifestyle changes and medications,[22] and educate patients in primary care, which is associated with improved outcomes.[23]

Although nurses had increased their knowledge over time of diabetes-related complications, including stroke (which is a proxy for in-depth diabetes knowledge) and major risk factors, less than 20% of nurses could state that hypertension, smoking or dyslipidaemia were also major risk factors for diabetes-related complications.[22] Similar gaps in nurses' knowledge were highlighted in a recent review of 28 studies reporting that most nurses knew retinopathy was a microvascular complication, but very few knew about peripheral neuropathy and its associated clinical implications.[24] Knowledge gaps on medications remain, as only 37% of nurses reported having sufficient knowledge to advise patients about their medications, mimicking a report from the United Kingdom where PNs reported lacking knowledge required for initiating insulin.[25]

Practice details and management

PHC nurses increasingly work more autonomously. Most work in larger general practices or clinics, and almost twice the proportion of nurses in 2016 compared with 2006–2008 had their own offices for administrative work.[15] Significantly more nurses in 2016 routinely consulted patients, conducted DAR independently of doctors (following trends in the UK[26]), manage patient's serum glucose, conduct cardiovascular assessments and foot examinations (indicating reduced barriers in providing care[27]), educate patients on reducing their risk of diabetes-related complications and follow-up on screening, referrals and test results.[28] These trends indicate increasing capacity and autonomy in managing patients with chronic conditions and are consistent with global trends,[2] although the increased support only extended to conducting DAR, not general diabetes management, and may reflect resistance to changing traditional models of primary care identified in a Canadian survey.[29] The proportion of nurses who provided nutritional and physical activity education remained the same over time, despite a significant increase in patients' mean BMIs,[17] reflecting the many challenges and barriers engaging patients about lifestyle changes in an obesogenic environment.

Clinical implications

Despite nurses consulting more diabetes patients in 2016,[17] gaining knowledge of diabetes and best management practices, fewer nurses

reported feeling valued or supported or that their suggestions were taken seriously in their overall diabetes management activities. Fewer nurses reported having support from dietitians or diabetes specialist nurses compared with nurses in 2006–2008, although more were supported by podiatrists and chronic care management nurses.[30] This contrasted with nurses who conducted DAR, where most felt supported in 2016,[30] and follows global trends where specific management tasks have shifted from GPs to nurses.[2,26] Nurses in 2016 reported feeling less valued than nurses in 2006–2008, which may reflect the younger cohort of nurses or structural and organisational changes. Salary gaps continue to widen between practice and hospital-based nurses,[31] and structural and organisational barriers reduce opportunities for career development and leadership roles in primary care.[32,33]

International context

Increasing the development and capacity of primary care nurses in New Zealand reflects global trends in offering more tangible career opportunities to further attract and nurture talented nurses.[34] Over the past 15 years, primary care nurses have become better educated, skilled, more confident and achieved similar or better health outcomes for patients with chronic conditions as GPs in a review of 18 randomised controlled trials.[1] Patients have also reported increased satisfaction after consulting a nurse compared with a GP, which could be attributed to longer consultations and more frequent follow-up care.[1] An Australian PN-led intervention achieved similar health outcomes and increased satisfaction for patients with type 2 diabetes, hypertension and ischemic heart disease as GPs, and was advantageous for both groups.[35] More recently, an Australian in-depth interview-based qualitative study of multidisciplinary primary care providers, which included PNs, reported improved communication and collaboration across primary and secondary care, improved patient self-care practices among people with chronic conditions and reduced hospital admissions.[36,37] An integrated model of care between secondary and primary care for diabetes patients with complex needs reduced the burden on secondary care services.[38] Similarly, in Estonia, health reforms designed to expand family (primary) care included a four-fold increase in primary care nurses and led to increased nurse consultations, patient access and attendance and reduced hospital admissions.[39] A review of 213 PHC teams, which included nurses in Italy, reported improved communication within and across health professionals that could potentially improve outcomes for people with type 2 diabetes.[40] In North America, advanced PNs educated to a Masters level, with collective prescribing rights, were increasingly and independently managing elderly patients, and able to meet their varied health needs in a range of rural and urban community settings.[41]

Despite progress in increasing capacity among primary care nurses in some countries, other developed countries lag behind. An evaluation of a shared model of primary care between PNs and GPs in the Netherlands highlighted the need for increased training and support for PNs to transition from a largely protocol-driven model of care to sharing management and decision making with GPs.[42] Nurses found it particularly difficult to integrate decision making, coaching and goal setting with patients with chronic conditions into the traditional protocol-based care model.[42] Similarly, in the United Kingdom, PNs reported needing increased support when incorporating psychological interventions to engage patients with diabetes to improve self-management behaviours.[43]

Strengths and limitations

A major strength of the surveys was the random selection of nurses from complete lists of all nurse groups who provide diabetes care in the community and the high response rates. Limitations included the cross-sectional design of the surveys that limited examining trends in qualifications, knowledge, experience, autonomy and career pathway progression from the same cohort of nurses. It is possible a proportion of nurses were in both surveys, although responses were analysed independently. Nurses may have over-reported post-graduate qualifications, experience and their perceived knowledge and confidence in educating patients on key practice points. It is possible that type 1 errors may have occurred due to the number of comparisons made between surveys. However, knowledge was tested during the telephone interview and correlated with self-reported levels.[22] Demographic findings correlated with national nursing survey results[19] and those reported from international surveys.[24,44]

Conclusion

PNs in New Zealand have significantly increased their post-graduate qualifications, knowledge of diabetes, independence and capacity in the community management of people with diabetes. Designated diabetes nurses are increasingly incorporated into the typical general practice model of care. This follows global trends in shifting the management of people with chronic care conditions from GPs to primary care nurses, increasing the capacity of the community-based nursing workforce, and reducing the burden and escalating costs associated with secondary healthcare provision. Despite increasing diabetes knowledge and autonomy, too few nurses had received sufficient diabetes education. Nurses lacked knowledge about type 1 and 2 diabetes and best medication management practices and felt less valued and supported in their overall management of diabetes. These findings, and those from international reports, indicate that undergraduate and post-graduate educational institutions need to expand their curriculum on diabetes and its management. Extending government funding for post-graduate PHC nursing education and support for nurses to undertake diabetes education will help mitigate gaps in knowledge and practice.

COMPETING INTERESTS
There are no potential conflicts of interests reported relevant to this study.

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AUTHOR INFORMATION
Barbara M Daly: Senior Lecturer, School of Nursing, Faculty of Medical and Health Sciences, The University of Auckland.
Bruce Arroll: Professor of General Practice and Primary Healthcare, School of Population Health, The University of Auckland.
Robert Keith Rhodes Scragg: Professor in Population Health, School of Population Health, The University of Auckland.

CORRESPONDING AUTHOR
Barbara M Daly: Senior Lecturer, School of Nursing, Faculty of Medical and Health Sciences, The University of Auckland, 85 Park Road, Grafton, Auckland 1142, New Zealand. Ph: +64 9 923 9882; 0064 27 276 2840. E: b.daly@auckland.ac.nz

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Appendix 1: Primary healthcare nursing diabetes management survey

Please complete this survey form to reflect your current situation.
Please tick the correct response and write NA if the question does not apply to your area of work.

Personal details		
1a Gender	Female	Male
1b Age		
☐ <25 ☐ 25–30 ☐ 31–35 ☐ 36–40 ☐ 41–45	☐ 46–50 ☐ 51–55 ☐ 56–60 ☐ 61–65 ☐ >65	
1c Which ethnic group do you belong to? (tick all those that apply)		
☐ NZ European ☐ Māori ☐ Cook Island Māori ☐ Samoan ☐ Tongan	☐ Niuean ☐ Chinese ☐ Indian ☐ Other (such as Dutch, Japanese, Tokelauan) Please state	
1d Is English your first language?	☐ Yes	☐ No
2a What year did you graduate from your primary (first) nursing course?	____ Year	
2b What country did you graduate in?		
☐ New Zealand	☐ Other (please state) ____	
2c What was the nursing qualification you gained?		
☐ RN ☐ BN ☐ BHSc	☐ Enrolled Nurse ☐ Other (please state) ____	
2d Do you have, or are you working towards, any other qualification? (Tick all those that apply)		
☐ Certificate ☐ Diploma ☐ Degree	☐ Masters ☐ Other (please state) ____	
• If you ticked any of the above: what year/s did you complete OR expect to complete your most recent qualification?		

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

3a Have you undertaken any specific diabetes education since you finished your primary nursing course?	☐ Yes ☐ No (**if no, please go to question 4**)
3b Where did you gain this education? (Tick all those that apply)	
☐ Tertiary institute ☐ Workplace ☐ Conferences	☐ Workshop ☐ Other _____
3c Please estimate the number of hours you have undertaken on diabetes education in the last 5 years?	
☐ <5 hours ☐ 5–10 hours	☐ 11–20 hours ☐ >20 hours
3d Regarding your diabetes experience, where have you mostly cared for diabetes patients? (Tick all those that apply)	
☐ Hospital ☐ District nursing ☐ Primary care	☐ Accident & medical ☐ Other _____
4a How many years (in total) have you practiced as a nurse in a community setting?	
☐ <1 year ☐ 1–5 years	☐ 6–10 years ☐ >10 years
4b What best describes your current nursing role?	
☐ Practice nurse ☐ Accident & medical ☐ Diabetes nurse specialist	☐ District nurse ☐ Other _____
4c How many years (in total) have you worked in this nursing role?	
☐ <1 year ☐ 1–5 years	☐ 6–10 years ☐ >10 years
5a What best describes your current work setting?	
☐ General Practice ☐ Accident & medical ☐ Home visits	☐ Hospital clinics ☐ Other

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

5b How long have you worked at your current practice/service?			
☐ <1 year		☐ 6–10 years	
☐ 1–5 years		☐ >10 years	
5c How many hours do you usually work each day? ____			
5d How many hours do you usually work each week? ____			
5e How many weeks do you usually work each year? ____			
Practice details			
6 What DHB is your practice/service located in?			
☐ Waitematā		☐ Counties Manukau	
☐ Auckland			
Within the last 3 months:			
7a During the week how many doctors usually work each day at your practice/service?			
☐ None		☐ 4–7	
☐ 1 only		☐ 8–10	
☐ 2–3		☐ >10	
7b During the week, how many nurses usually work each day at your practice/service?			
☐ 1 only		☐ 5–7	
☐ 2 only		☐ >7	
☐ 3–4			
7c Do any of the specialists involved in diabetes care (listed below) work at your practice/service?			
Diabetes nurse specialist	☐ Yes	☐ No	
Diabetes nurse educator	☐ Yes	☐ No	
Chronic care or long-term conditions nurse	☐ Yes	☐ No	
Diabetologist	☐ Yes	☐ No	
Dietitian	☐ Yes	☐ No	
Podiatrist	☐ Yes	☐ No	
Other (please state) ____			
7d How often does a nurse specialising in diabetes care visit your practice/service? At least once:			
☐ A week		☐ A year	
☐ A month		☐ Never	
☐ Every 6 months			

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

Patient details	
8a How many people are registered at your practice/service? ____	
8b How many diabetes patients are registered at your practice/service? ____	
8c How did you get the above information?	
☐ From the database	☐ Other (please state) ____
☐ Estimated	
8d What is the ethnic composition of diabetes patients at your practice/service? (Approximations will do)	
☐ European ____%	☐ Asian ____%
☐ Māori ____%	☐ Other ____%
☐ Pacific Island ____%	
The following questions relate to general diabetes management activities.	
9a Does your practice or service organise a blood test for diabetes patients before their consultation?	
☐ Always	☐ Rarely
☐ Often	☐ Never
☐ Sometimes	☐ Not applicable
9b Do diabetes patients routinely see you when they attend your practice/service?	
☐ Always	☐ Rarely
☐ Often	☐ Never
☐ Sometimes	☐ Not applicable
9c Do diabetes patients make an appointment to see you?	
☐ Always	☐ Rarely
☐ Often	☐ Never
☐ Sometimes	☐ Not applicable
9d Within your practice, who mostly carries out the follow-up care of diabetes patients after each consultation?	
☐ Doctor	☐ Both doctor and nurse equally
☐ Nurse	☐ Not applicable
9e How many diabetes consultations (including the "Get Checked Review") have you carried out over the past week?	
☐ None	☐ 5–7
☐ 1–2	☐ More than 7
☐ 3–4	☐ Not applicable

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

10a Who most often checks patients' laboratory results?		
☐ Doctor		☐ Both doctor and nurse equally
☐ Nurse		
• If you ticked either (***nurse***) or (***doctor & nurse***), do you personally check results?		
☐ Yes		
☐ No		
10b Who most often follow up diabetes patients to discuss their results?		
☐ Doctor		☐ Both doctor and nurse equally
☐ Nurse		
10c Do you think you have enough <u>knowledge</u> to:		
(i) Discuss abnormal laboratory results with diabetes patients?	☐ Yes	☐ No
(ii) Advise on lifestyle interventions to improve results?	☐ Yes	☐ No
(iii) Advise on pharmaceutical interventions or medications?	☐ Yes	☐ No
10d Would you be interested in learning more about <u>abnormal</u> laboratory results in order to advise diabetes patients independently of a doctor?	☐ Yes	☐ No
If yes, which of the following would you be interested in learning more about? (Tick all that apply)		
☐ HbA1c		☐ Serum Creatinine
☐ Total Cholesterol		☐ Microalbuminuria
☐ LDL Cholesterol		☐ Glomerular Filtration Rate (GFR)
☐ HDL Cholesterol		☐ Other _____
☐ Triglycerides (TAGs)		
11a Do you mostly give individual advice to your patients (and their families)?	☐ Yes	☐ No
If yes, what are the most <u>common</u> topics you advise on?		
11b Do you have access to educational materials for diabetes patients?	☐ Yes	☐ No

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

If yes, please identify these: (tick all those that apply)		
☐ Printed handouts		☐ Internet websites
☐ Colour pamphlets or brochures		☐ Pictures/examples of food
☐ Flip charts or folders		☐ Other (please state)
11c Do you run group education sessions for diabetes patients?	☐ Yes	☐ No
If yes, please state the most <u>common</u> topics discussed in these sessions.		
The following questions relate to the "Annual Diabetes (Get Checked) Review".		
12a Who mostly carries out the "Annual Diabetes (Get Checked) Reviews" at your practice/service?		
☐ Doctor		☐ Both doctor and nurse equally
☐ Nurse		☐ Not applicable
If you ticked (***doctor and nurse equally***), what aspects do the nurses mostly carry out?		
☐ Complete review		☐ Medication advice
☐ Weight		☐ Dietary advice
☐ Blood pressure		☐ Physical activity advice
☐ Feet check		☐ Smoking cessation
☐ Review/check glucose		☐ Other
☐ Insulin management		
12b Do you personally carry out "Annual (Get Checked) Reviews" (or any part of them)?		
☐ Yes		☐ NA
☐ No		
If yes, what percentage of the "Annual (Get Checked) Reviews" do you personally carry out?		
☐ <5%		☐ 51–75%
☐ 5–25%		☐ >75%
☐ 26–50%		
If no, state the main reasons for <u>not</u> carrying out "Annual (Get Checked) Reviews" (tick all those that apply)		
☐ Doctor carries out the Diabetes Reviews		☐ Patients are enrolled in other programmes
☐ Designated nurse carries out the Diabetes Reviews		☐ Other (please state)
12c How much support is there for you to participate in the "Annual (Get Checked) Review" in your practice/service?		
☐ A lot		☐ None
☐ Some		☐ Not applicable
☐ A little		
If you ticked (***a little***) or (***none***), can you state the main reasons?		

Appendix 2: Telephone interview questionnaire

1. At your practice/clinic/service		
a) Do you have access to a private room when consulting diabetes patients?	1. Yes	2. No
b) Which of the following do you have access to when communicating with patients? (*Read out all below*)		
1. Telephone 2. Computer 3. Printer 4. Internet	5. Email 6. Text 7. Other _____	
c) Which one/s do you most commonly use?		
d) Where do you usually carry out the administrative work for your patients? (*Not prompted*)		
1. A separate (or your own) room 2. A shared room 3. The receptionist/office area	4. Patient's home 5. Own car 6. Other	
d) What activities and assessments do you routinely carry out during a diabetes consultation? (*Excluding Get Checked/DAR*) (*Not prompted*)		
1. Weight 2. Blood pressure 3. Physical activity 4. Diet 5. Feet 6. Advice/foot protection 7. Capillary/BGL/BM 8. Self BGLs/Glucometer 9. Smoking cessation 10. Wound care	11. Discuss medication 12. Initiate insulin 13. Adjust medications 14. Prescribe medication/s 15. Vision 16. Urine testing 17. Referrals/follow-up tests 18. Referral for health promotion 19. Other	
e) Do you routinely check diabetes patients' latest laboratory results?	1. Yes	2. No

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

If yes, which results would you normally discuss with patients? (*Not prompted*)		
1. HbA1c 2. Total cholesterol 3. LDL cholesterol 4. HDL cholesterol 5. Triglycerides (TAGs) 6. Serum Creatinine		7. Microalbuminuria 8. Liver enzymes 9. UTI 10. Swab results 11. Thyroid hormone/s 12. Other
f) Do you ever give out the "Green Prescription"	1. Yes	2. No
If ***yes***, what activity do you most often prescribe?		
If ***no***, is there a reason for this?		
2. Regarding your diabetes management		
a) How would you rate your <u>knowledge</u> of best practice in the management of diabetes?		
1. Excellent 2. Very good 3. Good		4. Fair 5. Poor
b) Are you aware of the New Zealand Guidelines, written for the "Management of Type 2 diabetes"?	1. Yes ***If yes***, which guideline do you use?	2. No
If yes, how often do you use these guidelines in your practice?		
1. Always 2. Often 3. Sometimes		4. Rarely 5. Never
3. Regarding the detection of diabetes and its complications		
a) What are the most important <u>risk factors</u> for getting type 2 diabetes? (*Not prompted* but prompt "characteristics about patients that alert you to suspect diabetes")		
1. Overweight 2. Hypertension 3. Lack of exercise 4. Age 5. Family history/genetic		6. Dyslipidaemia (*and specify*) a) High LDL-C/Total Chol., b) High Triglycerides, c) Low HDL-C 7. Māori ethnicity 8. Pacific Island ethnicity 9. Southern Asian ethnicity 10. Other

Appendix 1 (continued): Primary healthcare nursing diabetes management survey.

b) Can you name the appropriate tests to diagnose type 2 diabetes? (*Not prompted*)	
1. HbA1c	3. Random venous ≥11mmol/L
2. Fasting plasma glucose ≥7mmol/L	4. Other
c) What is the underlying pathology, or case of: (*not prompted*)	
a. **Type 1**:	
1. Autoimmune/immune cells destroy beta cells	3. No insulin produced
2. Destruction of beta cells	4. Don't know
b. **Type 2**:	
1. Insulin resistance/insulin receptors not working	3. Lack of insulin produced
2. Lack of glucose into *cells*	4. Don't know
4. Regarding the management of diabetes	
a) What are the main complications or diseases that occur in people with diabetes? (*Not prompted*)	
1. Heart Disease/MI/CVD	6. Neuropathy/lack of sensation
2. Stroke	7. Ulcers/wounds
3. PVD/Vascular/Circulation	8. Foot problems/amputations
4. Retinopathy	9. Other
5. Renal disease	
b) What are the main (modifiable) risk factors for diabetes complications? (*Not prompted*)	
1. High BGLs/HbA1c	5. High Cholesterol or LDL-C
2. Lack of exercise	6. Low HDL-C
3. Hypertension	7. High Triglycerides
4. Smoking	8. Other
5. In your practice/service, how true are the following statements?	
a) You feel valued, as a skilled practitioner, in the management of diabetes	
1. Always	4. Rarely
2. Often	5. Never
3. Sometimes	
b) Your suggestions, regarding the management of patients with diabetes, would be taken seriously.	
1. Always	4. Rarely
2. Often	5. Never
3. Sometimes	

Appendix 2 (continued): Telephone interview questionnaire.

c) You feel supported in your management of diabetes patients?		
1. Always 2. Often 3. Sometimes		4. Rarely 5. Never
6. Regarding education: would you like further diabetes education?	1. Yes	2. No
If yes, what areas would you like further diabetes education in?		
1. Medication 2. Insulin management/initiation 3. Interpretation of lab test results 4. General research updates		5. Renal disease 6. Giving lifestyle advice 7. Cultural understanding 8. Other
7. Relating to your work and diabetes consultations		
a) What days have you worked over the past week (last 7 days including yesterday)?		
1. Monday 2. Tuesday 3. Wednesday 4. Thursday		5. Friday 6. Saturday 7. Sunday
Computer program—random day selected is: ____		
a) On__ how many hours did you work?	__hrs	
b) How many diabetes consultations did you carry out?	__(number)	
c) How many were "Get checked/ Annual Reviews"?	__(number) or Other special consults __(number)	
Please refer to the notes of the diabetes patient/s you consulted on __ (selected day)		
8.a. Have you consulted with this patient before?	1. Yes	2. No
b) Are they male or female?	1. Male	2. Female
c) How old are they?	__years	

Appendix 2 (continued): Telephone interview questionnaire.

d) What is their ethnicity?		
1. NZ European 2. Māori 3. Samoan 4. Cook Island Māori 5. Tongan		6. Niuean 7. Chinese 8. Indian 9. Other
e) What type of diabetes do they have?		
1. Type 1 2. Type 2 3. Other ____		
f) Where did you carry out this consultation?		
1. A private room 2. Cubicle 3. In patient's own home		4. Shared room 5. Other
g) What type of consultation was this? (*May need to say i.e., "normal follow-up" or special programme*)		
1. Follow-up 2. Annual Diabetes Review/Get Checked 3. At risk individual (ARI)		4. Long-term condition 5. CVD triple therapy 6. Other
h) How long did this consultation last: __minutes		
9. During this consultation, did you? ____ (read out each)		
a) Weigh the patient	1. Yes	2. No
What is their latest weight __kg, BMI__ (or height)		
b) Take their blood pressure	1. Yes	2. No
What is their latest BP _mmHg		
c) Check their feet	1. Yes	2. No
If yes, what did you check: (*not prompted*)		
1. Colour 2. Skin integrity 3. Nails 4. Pulses 5. Oedema/swelling		6. Sensation 7. Microfilament test 8. Ipswich 9. Other

Appendix 2 (continued): Telephone interview questionnaire.

If no, when was their last foot examination?	Date of last test: _,_,_ (day, month, year)	
1. ≤3 months 2. 4–6 months 3. 7–12 months	4. >12 months 5. Don't know	
d) Did you give advice about foot protection?	1. Yes	2. No
If yes, what advice did you give?		
1. Suitable footwear 2. Moisturise feet 3. Consult podiatrist	4. To check own feet 5. Other care	
e) Check their glucose (finger prick)	1. Yes	2. No
If yes, what was it __mmol/L		
f) Did you discuss their BGL's?	1. Yes	2. No
g) Give wound care (i.e., change a dressing)	1. Yes	2. No
h) Other care (please specify)		
i) Does this patient <u>self</u>-monitor their BGL's?		
1. Yes 2. No 3. Don't know		
10. Regarding test results		
a) How long ago did this patient have a blood test?	Date of last test: _,_,_ (day, month, year)	
1. ≤3 months 2. 4–6 months 3. 7–12 months	4. >12 months 5. Don't know	
b) *What is their latest:*		
1. HbA1c __mmol/mol 2. Lipid results: Total Cholesterol__, LDL__, HDL__, Triglycerides__	3. What is their Serum Creatinine __mmol/L 4. Other tests	
c) Did you discuss their blood results at this consultation?	1. Yes	2. No

Appendix 2 (continued): Telephone interview questionnaire.

If yes, which results did you discuss? (*Not prompted*)		
d) How long ago did this patient have a urine test for <u>microalbuminuria</u>? *What was this*: __mg/L		
1. ≤3 months 2. 4–6 months 3. 7–12 months		4. >12 months 5. Don't know
e) How long ago did this patient have a retinal screen?		
1. <2 years 2. >2 years 3. Don't know		
11. Regarding medications		
a) Do you know what medications this patient has been prescribed?	1. Yes	2. No
If yes, what medications have they been prescribed?		
1. Metformin	1. Yes	2. No
2. Sulphonylurea	1. Yes	2. No
3. Insulin	1. Yes	2. No
4. Aspirin	1. Yes	2. No
5. Beta blocker	1. Yes	2. No
6. ACE Inhibitor	1. Yes	2. No
7. Statin	1. Yes	2. No
8. Diuretic/Furosemide	1. Yes	2. No
9. Warfarin	1. Yes	2. No
10. Calcium channel blockers	1. Yes	2. No
11. Digoxin	1. Yes	2. No
12. Gout/allopurinol	1. Yes	2. No
13. Other	1. Yes	2. No
b) Did you <u>prescribe</u> or <u>adjust</u> (circle) any medications	*If yes, state*	
c) Does this patient routinely take their medications?		
1. Yes 2. No 3. Don't know		

Appendix 2 (continued): Telephone interview questionnaire.

d) Did you give advice about their medication?	1. Yes *If yes, please state*	2. No
12. Regarding education and health promotion		
a) Does this patient smoke?		
1. Yes 2. No 3. Don't know		
If yes, do they want to stop?		
1. Yes 2. No 3. Don't know		
If yes, did you suggest nicotine replacement therapy?		
1. Yes 2. No &/or Other medication		
If yes, did you advise of any community support services?	1. Yes *If yes, state*	2. No
b) Did you give advice about: <u>diet</u>, <u>physical activity</u> or <u>other health issue</u>? (Read out)		
1. Diet	1. Yes ***If yes***, what did you advise?	2. No
2. Physical activity	1. Yes ***If yes***, what did you advise?	2. No
3. Other (please specify)		
c) Did you give out a "Green Prescription"?	1. Yes ***If yes***, state main activity	2. No
If no, have you ever given a "Green Prescription" to this patient before?	1. Yes	2. No
13. Regarding follow-up		
a) Does this patient make regular appointments at your practice/service?		
1. Yes 2. No 3. N/A		

Appendix 2 (continued): Telephone interview questionnaire.

b) When was their last appointment? _,_,_ (day, month, year) (*other than this one*)		
1. ≤3 months 2. 4–6 months 3. 7–12 months		4. >12 months 5. Don't know
c) Was a follow-up appointment made?	1. Yes ***If yes***, what date _,_,_	2. No
1. ≤3 months 2. 4–6 months 3. 7–12 months		4. >12 months 5. Don't know
d) Did you organise or advise any other appointments?	1. Yes	2. No
If yes, please state the type of follow-up		
1. G/P 2. Practice Nurse 3. DNS/DNE 4. Diabetologist 5. Dietitian 6. Podiatrist		7. Ophthalmologist 8. Renal specialist 9. Cardiac specialist 10. Vascular specialist 11. Other
e) Is this patient able to telephone you directly?		
1. Yes 2. No 3. Yes—via receptionist or clerk		
f) Do you plan to follow-up this patient?	1. Yes	2. No
If yes		
1. Telephone 2. Email		3. Text 4. Don't know
If yes, what issues will you follow up?		
1. Referrals/screening 2. Test/blood results		3. Medications/scripts 4. Other
g) How long do you think <u>this</u> follow-up will take?	__minutes or __minutes/week	

Co-design of youth appropriate services for young people with rheumatic fever/rheumatic heart disease in Counties Manukau District

Lucy Wong, Agnes Wong, Lynne Maher, Bridget Farrant, Kate Palmer-Neels, Fofoa Pio, Phillipa Anderson, Belinda Paku

ABSTRACT

AIM: To co-design a rheumatic fever service model which enables young people with acute rheumatic fever/rheumatic heart disease (ARF/RHD) and their families to access the health and wellbeing services they need.

METHOD: Co-design, a collaborative and participatory approach, was used to gather experiences and ideas from 21 consumers and 30 health professionals. Thematic analysis was undertaken.

RESULTS: Māori and Pacific patients and their whānau/aiga identified the importance of whānau/aiga support and involvement throughout their ARF/RHD journey. They described that the way care was delivered was often frustrating, fragmented and lacked effective communication. Participants expressed the need for information to improve their understanding of ARF/RHD. Health professionals identified the need for better continuity of care and felt that they were currently working siloed from other professionals with little visibility of other roles or opportunity for collaboration. The ideas for improvement were grouped into themes and resulted in development and prototyping of peer support groups, patient and staff education resources, clinical dashboard and pathway development, and an enhanced model of care for delivery to patients receiving penicillin prophylaxis.

CONCLUSION: The co-design process enabled consumers and staff of ARF/RHD services to share experiences, identify ideas for improvement, co-design prototypes and test initiatives to better support the needs of those delivering and receiving ARF/RHD services.

The incidence of rheumatic fever in Aotearoa New Zealand is much higher than in comparable countries and regions such as North America[1] and the United Kingdom.[2] Within Aotearoa New Zealand, the incidence varies greatly by geographic region and ethnicity. Māori and Pacific peoples are disproportionately affected, for both acute rheumatic fever (ARF) and chronic rheumatic heart disease (RHD).[3–6]

Counties Manukau has the highest burden of ARF/RHD of any region in Aotearoa New Zealand.[7] In 2021, 26 out of 94 new cases of ARF nationally were from Counties Manukau District, and 14 of these were in young people aged 15–24 years at the time of diagnosis.[8] It should be noted that this relies on ICD coded discharge data, which has been shown to over-estimate cases of rheumatic fever.[9,10] People diagnosed with ARF require secondary prophylaxis (usually a monthly injection of benzathine penicillin G [Bicillin]), generally for 10 years or until they reach 21 or 30 years of age, depending on degree of cardiac involvement,[11] alongside dental, rheumatic fever specialist clinic and cardiology (including echocardiography) follow-up. This places considerable burden on young people and whānau. Concern has been raised that the health system may not be providing developmentally and culturally appropriate care that would benefit young people and whānau/aiga.[12,13]

In 2020, Manatū Hauora – Ministry of Health allocated funding to Counties Manukau Health (CMH) to prototype changes and improve services for young people aged 12–24 with ARF/RHD. The aim was to strengthen age appropriateness and cultural competency of the service and deliver a holistic service that meets the health needs of young people.

This study used a participatory co-design approach to gather patient, whānau/aiga and health professionals' experience and to enable them to design potential solutions to improve the rheumatic fever service.[14] It had two phases:

1. To understand the experiences of young people, their whānau/aiga and health

professionals using the ARF/RHD services in the South Auckland community and support them to identify any ideas for service improvement.
2. To co-design and test solutions based on the experiences and ideas shared.

Phase one

Phase one focused on understanding the life journey, experiences and ideas for improvement from young people, their whānau/aiga and health professionals using the ARF/RHD services in the South Auckland community. A Consumer Advisory Group (CAG) was established, who supported the project team, providing expertise in personal experiences of ARF/RHD, Te Ao Māori and Pasifika worldviews.

Phase one methods

Study design

Phase one consisted of engaging patients, whānau/aiga and health professionals, gathering experiences and ideas through interviews and hui and undertaking thematic analysis of these data.

Setting and location

The study was conducted in Counties Manukau between June and November 2021. A range of disruptions caused by the global COVID-19 pandemic particularly impacted on the recruitment and engagement of patient and whānau/aiga participants.

Ethics approval was obtained from Auckland Health Research Ethics Committee (reference: AH22496).

Data collection

Patients and whānau/aiga

To ensure recruitment of a representative sample, a purposively selected sample seeking diversity of both ethnicity and disease severity was considered. Based on patient registration information for young people receiving healthcare for ARF/RHD in Counties Manukau, approximately 40% identify as Samoan ethnicity, 25–30% are NZ Māori, 15% are Tongan and 15% are of Cook Island ethnicity. Patients with differing levels of severity are likely to have different experiences, so engagement was sought with young people from each of the following groups:

1. History of ARF with no or mild cardiac involvement prescribed Bicillin prophylaxis.
2. Moderate to severe RHD disease with no history of valve surgery prescribed Bicillin prophylaxis.
3. History of ARF with RHD and post-valve surgery (includes those with valve repair, replacement with homograft valve and replacement with mechanical valve requiring warfarin anticoagulation) and prescribed Bicillin prophylaxis.

In line with a pro-equity and pro-Te Tiriti approach, this study aimed to oversample Māori to ensure the Māori voice was adequately captured. The aim was to recruit 15 Pasifika young people and 15 Māori young people and their respective aiga/whānau.

Initial contact inviting participation was made by a familiar staff member between late July and early August 2021. Of those who expressed an interest to participate, most preferred an in-person interaction. Aotearoa New Zealand moved into COVID-19 Alert Level 4 on 17 August 2021 and engagement ceased at that time. When Auckland moved to COVID-19 Alert Level 3 on 21 September 2021, participants were contacted by Māori and Pacific (Samoan) researchers contracted to CMH to ascertain if they were still interested in sharing their experiences and offering this via Zoom. Zoom enabled some conversations to happen; however, there were barriers to participation, including anxiety relating to security and confidentiality, and technological challenges including no internet access and lack of familiarity with Zoom. Some whānau/aiga did not have computers but were able to join Zoom via their smart phones. While this did support the interview taking place, it was challenging to see and connect with multiple whānau/aiga due to the small screen.

Five Māori young people and their whānau and eight Samoan young people and their aiga were able to be interviewed via Zoom. One Samoan young person and their aiga were interviewed in a socially distanced arrangement outdoors, once restrictions allowed this.

Health professional participants

Health professionals (HPs) involved in rheumatic fever care were identified by lead clinicians. This included clinicians from primary and secondary care with a range of experience and work in the area of rheumatic fever—from those working solely providing care and leadership in rheumatic fever to clinicians who may deliver

Table 1: Interviewed patients and accompanying whānau/aiga.

Age of the young person	Ethnicity	Whānau/aiga who participated alongside the young person
12–15 years old	Samoan (1) NZ Māori (2)	Samoan (4) NZ Māori (4)
16+ years old	Samoan (7) NZ Māori (2)	Samoan (1) NZ Māori (2)

Table 2: Thirty interviewed health professional participants.

Years of work with RF service (grouped)	Ethnicity	Professional group
>20 years	NZ Māori (1) NZ European (3)	Doctor (3)
16–20 years	NZ Māori (2) NZ European (2)	Nurse (1) Play Specialist (1)
10–15 years	NZ Māori (3) NZ European (4) Samoan (1) Cook Island Māori (1) Other European (1)	Doctor (4) Nurse (2) Play specialist (1) Support worker (1)
6–9 years	NZ Māori (1) NZ European (1)	Dentist (1) Pharmacist (1)
2–5 years	NZ Māori (1) NZ European (6) Samoan (2) Indo-Fijian (1) Indian (1)	Nurse (8) Pharmacist (1) Play Specialist (1) Social Worker (1)
≤1 year	NZ Māori (1) Cook Island Māori (1) Samoan (1) Tongan (1) Indian (1)	Nurse (3) Social Worker (1)

intramuscular (IM) Bicillin as part of their broader work. Most clinicians had provision of rheumatic fever care as a small component of their employment.

Note: Some participants self-identified in more than one demographic category, which means the total numbers are more than 30 participants.

Data analysis

All patients and whānau/aiga interviews/hui were recorded, analysed and written up by the Māori and Samoan researchers who facilitated the interviews/hui. Health professionals' interviews were recorded, transcribed verbatim and entered on NVivo software. Transcripts were coded and HPs' experiences were analysed using the Braun and Clarke's six step method for thematic analysis.[15]

Phase one—findings

A) Patients and whānau/aiga

Three intersecting themes were identified from the Māori and Samoan interviews and focus

groups, and one subtheme was specific to aiga.

Whānau and aiga-centred care

Whānau is used here to reflect a Māori view of whānau, which includes relatives, friends and the community. Participants noted that aiga comprises of parents, siblings, partners, grandparents, aunties, uncles and church family.

Māori and Samoan participants stressed the importance of having their whānau and aiga involved in their healthcare at all stages. Whānau (Māori participants) and aiga (Samoan participants) acted as crucial supporters and advocates for the young people, particularly as most participants expressed that there was a lack of social support available for whānau/aiga. Māori and Pacific participants suggested opportunities to create a rheumatic fever support group as a space to connect with those who have similar lived experiences of rheumatic fever, either online or in-person. Most Samoan participants suggested that a dedicated support person for aiga was important; a support person would have a sound understanding of rheumatic fever and the care required, act as a conduit for information and provide moral support and an advocate for the young person and aiga. Peer support that involves whānau/aiga and is provided in culturally safe settings, e.g., churches or community centres, was suggested.

> *"She (my mum) even fought to stay the night with me, because I said to her 'like, Mum I know I'm 21 but like I'm just, can you stay? This is weird and this is new to me, we don't know what's going on.' At the time, especially waiting to have a heart scan, I was super anxious and scared" – Māori patient*

> *"There was the odd person who would come in to talk to [our parents], but other than that they were just left on their own. I think focusing on some support for them, just so that when one of us is in hospital, at least our families know that there is support there for them, and they can reach out for any kind of help, [to] people that can understand them. Rather than them being scared to ask for help, because they don't know if that person's going to necessarily understand the situation we're in." – Aiga member*

Clear, open communication that supports whānau/aiga involvement in decision-making

Whānau/aiga discussed the importance of open and clear communication so that they can be well-informed and involved in decision-making. The communication experienced by whānau/aiga was predominantly verbal, one-way (from health professional to patient) without input from whānau and aiga and they described the excessive use of medical jargon.

> *"I know he needs to talk to somebody because half of the time he doesn't even know what he's got." – Aiga member*

> *"I just like the plain simple language, I like them to dumb it down for me, because I'm not going to say 'yes, yes,' like I know when there's big as words that I can't understand. English is not my forte, and that's all they speak out there." – Whānau member*

> *"Communication is what we need … because we don't know, all we know is [the] injection every month. That's it, [we] don't see it till next month. There's no communication with what's going on with her and that communication is what we need." – Whānau member*

Whānau/aiga suggested user-friendly modes of information delivery, such as the use of simple language; whānau felt that written information might be helpful, and aiga encouraged the use of simple, coloured pictures and diagrams.

> *"When I was in hospital, they didn't give any information on paper or anything like that, it was all verbal … It would have been cool to have it on paper so I could read it, and basically have what it is, to explain what it actually is in a form of not those big words, just something simple." – Māori patient*

Māori participants varied in their desire for communications in te reo Māori. However, Samoan young people and aiga shared that it was important to have the option to translate communications into the Samoan language, particularly for their parents, grandparents and elders of the aiga for whom English may not be their first language.

"Translate it into our languages, like Samoans talking to Samoans, we understand each other. [By doing that] people can relate to each other." – Samoan patient

Additionally, Samoan participants suggested the need for increased awareness of rheumatic fever prevention within the Pacific community. These included reaching Pacific communities (i.e., via churches, community groups and Pacific radio stations) through engagements that are Pacific-led, delivered in Pacific-specific languages, and tailored to the multi-generational make-up of Pacific communities and aiga.

"We [had] a high school programme about rheumatic fever. All these kids were there, and they were showing us what the heart looks like, and what valves are repaired when you have rheumatic fever. It was cool, so using the pictures is a good idea … A visual way of showing [little kids] would be a whole lot easier, rather than trying to explain something and not knowing how to get it across." – Aiga member

Healthcare practices centred on patient needs rather than system needs

Issues raised included a lack of transport, the clinic location and opening hours of clinics, and that home visits were preferable as this reduced the burden on whānau/aiga to organise childcare and transport. Whānau/aiga felt regular check-ups would improve the service as they often felt anxious about their child's health. The lack of continuity of care resulted in frustration and confusion for some whānau/aiga about which person or department they should contact when they needed help. Whānau valued quality of care more than continuity of care. For most aiga, the continuity of care was critical, as it enabled rapport and trust building with health professionals, reduced the likelihood of missing information and lessened the pressure placed on young people and aiga to recall details from previous appointments and medical histories.

"I have to remember how long I've done my injection for … My nurses are always like, 'are you due to finish this soon?' and I'm looking at her like 'I don't know. I don't know when I'm going to finish, no one tells us, you haven't given me any information on that.' I have to go back and count [all the years] when I got my surgery." – Samoan patient

"If you had that person that you feel empathised with you, and gave a damn about your son's health, then you would feel more vulnerable to release whatever they're wanting. There's just a big gap between doctor and their families" – Aiga member

B) Health professional participants

Five themes emerged from the HPs' interviews.

RF nurse specialists are invaluable supports to the wider team

Overall, RF nurse specialists were described as invaluable supports to the wider team, particularly as liaisons between primary and secondary levels of care.

Workforces should be more reflective of the community

Professionals felt that to help deliver more culturally appropriate care, the RF workforce should be more reflective of the community and culturally competent to support care and engagement of patients and their whānau/aiga.

Healthcare practices are often centred on system needs not patients' needs

Barriers to the patient receiving equitable care included fixed clinic and lab operation hours, transportation, clinic locations and high treatment costs. Inconsistencies were found in HPs' knowledge of care pathways, which impacted on delivery of consistent care and care planning. The broader health needs of young people, rather than their health condition alone, were often overlooked due to time constraints. Staff were keen for improved staff education and clearer treatment pathways to support staff practice focused on patient needs.

"We've got a multidisciplinary meeting happening, but we don't have a multidisciplinary approach. What I mean is, we're still working in silos." – Pacific Nurse

"The thing that frustrates me most of all is that the RF Clinic is supposed to be a multidisciplinary clinic, it's supposed to be

a one-stop-shop for children, adolescents and young people. That's the model for adolescent medicine. If you want to engage young people in their healthcare, then you need to make it easy to do that. They don't need to get six different appointments to go to six different places at six different times to keep themselves well." – Doctor

Lack of appropriately resourced ARF/RHD clinical services

High outpatient waitlist volumes, competing clinical priorities and demands from multiple clinical tasks, alongside caring for people with ARF/RHD, placed additional stress on HPs to meet the care needs of their patients.

"…The time doesn't allow us when would like to do more for our patients." – RF Clinical Nurse Specialist (CNS)

"Over the years that I've been working in the clinic, it has become overwhelmed by the number of patients that we see, and it is nowhere as good a clinic as it used to be." – Doctor

Collaborative and coordinated multidisciplinary ARF/RHD services are needed

Health professionals are mostly working in silos and have little visibility of other roles working within the ARF/RHD service. Staff recognised a lack of well-established pathways for working together. When collaboration does occur, it is often late in the patient's care journey, which limits the ability for patients and whānau/aiga to access a range of support services that they may need. However, when multidisciplinary collaboration happens, it is considered a useful forum to get to know other ARF/RHD colleagues.

"We should come in somewhere at the beginning, but we're asked to come in at the end part, where they're (the patient) at high risk … it's like being a GI Jane to connect and re-engage them." – RF CNS

"We act only when patients are not adhering to their medication, instead of proactively working towards preventing that from happening … The ability for us to be able to think ahead and provide ahead of time can mean unnecessary hospital admission." – RF CNS

Phase two—ideation and service design

This second phase of the project was to provide an opportunity for health professionals, patients and their whānau/aiga to review the improvement ideas and select some to prototype and test. A summary of experiences and ideas captured in phase one was synthesised and shared with the participants to generate conversations about ideas for service improvement.

A) Young people and whānau/aiga

The intention was for all young people and their whānau/aiga from the first phase to be invited to participate in a second workshop-style hui to review the experiences and identify ideas for service improvement. However, COVID-19 restrictions impacted on this. Two Māori young people with one whānau member each and one aiga member participated in a separate hui. Feedback included the need for age-appropriate, multi-lingual, understandable written resources that provided specific information relating to the patient's life journey of ARF/RHD. Improvements identified by whānau/aiga related to access to clinics, which can be challenging. Ideas included the provision of plenty of notice for appointments, the provision of transportation if needed and the opportunity for home visits when that was more appropriate for whānau/aiga. It was also felt that more regular check-ups, not just when clinicians feel it is indicated, would provide helpful reassurance to whānau/aiga that their child was well. Having regular visits from the nursing team was identified as an opportunity where care beyond simply providing the Bicillin injections could be provided. Importantly, this would also build whanaungatanga and trust so that patients and whānau/aiga feel they could ask for more support if needed.

In order to facilitate whānau/aiga-centred care, improve kōrero/talanoa and reduce barriers to good healthcare, ideas included the need for a specific role or key contact person for whānau/aiga to connect with to support them to access the right care at the time they need it.

B) Health professionals

All health professionals that had been interviewed were invited to join one of three online workshops/hui to select ideas for initial testing.

From the health professional workshops/hui, a range of improvement ideas, many of which were

common with patients and whānau/aiga emerged. These formed into three key areas:

- Education—that better met the needs of patients, whānau/aiga and health professionals.
- Systems and technology—to allow for better streamlined information between and within services.
- Comprehensive and coordinated care—a broad overarching area of focus which included access to services available.

A prioritisation tool was developed to enable staff participants to identify from their perspective which ideas should be tested first. The tool (Appendix 1) enabled consideration of equity, impact to patients and whānau/aiga, impact for Māori and alignment with Te Tiriti and impact for the way clinicians care for their patients.

In addition, after these workshops, a workshop was held with CAG members to review and discuss the ideas that the health professionals had prioritised. The CAG confirmed that ideas that were important from a patient perspective had been prioritised.

Improvement actions

The following improvement ideas have been prototyped and tested as a result of the co-design approach to improving ARF/RHD services for young people at CMH.

1. **Better meeting the needs of patients, whānau/aiga and health professionals through connections and education.** Addressing concerns around whānau/aiga centred care, communication gaps and health professionals' skill development.

Peer support

Patients, whānau/aiga and CAG had shared that ARF/RHD was often a lonely journey and they wanted to meet others with the same condition. HPs supported the idea of peer support as a way of providing support for others and empowering young people to manage their condition. Partnership with a not-for-profit organisation, Heart Kids New Zealand, was established to co-deliver a peer support evening with ARF/RHD patients from CMH. Although only a small number of young people attended, they valued the opportunity to connect, and there are plans to deliver additional events in the future.

Patient resources

Patients and whānau/aiga expressed the need for resources that focused on the RF journey and what their condition meant for their life, including the need for ongoing secondary prophylaxis and the ability to return to normal daily activities. This needed to be age-appropriate, informative and presented in an easy-to-understand way. Five existing resources from Aotearoa New Zealand and Australia were reviewed by young people and CAG members, who identified information that did or did not work for them. This contributed to the co-design of new resource, "My RF Journey" by clinicians, communication specialists, CAG members and young people (including those with and without ARF/RHD) to ensure that information about RF is youth appropriate and suitable for different stages of the ARF/RHD journey.

Education videos for health professionals

Health professionals identified differing levels of knowledge about the management of ARF/RHD patients and felt they would be better supported through access to further information resources. There is a shared recognition that adolescence is complex, cultural needs were not always met, and that the system is currently designed in a way that does not always support young people to receive the care they need.

Four short e-learning modules for health professionals to support the management of ARF/RHD patients and the provision of youth-friendly care have been co-developed—Working with young people with ARF/ RHD, Youth Development, Consent and Confidentiality, and Engaging and assessing health and developmental needs of young people. These will be readily accessible by all health professionals working with young people who have ARF/RHD and are designed to be packaged with other modules already used, for example, to support HP developing skills in culturally safe practice.

2. **Systems and technology to facilitate sharing of information and better centre care on patients.** Addressing need for patient centred care, communication gaps and collaboration.

Patient clinical pathways

Health professionals' experiences highlighted the need for better consistency of care. Patient pathways specific to the degree of RHD were developed to ensure consistency of care and to

provide clarity regarding the standard of care for patients with ARF/RHD. These were developed together with health professionals based on NZHF Guidelines on what should be the ideal standard of care at Counties Manukau for both Paediatric and Adult General Medicine wards, from admission through to completion of Bicillin. These pathways supplement national ARF clinical guidelines and provided an opportunity for health professionals to identify any gaps and opportunities for improvement to the care pathways. They are now available for health professionals to use and share with patients and whānau.

Patient dashboard

A range of health professionals contribute to ARF/RHD care, including Cardiologists, District nurses, Physicians, GPs, Pharmacists and Dentists. Having this range of professionals working in different systems leads to a lack of visibility for professionals and whānau/aiga as to what care has been provided. Health professionals shared that there was a need to improve coordination of care between services, districts and primary care services. A live electronic platform, which is currently only available to clinicians, has been developed to provide visibility of ARF/RHD patient cohort information in one place. This includes the dates they started Bicillin, their Bicillin adherence rate and clinic attendance. This platform will enable better clinical collaboration and awareness of progress with care.

3. **Comprehensive and coordinated care.** Addressing concerns around lack of comprehensive and coordinated care that is developmentally and culturally appropriate.

Enhanced model of care for young people receiving Bicillin prophylaxis

Health professionals, patients, whānau/aiga and CAG experiences all highlighted the need for better continuity and connection of care to promote whānau/aiga trust and engagement with ARF/RHD services. A new nursing and case-management model of care has been piloted whereby patients are supported by a smaller team of nurses with expertise in district nursing and youth health, who provide their monthly Bicillin injections and have protected time to offer proactive, holistic wrap-around youth-centred care as needed. This model of care enables patients to build a relationship with a smaller team of nurses during their ARF/RHD journey and increases flexibility for them to receive more holistic comprehensive care alongside their monthly Bicillin.

The first six months of this pilot are being evaluated, with a view to ongoing refinement and exploration of models of care.

Strengths and limitations

The strength of this study was the inclusion of consumers, from the initial gathering of experiences to co-design of improvement ideas representative of the needs of the service users. Evaluation and modelling of the benefits is underway to understand the impact of these ideas on ARF/RHD patients and their whānau/aiga.

The COVID-19 pandemic restricted our ability to engage with patients and whānau/aiga in-person. It also limited the number of patients and whānau/aiga we were able to recruit and interview via hui or talanoa.

While our researchers attempted to contact Cook Island Māori and Tongan patients, we were unsuccessful in our engagement with these ethnic groups. Therefore, the experiences shared are not reflective of all Pacific ethnicities affected by ARF/RHD in the Counties Manukau region.

Conclusion

The experiences of ARF/RHD patients and their whānau/aiga members have highlighted the need to include the voices of our young people for effective service design. The improvements made to ARF/RHD services for young people in Counties Manukau need to be developmentally and culturally appropriate to empower patients and whānau/aiga to understand and be involved in their journey.

There is also a need for a coordinated approach to care, with health professionals working together to allow for good continuity of care, streamlining of services and timely delivery that meets the need of the patients.

Service design needs to be more inclusive of the voices of our young people, who are known to have different needs and expectations for services than their older counterparts with similar healthcare needs.

COMPETING INTERESTS
Nil.

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AUTHOR INFORMATION
Lucy Wong: Improvement Advisor, Ko Awatea, Te Whatu Ora Counties Manukau, Auckland.
Agnes Wong: Project Manager, Kidz First Centre for Youth Health, Te Whatu Ora Counties Manukau, Auckland.
Lynne Maher: Principle of Co-design, Ko Awatea, Te Whatu Ora Counties Manukau, Auckland.
Bridget Farrant: Adolescent Physician, Kidz First Centre for Youth Health, Te Whatu Ora Counties Manukau, Auckland.
Kate Palmer-Neels: Contractor whānau, Ko Awatea, Te Whatu Ora Counties Manukau, Auckland.
Fofoa Pio: Contractor whānau, Ko Awatea, Te Whatu Ora Counties Manukau, Auckland.
Philippa Anderson: Public Health Physician, Population Health Team, Te Whatu Ora Counties Manukau, Auckland.
Belinda Paku: Rheumatic fever Clinical Nurse Specialist, District Nursing Service, Te Whatu Ora Counties Manukau, Auckland.

CORRESPONDING AUTHOR
Bridget Farrant: Kidz First Centre for Youth Health, Te Whatu Ora Counties Manukau, Private Bag 93311, Auckland, New Zealand.
E: bridget.farrant@middlemore.co.nz

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Appendix 1: Idea prioritisation tool

Achieving equity—does this have the potential to highlight and address equity issues currently experienced by patients?		
1= no change, equity remains an issue	3= has potential to highlight equity issues	5= highlights inequities and addresses them
Impact—is there a positive impact on patients and whānau?		
1= impact not noticeable by patients	3= some impact on patients	5= positive impact on patients and whānau
Te Tiriti/Māori responsiveness—what is the impact for Māori? Does this align with Te Tiriti?		
1= little/negative impact or insignificant	3= some impact, makes attempt to align with Te Tiriti	5= positive impact, aligns with Te Tiriti
Clinical efficacy—how does this affect the way you care for patients?		
1= no change to care	3= some change/ effect on care	5= large changes to the way care is delivered

Increasing rates of referrals for investigation of primary aldosteronism at a tertiary centre

William Park, Patricia Whitfield, Brian Corley, Simon Harper, Joe Feltham, Richard Carroll

ABSTRACT

AIM: To describe the frequency and characteristics of patients referred for specialist investigation of primary aldosteronism (PA) in the lower North Island over a 5-year period, and the outcomes of those who received treatment.

METHODS: Patients who underwent confirmatory testing or treatment for PA at Wellington Regional Hospital were retrospectively identified and data were collected from electronic clinical records.

RESULTS: There has been a five-fold increase in both referrals and confirmatory testing for PA in 2021 compared to 2015. Compared to patients without PA, those eventually diagnosed with PA had a higher ARR, serum sodium, antihypertensive requirement and cardiovascular disease prevalence, as well as lower serum renin, potassium and GFR (all $p < 0.05$), but similar blood pressure. Complete or partial clinical success was achieved in 96% of surgically treated patients compared with 70% of medically treated patients. Thirty-nine percent of patients experienced minor adverse effects with spironolactone and only one significant adverse event was experienced perioperatively.

CONCLUSIONS: The rate of referrals and confirmatory testing for PA are increasing in our region. Adrenalectomy and mineralocorticoid antagonist therapy are both safe and effective treatments, although minor adverse effects were common with spironolactone.

Primary aldosteronism (PA) is a pathology of autonomous secretion of aldosterone from one or both adrenal glands, classically associated with hypertension and hypokalemia. PA appears to carry a greater burden of cardiovascular disease than essential hypertension and is independently associated with end organ damage, including cardiovascular disease, stroke, left ventricular hypertrophy, microalbuminuria and atrial fibrillation.[1,2] The prevalence of PA in hypertensive adults is at least 6%, with some estimates exceeding 20% in those with refractory hypertension.[1,3–4]

In Aotearoa New Zealand, screening is generally performed with a plasma aldosterone to renin ratio (ARR). PA is suggested by a high aldosterone and appropriately suppressed renin level, with thresholds differing depending on local guidelines, although the sensitivity and specificity of the ARR is variable depending on the assay and threshold used. The diagnosis is confirmed by dynamic testing. A saline infusion test (SIT) is most commonly performed in Aotearoa New Zealand, whereby two litres of normal saline is infused intravenously over 4 hours, and aldosterone levels are measured both before and after the infusion. The expansion in intravascular volume should suppress renin, and thus aldosterone production, in healthy individuals. In patients with PA, the aldosterone concentration remains inappropriately high at the 4-hour mark. Cortisol may also be measured, as a non-suppressed cortisol at 4 hours may indicate a confounding ACTH effect and produce false positive results. For patients in whom the SIT suggests inappropriate aldosterone secretion, adrenal vein sampling (AVS) may then be performed by an interventional radiologist. AVS may be used to identify unilateral disease in patients who are surgical candidates, as unilateral PA can be cured by surgically removing the pathologic adrenal gland. Unilateral disease is typically due to a functioning adenoma, while bilateral disease may be due to adrenal hyperplasia. Contemporary studies show a higher frequency of unilateral adenomas than reported historically with the availability of improved imaging and biochemical assessments, suggesting a higher proportion of unilateral disease in patients with confirmed PA.[5] Computed tomography (CT) can be used to identify an adenoma, but caution needs to be applied to interpreting the significance of an adenoma, particularly in older patients where incidental adrenal adenomas are common.[6] The exact role of AVS compared with CT to inform the

decision to undertake adrenalectomy remains to be clarified.[7] Patients with bilateral disease or those who choose not to undertake surgery may be treated with mineralocorticoid antagonists (MRAs) such as spironolactone or eplerenone; however, eplerenone is not funded for this indication in Aotearoa New Zealand. Both surgical and medical therapies have been shown to be effective at reducing blood pressure, and there are likely additional benefits to cardiovascular health independent of blood pressure improvements.[8–10]

Despite a readily available screening test, PA has historically been underdiagnosed in Aotearoa New Zealand and internationally.[11,12] Lower frequency of screening may be due to the misconception that hypokalemia is a prerequisite for PA or that it would be managed similarly to essential hypertension once diagnosed.[11,13] The requirement for medication changes before dynamic testing also discourages clinicians from screening, especially since the ARR may produce frequent false results even when interfering medications have been removed.[14,15]

It is well documented in overseas cohorts that certain characteristics increase the likelihood of PA, including hypokalemia, a higher ARR and a greater antihypertensive requirement.[8,10] Other characteristics such as a shorter duration of hypertension, lower BMI and absence of end organ damage can predict the likelihood of success from adrenalectomy.[16] However, the predictive value of clinical characteristics in predicting diagnosis or response to treatment has not been studied in Aotearoa New Zealand.

In this audit, we described the characteristics of patients referred to our centre for confirmatory testing for PA. We analysed whether any of these characteristics predicted a diagnosis of PA after a positive screening test. For those with an eventual positive diagnosis, we described their surgical and medical outcomes and whether the Primary Aldosteronism Surgical Outcome (PASO) score was able to predict clinical success of surgery.[16] These relationships may aid clinicians in diagnosing PA, and among patients who have confirmed disease, may inform the decision of whether to offer surgical intervention.

Methods

Study population

This audit was reviewed and approved by Capital and Coast District Health Board (CCDHB) Clinical Audit and Research Committee. All patients who attended our unit for an SIT, AVS, adrenalectomy or initial post-intervention follow-up for PA between 1 January 2016 and 31 November 2021 were included. At the time of data collection, our unit covered the regions previously known as Capital and Coast, Hutt Valley and Wairarapa District Health Boards (DHBs), collectively referred to as 3DHB. We additionally performed AVS and adrenalectomies for patients in the mid to lower North Island (previously Hawke's Bay, Whanganui and MidCentral DHBs). Investigations performed up to 19 April 2022 were included. Patients were identified with a searchable template for SIT and AVS results on the electronic medical record (EMR), and a clinician-recorded list of adrenalectomies was used. Email referrals were manually checked to ensure no eligible patients were missed. Patients referred locally for investigation of PA usually have an SIT performed after an ARR result above the local threshold of 30.5 pmol/mIU or high clinical suspicion, such as resistant hypertension and hypokalemia despite a normal ARR. Patients from other regions were typically referred for AVS after case confirmation, though occasionally referred for SIT or directly for adrenalectomy.

Data collection

Demographic information, clinical and biochemical characteristics and antihypertensive medications were preferentially collected from the referral letter and supplemented by the EMR. Ethnicity was analysed as total response ethnicity under Level 1 ethnic codes and compared to the ethnicity distribution of our catchment based on 2018 Census data.[17] AVS and SIT results were extracted from templates filled out in the EMR. Data was stored securely in REDCap on hospital servers.

Diagnosis, subtyping and treatment

Plasma aldosterone concentration for ARR, SIT and AVS was measured in EDTA plasma using the IDS-iSYS® Immunochemiluminometric assay with a reference range of 103 to 1,197 pmol/L when upright. Plasma renin concentration was measured in EDTA plasma using the IDS-iSYS® chemiluminescence immunoassay with a reference range of 5.3 to 99.1 mIU/L when upright. A screening ARR cutoff of 30.5 pmol/mIU is recommended by the manufacturer, with a quoted sensitivity of 98.9% and specificity of 78.9% when units are converted from the validation study.[18] Screening ARRs were taken by local laboratories

and recommended to be tested while sitting and before 10 am. There was no rapid cortisol assay available during AVS procedures to assess successful cannulation.

Local SIT protocols aligned with Endocrine Society recommendations. MRAs were stopped 6 weeks prior to testing, and all other antihypertensive medications except alpha-blockers and calcium channel blockers were stopped 2 weeks prior, unless continuation was clinically necessary. The protocol for AVS procedures was the same but specified a 4-week washout for MRAs. The test was performed supine with potassium, creatinine and aldosterone measured at 0 minutes and 4 hours. Renin was additionally measured at 0 minutes for a baseline ARR. Protocols did not change over the study period. All SIT and AVS results were interpreted through discussion at a departmental meeting that included at least one consultant endocrinologist. Cortisol was not routinely measured as part of an SIT during the study period. Local SIT protocols use the following 4-hour aldosterone levels as thresholds for the diagnosis of PA:

- <140 pmol/L—aldosterone suppressed; PA excluded.
- 140–280 pmol/L—indeterminate; diagnosis based on renin, aldosterone and potassium levels over duration of the test. May be repeated after optimising interfering factors.
- >280 pmol/L—aldosterone not suppressed; PA confirmed.

Due to the increasing frequency of adrenal incidentalomas with increasing patient age, AVS was required in patients aged over 40 years. AVS were Synacthen-stimulated and performed by a single operator, except in three unsuccessful cases where it was documented that an alternative operator had attempted the procedure. A selectivity index >5:1 confirmed cannulation success and a lateralisation index of >4:1 confirmed unilateral secretion. In patients under 40 years old, radiological lateralisation was accepted without AVS. Based on lateralisation data and patient preference, either surgical or medical therapy was offered as clinically indicated. Patients outside of our catchment were included in surgical outcome analyses if they received adrenalectomy at our centre, and follow-up was available. Patients who were diagnosed and/or followed up at our centre were included in the medical treatment outcome analyses if follow-up was available. Follow-up data was preferentially collected from the EMR through clinic appointment letters 6–12 months after intervention, but interactions outside the window were used when this was unavailable. The primary care and electronic prescription records were used to supplement hospital records or as the main data source when clinic letters were unavailable.

Clinical and biochemical success criteria[19,20]

Defined daily dose (DDD) was used to quantify total antihypertensive medication requirement and determine clinical success. DDD was calculated using the World Health Organization ATC/DDD Index 2021.[21] Changes in DDD were significant if they were more than 0.5 times the pre-intervention DDD. Changes in blood pressure were significant if systolic blood pressure reduced by >20mmHg or diastolic by >10mmHg. Normotension was defined as office readings of <140/90mmHg or home readings of <135/85mmHg. Antihypertensive medications used for other indications such as alpha-blockers for prostatic hypertrophy or beta-blockers for atrial fibrillation were included in the DDD. Pre-treatment blood pressure readings and DDD were taken from the closest time to initiating an MRA or surgery as possible, typically the clinic appointment prior to intervention, but the referral blood pressure and DDD was used if unavailable.

For surgically treated patients, complete clinical success required normotension and no antihypertensive medication at follow-up, and partial clinical success required a reduction in blood pressure and/or DDD compared to pre-operative status. Patients treated with an MRA were deemed to have had complete clinical success if they remained normotensive on MRA therapy without other antihypertensive medication. Partial clinical success required a reduction in blood pressure and/or DDD after starting an MRA. Complete biochemical success required a normal ARR at follow-up without hypokalemia, while partial biochemical success required reduction in plasma aldosterone of >50% from pre-surgery with no hypokalemia.

PASO surgical outcome score

The PASO surgical outcome score can be used to predict likelihood of complete clinical success for surgically treated patients with unilateral disease, where a favorable outcome is more likely with a shorter duration of hypertension, female

sex, lower BMI, lower antihypertensive medication requirement, absence of target organ damage (TOD) and larger adrenal lesion. A score greater than 16 predicts probable clinical success.

Onset of hypertension was determined by the earliest date of the patient taking antihypertensive medications or a recorded diagnosis of hypertension. Sex and BMI were typically provided in the referral letter. TOD was present if the patient had documented microalbuminuria or met criteria for left ventricular hypertrophy on ECG or echocardiogram, as documented in the EMR. When unavailable or when neither of these criteria were met, TOD was entered as absent while BMI, duration of hypertension and adrenal lesion diameter were entered as the median value.[22]

Analyses

When patient information was unavailable for a particular analysis, the patient was excluded from that analysis only. Except when discussing treatment outcomes and numbers of procedures performed, patients outside of our region were excluded from analyses as they typically had been diagnosed prior to referral and were heterogeneous to those identified locally.

Independent *t*-Tests were used to describe differences in means between groups unless results were non-parametric, in which case a Mann–Whitney U test was used. Paired *t*-Tests were used to describe mean changes before and after intervention unless results were non-parametric, in which case a Wilcoxon Rank-Sum Test was used. Differences in proportions were calculated using an n-1 Chi-squared test. Statistical significance was set at a p-value of 0.05.

Results

180 patients met the criteria for inclusion, 24 being out of our catchment. Among all eligible patients, from 14 October 2014 to 24 March 2022, we performed 173 SIT and 80 AVS procedures, as well as 27 adrenalectomies (Figure 2). This includes 4 SIT, 19 AVS and one adrenalectomy performed for patients out of catchment. Twenty patients had more than one SIT and 16 patients had more than one AVS performed at our centre.

156 eligible patients were identified within our catchment. Baseline characteristics are shown in Table 1. Most of these referrals came from general practitioners (57%), followed by cardiologists (9.6%), renal physicians (5.8%), general medicine physicians (5.8%), general surgeons (1.9%) and other specialists (1.3%). Eleven percent were identified by an endocrinologist. The remainder (7.7%) had unknown referrers. The reported ethnicity of referred patients in comparison to ethnicity rates in our region is shown in Figure 3.

Indications for referral

Forty patients out of 140 identified in our catchment with adequate referral information did not meet any Endocrine Society guidelines for PA screening (29%), as outlined in Table 2. This included two normotensive patients, both of whom were eventually diagnosed with normotensive PA. Three patients had an ARR below the referral threshold of 30.5 pmol/mIU, but there was high clinical suspicion of PA. Two of these patients went on to be diagnosed with PA.

One patient with a suppressed SIT was categorised as having PA due to a convincingly high baseline ARR and aldosterone. One patient with a non-suppressed SIT was determined not to have PA due to an inappropriately high 4-hour renin.

Subtypes of PA

Sixty-three eligible patients within our catchment (40%) eventually received a diagnosis of PA, 76 patients (49%) had the diagnosis excluded, and the remaining 17 patients were still under investigation at completion of data collection or had indeterminate investigations, so were excluded from Table 1. We performed 169 SIT for 150 unique patients within our catchment, contributing to 58 confirmed PA diagnoses, not including five patients diagnosed with PA without SIT, in keeping with Endocrine Society guidelines. This resulted in a positive SIT rate of 34%.

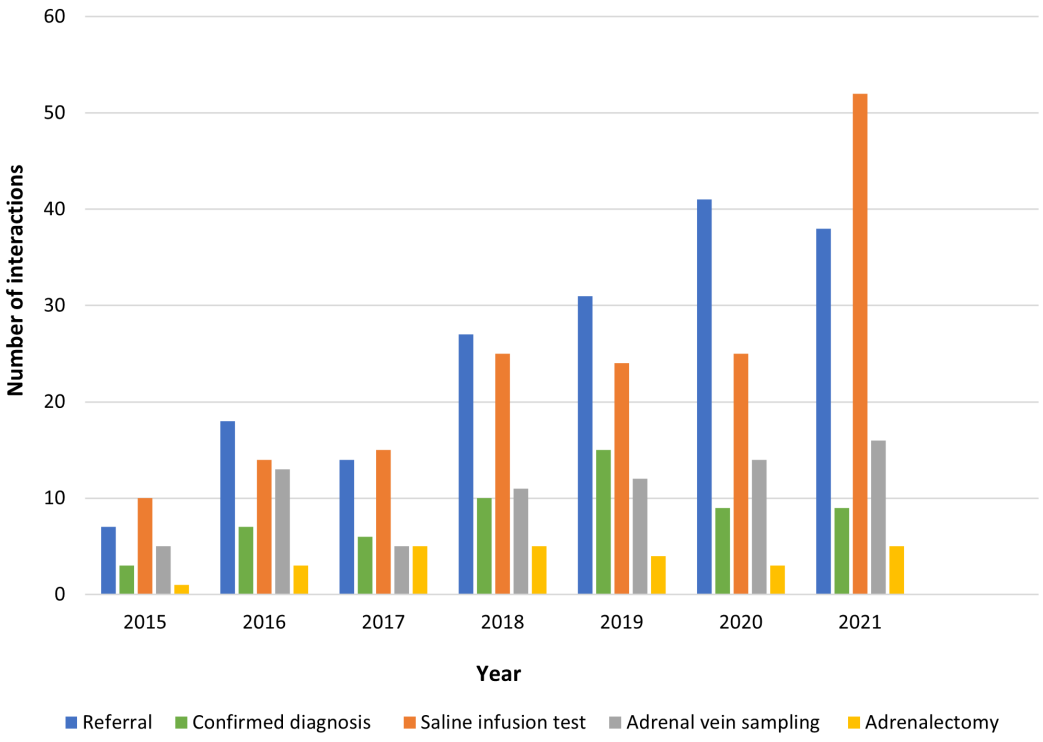
Of those who received a positive diagnosis, 22 had unilateral disease (35%), 20 had bilateral disease (32%) and 21 were unconfirmed (33%), where AVS was still being awaited (9.5%), not attempted (9.5%) or unsuccessful (14%). Six patients under 40 years old with unilateral findings on imaging were subtyped as unilateral PA and referred for surgery without AVS in keeping with local protocols.

Eighty AVS procedures were performed to subtype eligible patients who had confirmed or probable PA, including 14 second-attempt AVS and two third-attempt AVS. The success rate was 64% among patients' first AVS procedures and 58% when including second and third procedures. Twenty-five of these procedures were performed for patients outside of our catchment, and three unsuccessful AVS attempts were documented as

Figure 1: PASO surgical outcome scoring criteria.[16]

Variable	Category	Points
Duration of Hypertension (months)	<120	7.5
	120-239	3.5
	>/= 239	0
Sex	F	3
	M	0
BMI (Kg/m^2)	< 24	1.5
	24-29.9	0.5
	>/= 30	0
Antihypertensive medication (DDD – Defined Daily Dose)	< 3	6
	3-8.99	3
	>/=9	0
Target Organ Damage (LVH and/or MA)	Yes	0
	No	3
Nodule Size at Imaging (diameter, mm)	< 13	0
	13-19	2
	>/= 20	4

Figure 2: Total number of referrals, diagnoses and procedures performed for suspected or confirmed PA for any patient at Wellington Regional Hospital from 2015 to 2021.[a,b]



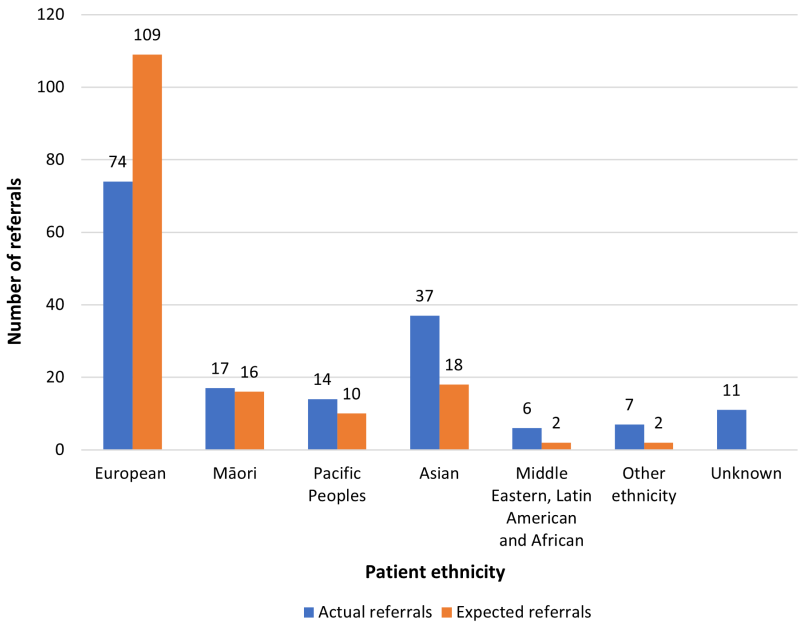
[a]For patients identified by an endocrinologist or with unknown date of referral, the first known date of interaction with our centre's endocrinology department for investigation of PA was used.
[b]2014 and 2022 were incompletely recorded, so excluded from this graph. Four saline infusion tests and one adrenal vein sampling of unknown dates were excluded.

Table 1: Baseline characteristics of patients within catchment at referral.

Characteristics at referral (reference range, units)	PA confirmed (n=63)[a,b]	PA excluded (n=76)[a,b]	P-value for difference between groups
Age (years)	49.8+12.8	49.9+13.2	0.97
Female gender	44%	76%	**<0.001**
Endocrine Society screening criteria met[5]	82%	66% (n=68)	**0.038**
Systolic BP (mmHg)	153+23.5	156+20.1	0.49
Diastolic BP (mmHg)	93.5+14.8	93.0+12.2	0.82
Number of different antihypertensive drugs	2.08+1.66	1.15+1.20	**<0.001**
Antihypertensive DDD equivalent	3.01+3.03	1.37+2.02	**<0.001**
Time from diagnosis of hypertension to referral (years)	8.61+9.18 (n=54)	5.55+7.28 (n=60)	**0.041**
Any cardiovascular comorbidity[c]	24%	9.6%	**0.025**
Serum potassium (3.5–5.2 mmol/L)	3.87+0.59	4.40+0.39	**<0.001**
Serum sodium (135–145 mmol/L)	142.2+2.37	140.5+3.25	**0.001**
Potassium supplementation	24%	1.3%	**<0.001**
Documented hypokalemia prior to referral	44%	3.9%	**<0.001**
eGFR <60ml/min/1.73m^2	13%	1.3%	**0.006**
Plasma renin (5.3–99.1 mIU/L)	7.29+5.70	10.0+8.75	**0.047**
Plasma aldosterone (103–1,197 pmol/L)	731+555	523+280	**0.006**
ARR (<30.5 pmol/mIU)	159+160	71.6+41.1	**<0.001**

[a]n=sample size for specific analysis; not commented on if <10% of data points were missing.
[b]Data is presented as mean + standard deviation.
[c]Cardiovascular comorbidities include ischaemic heart disease, cerebrovascular disease (stroke and transient ischaemic attack), chronic kidney disease, peripheral vascular disease and congestive heart failure.

Figure 3: Total response ethnicity of eligible patients within catchment compared with ethnicity distribution of adults aged 20 and over.[a]



[a]Total response ethnic groups have been used where patients may have >1 ethnicity recorded. Total responses therefore add to greater than the number of patients.

Table 2: Percentage of Endocrine Society screening criteria met in all eligible patients within catchment.

Endocrine Society screening criteria[8]	Percentage of patients meeting criteria[a]
BP >150/100 on each of three measurements obtained on different days	51%
BP >140/90 resistant to three conventional antihypertensive drugs (including a diuretic)	14%
Four or more antihypertensive drugs prescribed	14%
Hypertension and spontaneous or diuretic-induced hypokalemia	21%
Hypertension and adrenal incidentaloma	12%
Hypertension and sleep apnea	10%
Hypertension and a family history of early onset hypertension or cerebrovascular accident at a young age (<40 years)	6.4%
First degree relative of a patient with PA	0%
No criteria met	29%

[a]Some patients met >1 criteria, so the sum of percentages adds to greater than 100%.

Table 3: Characteristics of PA patients based on lateralisation.

Characteristics at referral (reference range, units)	Bilateral PA[a] (n=20)	Unilateral PA[a] (n=22)
Age (years)	45.3+10.9	50.7+14.2
Female gender	55%	36%
Systolic BP (mmHg)	157+23.2	149+24.1
Diastolic BP (mmHg)	96.3+12.2	90.9+15.1
Number of different antihypertensive drugs	1.40+1.47	2.68+1.52
Antihypertensive DDD equivalent	1.53+1.81	4.09+2.70
Serum potassium (3.5–5.2 mmol/L)	4.22+0.39	3.42+0.47
Serum sodium (135–145 mmol/L)	142+2.49	137+2.46
Plasma renin (5.3–99.1 mIU/L)	9.73+7.56	6.54+4.73
Plasma aldosterone (103–1,197 pmol/L)	591+326	831+669
ARR (<30.5 pmol/mIU)	87.1+68.6	186+135

[a]Data is presented as mean + standard deviation.

Table 4: Effect of treatment on clinical and biochemical characteristics.

Characteristic (reference range, units)	Adrenalectomy (n=25)[a,b]	MRA therapy (n=23)[a,b]
Systolic BP (mmHg)	-19.0 (-27.0 to -12.5)	-15.5 (-24.0 to -6.93)
Diastolic BP (mmHg)	-9.45 (-14.7 to -4.25)	-5.89 (-12.0 to +0.24)
Antihypertensive DDD equivalent	-1.16 (-2.00 to -0.50)	-0.17 (-1.16 to +0.66)
Number of different antihypertensive drugs	-1.50 (-2.00 to -1.50)	+1.00 (0.0 to +1.00)
Serum potassium (3.5–5.2 mmol/L)	+1.01 (+0.73 to +1.30)	+0.48 (+0.17 to +0.80) (n=19)
Serum sodium (135–145 mmol/L)	-1.26 (-2.32 to -0.20)	-3.50 (-5.00 to -2.00) (n=19)
Serum renin (5.3–99.1 mIU/L)	+14.9 (+6.70 to +25.5) (n=20)	N/A[c]
Serum aldosterone (103–1,197 pmol/L)	-441 (-616 to -287) (n=20)	N/A[c]
ARR (<30.5 pmol/mIU)	-127 (-215 to -85) (n=20)	N/A[c]

[a]n=sample size for specific analysis; not commented on if <10% data points were missing.
[b]Data is presented as mean change (95% confidence interval).
[c]Aldosterone and renin are not routinely measured for patients receiving MRA therapy at our centre.

not being performed by the primary operator. AVS failure related to failure to successfully cannulate the right adrenal vein on all but two occasions. There were no significant AVS complications documented in the EMR over the study period.

Treatment outcomes

Clinical and biochemical treatment outcomes are shown in Table 4. Twenty-five patients out of 27 had follow-up available after adrenalectomy performed in our region (mean follow-up 256 days, range 16 to 1,456 days). Of these 25 with available follow-up information, 24 adrenalectomies were performed by a single endocrine surgeon, including three in private. Two additional patients who met eligibility criteria for inclusion in the study were excluded from analyses of treatment success as they had adrenalectomy performed outside of our centre. Twenty-four patients (96%) achieved clinical success, including seven patients (28%) with complete clinical success and 17 (68%) with partial clinical success. Only one patient (4%) had absent clinical success. Complete biochemical success occurred in 20 patients (80%), with one patient each having partial biochemical success and absent biochemical success (4% each). Three patients did not have a post-operative ARR available (12%).

A PASO surgical outcome score of >16 correctly predicted complete clinical success of adrenalectomy for unilateral PA with a sensitivity of 57% and a specificity of 89%. The positive predictive value was 67% and the negative predictive value was 84%, giving the model an accuracy of 80% in our sample.

Of the 20 patients who underwent documented medical treatment with an MRA and had follow-up information available, 14 (70%) achieved clinical success, including seven patients (35%) with complete clinical success and seven (35%) with partial clinical success. Five (25%) had absent clinical success. The remaining one patient had an increased BP but reduced antihypertensive medication dosage. Three additional patients had follow-up with inadequate information to determine clinical success.

Adverse events of surgical treatment

Of the 23 patients with available surgical information who underwent adrenalectomy under the care of an endocrine surgeon in our centre, 12 (52%) experienced self-limiting post-operative numbness. One patient experienced permanent sensory loss at the T12 dermatome. Another was readmitted for transient post-operative pain. One patient experienced a major adverse event (4%) with a post-operative acute kidney injury causing deterioration of chronic kidney disease. There were no recorded cases of significant intraoperative complications or perioperative mortality.

Adverse events of medical treatment

One patient of eight who tried eplerenone experienced severe vomiting, but no other patients had documented adverse effects. Thirteen out of 33 patients who tried spironolactone experienced adverse drug reactions (39%), specifically gynaecomastia (24%), low libido (6%), hypotension (6%), fatigue (3%), constipation (3%) and unspecified intolerance (6%). Two patients (6%) stopped spironolactone for conception. One additional patient not included in the above group denied MRA therapy due to the potential anti-androgenic side effects.

Discussion

We can expect that almost 8,000 people are living with PA in our catchment size of 409,260 individuals aged 20 years or over, given the national prevalence of hypertension of 31% and a conservative estimate that PA is present in 6% of adults with hypertension based on international data.[17,23] We are not aware of any recent data on the likely prevalence of PA in Aotearoa New Zealand. Over the 5-year study period we only had 63 confirmed diagnoses of PA in our catchment and 156 eligible patients identified. While this indicates that PA is likely to be heavily underdiagnosed in our region, the number of referrals and SITs undertaken have both increased five-fold from 2015 to 2021 with a clear upward trend, even with the interruptions to services due to COVID-19 in 2020 and 2021. Rates of diagnosis have also generally shown a positive trend over the same period.

Compared to the total response ethnicity of adults aged 20 and over based on 2018 Census data for the region, there were significantly more referrals than expected for patients of Asian ethnicity and less than expected for patients of European ethnicity. The proportion of referred patients who identified as Māori was similar to the proportion of Māori in the region. There are no other data describing ethnic differences in PA prevalence in Aotearoa New Zealand, including the effect of PA on Māori, which is particularly

crucial to establish given the inequities in cardiovascular disease which affect Māori.[24]

We found that certain characteristics may offer value in predicting a diagnosis of PA independently of having a raised ARR. In our sample of patients referred in for assessment of potential PA, hypokalemia or potassium supplementation were not sensitive indicators of PA but were relatively specific. Other findings may increase the likelihood of PA, including higher antihypertensive requirement, ARR level and cardiovascular disease. Despite 29% of referred patients not having clear evidence of meeting the Endocrine Society criteria for PA screening, we support the use of these criteria as well as using clinical judgement for case detection, given that 18% of patients within our catchment with eventual PA did not clearly meet these criteria at referral.

We observed high rates of complete or partial clinical success in our cohort. However, 42% of male patients experienced gynaecomastia with spironolactone. PA patients may benefit from eplerenone being subsidised as it has lower rates of adverse effects, including in our cohort, but thought to have similar or only slightly lower efficacy in treating PA.[25,26] Currently eplerenone is not funded to use for PA in Aotearoa New Zealand, despite being funded for use in congestive heart failure, so would cost PA patients $300 per year at a typical dose of 50mg.[27]

Burrello et al. have validated a PASO score of >16 to predict complete clinical success of adrenalectomy with an accuracy of 79% (sensitivity of 71%, specificity 84%) with an original cohort of 380 patients, which largely matches what was observed in our sample.[16] Our sensitivity was somewhat lower (57%), although we had a very small sample size of only seven patients with complete clinical success.

Little has been published on PA in Aotearoa New Zealand, which is a barrier to generating awareness and understanding of this condition that requires disease-specific therapy to be managed effectively.[11] Our study has several strengths which aim to remedy this. It is the first in Aotearoa New Zealand to examine the increasing rates of referrals and testing for PA. Our findings reinforce the importance of identifying PA with targeted screening, including in patients with long-standing hypertension. On average, our cohort had almost 10 years of established hypertension before being diagnosed with PA, but most still received effective intervention.

Our study is also the first in Aotearoa New Zealand to discuss the predictive value of clinical and biochemical characteristics in the diagnosis of PA, as well as attempting to validate the PASO predictive score. Herd et al. have previously described the effectiveness of surgical treatment of PA in Aotearoa New Zealand, but did not go so far as to describe the characteristics that predict a positive diagnosis.[28] A handful of papers published in other journals have discussed case reports, the point prevalence of PA and role of dynamic testing in Aotearoa New Zealand, but none have described the entire course of diagnosis and treatment, medical treatment outcomes, or increasing referrals. This cohort is comparable with cohorts described in the international literature, noting similar rates of complete clinical success from surgery (28% in our cohort vs 37%), medical treatment (both 35%) and suppressed SITs (46% vs 44%).[19,20,29]

Our study has several limitations. Firstly, patients only became eligible when undertaking specialist investigation for PA, so the characteristics we described in Table 1 may therefore be less valid in a primary care setting. Secondly, the study was limited to a single centre and retrospective, which contributed to missing information. For example, 52% of patients did not have sufficient information to exclude or confirm presence of TOD for the PASO score, so the imputation of this value as absent reduces the predictive validity in our cohort. Follow-up occurred outside of the recommended 6–12 month window in 52% of surgically treated patients, which may distort rates of clinical success.[30] Our AVS success rates being lower than expected from international literature also reduced observed rates of unilateral disease.[31] Finally, we did not routinely measure cortisol as part of our SIT protocols, which may have introduced a confounding effect of aldosterone levels from ACTH.[8] We hope to eventually move to using mass spectrometry for these assays when it becomes available in Aotearoa New Zealand, given the inaccuracy of immunoassays in diagnosing PA.[5]

Future research should aim to overcome these limitations by describing the status of PA from a primary care point of view where patients are most frequently identified, which may also allow estimates of prevalence, including ethnic differences and inequities. Prospectively describing the medical and surgical outcomes of PA patients would more effectively describe the success rates and harms of treatment, including providing further evidence to support funding eplerenone.

COMPETING INTERESTS
Nil.

AUTHOR INFORMATION
William Park: Trainee Intern, University of Otago, Wellington.
Patricia Whitfield: Consultant Endocrinologist, Endocrine, Diabetes and Research Centre, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley, and Department of Medicine, University of Otago, Wellington.
Brian Corley: Consultant Endocrinologist, Endocrine, Diabetes and Research Centre, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley, and Department of Medicine, University of Otago, Wellington.
Simon Harper: Endocrine & General Surgeon, Department of General Surgery, Wellington Regional Hospital, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley, and Department of Surgery and Anaesthesia, University of Otago, Wellington.
Joe Feltham: Consultant Diagnostic & Interventional Radiologist, Department of Radiology, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley.
Richard Carroll: Consultant Endocrinologist, Endocrine, Diabetes and Research Centre, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley, and Department of Medicine, University of Otago, Wellington.

CORRESPONDING AUTHOR
Richard Carroll: Consultant Endocrinologist, Endocrine, Diabetes and Research Centre, Te Whatu Ora Health New Zealand Capital, Coast and Hutt Valley, and Department of Medicine, University of Otago, Wellington. Private Bag 7902, Wellington 6242. Ph: +64 4 806 2140. E: Richard.Carroll@ccdhb.org.nz

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Investigation and treatment after non-ST segment elevation acute coronary syndrome for patients presenting to rural or urban hospitals in Aotearoa New Zealand: ANZACS-QI 75

Rory Miller, Garry Nixon, Robin M Turner, Tim Stokes, Rawiri Keenan, Corina Grey, Yannan Jiang, Sue Wells, Wil Harrison, Andrew Kerr

ABSTRACT

AIMS: Compare the care patients with non-ST segment elevation acute coronary syndrome (NSTEACS) received in Aotearoa New Zealand depending on the rural–urban category of the hospital they are first admitted to.

METHODS: Patients with NSTEACS investigated with invasive coronary angiogram between 1 January 2014 and 31 December 2019 were included. There were three hospital categories (routine access to percutaneous coronary intervention [urban interventional], other urban [urban non-interventional] and rural) and three ethnicity categories (Māori, Pacific and non-Māori/non-Pacific). Clinical performance measures included: angiography ≤3 days, assessment of left ventricular ejection fraction (LVEF) and prescription of secondary prevention medication.

RESULTS: Of 26,779 patients, 66.2% presented to urban-interventional, 25.6% to urban non-interventional and 8.2% to rural hospitals. A smaller percentage of patients presenting to urban interventional than urban non-interventional and rural hospitals were Māori (8.1%, 17.0% and 13.0%). Patients presenting to urban interventional hospitals were more likely to receive timely angiography than urban non-interventional or rural hospitals (78.5%, 60.8% and 63.1%). They were also more likely to have a LVEF assessment (78.5%, 65.4% and 66.3%). In contrast, the use of secondary prevention medications at discharge was similar between hospital categories. Māori and Pacific patients presenting to urban interventional hospitals were less likely than non-Māori/non-Pacific to receive timely angiography but more likely to have LVEF assessed. However, LVEF assessment and timely angiography in urban non-interventional and rural hospitals were lower than in urban interventional hospitals for both Māori and non-Māori/non-Pacific.

CONCLUSIONS: Patients presenting to urban hospitals without routine interventional access and rural hospitals were less likely to receive LVEF assessment or timely angiography. This disproportionately impacts Māori, who are more likely to live in these hospital catchments.

In Aotearoa New Zealand, patients with non ST-segment elevation acute coronary syndrome (NSTEACS) may present to one of three main groups of hospitals: urban hospitals i) with (interventional) or ii) without (non-interventional) routine access to percutaneous intervention (PCI), or iii) rural hospitals.[1,2] Hospitals without routine access to PCI typically have smaller catchments that include a higher proportion of Māori.[3] Rural hospitals usually have fewer resources and are at a distance (40 minutes to 4 hours by road) to urban hospitals.[4]

Patients who present to hospitals without access to PCI will receive initial treatment at that facility. Stable patients in urban hospitals or larger rural hospitals may be admitted to that facility while awaiting transfer for invasive coronary angiography (angiography hereafter) and further treatment. Unstable patients or those who present to rural hospitals that have fewer resources may require early transfer to a larger hospital. Patients may undergo several hospital transfers to receive definitive care.[5]

For patients with NSTEACS, guidelines recommend that angiography is performed within 3 days for all but very low-risk patients (Aotearoa New Zealand target is 70%), that there should be an assessment of left ventricular function (Aotearoa New Zealand target is 85%) and secondary preventative medications are prescribed (Aotearoa New Zealand target is 85%).[6–8]

Recent data from Aotearoa New Zealand show

that patients with ST elevation myocardial infarction (STEMI) and NSTEACS that present to urban non-interventional or rural hospitals were less likely to receive angiography, but there are no differences in mortality (up to 1 year) and few differences in readmissions to hospitals with adverse cardiac events, heart failure or major bleeding.[1,2] However, regardless of the type of hospital at presentation, Māori have higher mortality following STEMI and NSTEACS compared to non-Māori, non-Pacific peoples and have reduced access to invasive cardiac investigations.[9] These inequities are more pronounced for Māori that live in rural areas.[9,10] There are few data on the investigations and treatments provided to patients that present to Aotearoa New Zealand rural hospitals with NSTEACS.

The aim of this study was therefore to determine if there were differences in the inpatient investigations and treatments that patients received during an admission with NSTEACS associated with the category of hospital (rural, urban non-interventional or urban interventional) that the patient presented to, and to explore any interactions with ethnicity.

Methods

All first admissions to Aotearoa New Zealand public hospitals for patients aged 20 or older with NSTEACS entered in the All New Zealand Acute Coronary Syndrome Quality Improvement (ANZACS-QI) programme between 1 January 2014 and 31 December 2019 were included in the study.

The ANZACS-QI ACS-CathPCI registry was used, which captures in-depth data on the subset of patients that have acute coronary syndrome (ACS) and receive a coronary angiogram in Aotearoa New Zealand public hospitals (approximately 60% of patients with NSTEACS).[1,2,11,12]

Hospitals were identified using the facility code assigned by the New Zealand Ministry of Health and divided into three urban–rural hospital categories (Table 1):[1,2]

1. Urban hospitals with routine access to PCI (urban interventional)
2. Urban hospitals without routine access to PCI (urban non-interventional), or
3. Rural hospitals

Patients were assigned to the first hospital of presentation. To account for the movement of patients between hospitals, admission events were bundled together.[12]

Clinical performance measures

Clinical performance measures that were considered included: invasive coronary angiography performed within 3 days of first presentation; an assessment of the left ventricular ejection fraction

Table 1: The classification of Aotearoa New Zealand public hospitals into urban hospitals with routine access to percutaneous intervention (PCI), urban hospitals without routine access to PCI and rural hospitals.

Group	Hospital
Urban hospital with routine access to percutaneous intervention (PCI) (urban interventional)	Middlemore; Auckland City; North Shore; Waitākere; Waikato; Tauranga; Wellington; Hutt; Nelson; Christchurch; Dunedin
Urban hospital without routine access to PCI* (urban non-interventional)	Whangārei; Whakatāne; Rotorua; Gisborne; Taranaki Base; Whanganui; Palmerston North; Hawke's Bay; Masterton/Wairarapa; Blenheim (Wairau); Timaru; Southland (Kew)
Rural hospital	Kaitaia; Rawene (Hokianga); Bay of Islands; Wairoa; Dargaville; Thames; Taupō; Hāwera; Taumarunui; Te Kuiti; Tokoroa; Kaikōura; Te Nīkau (Greymouth); Westport/Buller; Ashburton; Oamaru; Lakes District; Dunstan; Clutha Health First; Gore; Wairoa Hospital and Health Centre; Dannevirke Community Hospital; Maniototo Health Services; Te Whare Hauora O Ngāti Porou—Te Puia Springs; Golden Bay Community Health

* Some hospitals in this group may have had access to diagnostic invasive angiography or limited access to PCI. Some hospitals (e.g., Whangārei) have opened an angiography suite after the conclusion of the study period.

(LVEF); and whether the following medications were prescribed at discharge—aspirin, dual antiplatelet therapy (DAPT), statin, angiotensin-converting enzyme inhibitor or angiotensin receptor blocker (ACEi/ARB) and beta-blockers. These were selected as key indicators of quality care and are consistent with Aotearoa New Zealand ACS targets, as well as Australasian and international guidelines and existing literature.[6–8]

Data collected

Age, sex, prioritised ethnicity categorised as Māori, Pacific and non-Māori, non-Pacific peoples (using the Ministry of Health's protocols),[13] body mass index (BMI), smoking status, history of diabetes, congestive heart failure (CHF), prior cardiovascular disease, renal dialysis, admission heart rate (HR) and systolic blood pressure (SBP), low density lipoprotein cholesterol concentration (LDL), initial Killip group,[14] cardiac arrest on arrival, estimated glomerular filtration rate (eGFR), Grace score[15] and anticoagulant use were collected.

Clinical information included: the time from arrival at the hospital of presentation to angiography (in days); assessment of the LVEF, either by echocardiogram or left ventricular angiogram; findings from angiogram and LVEF assessment; whether PCI was performed; and if there was a referral for (inpatient or outpatient) coronary artery bypass grafting.

The prescription of, or documented contra-indication, to aspirin, another antiplatelet agent, statin, angiotensin-converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARB) or beta-blockers were recorded. Patients were considered to have been prescribed dual antiplatelet therapy if they had both aspirin and a second antiplatelet agent prescribed at discharge.

Statistical analysis

Data were summarised using mean and standard deviation (SD) for continuous data and frequency and percentage for categorical data, overall and by hospital category.

Logistic regression, separately for each performance measure, was used to estimate the odds ratios (OR) with 95% confidence intervals (95% CI) comparing urban non-interventional and rural hospitals with urban interventional hospitals (reference group). A binary outcome was created for the prescription of a medication where "prescribed" or "contra-indication" were re-categorised as "true".

For all models, the following potential confounders of hospital category were included: sex, ethnicity, age, type of NSTEACS, current smoker, prior cardiovascular event, history of diabetes, BMI, HR, SBP, Killip group, LDL, eGFR, history of CHF, health region (Northern, Te Manawa Taki, Central, Southern) and anticoagulant use. LVEF assessment and the findings from this assessment were both considered additional confounders in the models for angiography that occurred within 3 days and prescription of secondary preventative medications. Angiography within 3 days was considered a confounder in the models for LVEF assessment and the prescription of secondary prevention medications.

All model assumptions were checked. Complex non-linear associations were dealt with by categorisation as follows: age (20–44 years, 45–59 years, 60–69 years, 70–89 years and 90+ years); BMI (<18, 18.5–24.9, 25–29.9, 30–34.9 and 35+), heart rate (<50, 50–99, 100–149 and >150 beats per minute); SBP (<100, 100–149, 150–200 and 201+ mmHg) and LDL (0–1.9, 2–3.9, 4–5.9 and 6+ mmol/L).

Backwards elimination was used to identify and remove non-significant confounders; however, important confounders (age, ethnicity) were retained regardless of significance. Likelihood ratio tests were used to assess the significance of each variable in the model. Only *a priori* interactions (age and ethnicity) were investigated.

Large amounts (>10%) of missing data within a single variable were categorised and coded as a separate category and included in the regression models. A sensitivity analysis was performed comparing this method with multiple imputation (Appendix 4).

All analyses were performed in R (version 4.1.1) using R-Studio (22.02.3 Boston, MA).[16]

Ethics

The ANZACS-QI study is part of a programme of research originally approved by the Northern Region Ethics Committee in 2003 (AKY/03/12/314), with subsequent approval by the National Multi Region Ethics Committee in 2007 (MEC07/19/EXP) and with annual re-approval since as part of a vascular research programme (2022 EXP 13442). Individual patient consent was not required as all data are de-identified.[11]

Results

There were 26,779 patients with NSTEACS between 2014 and 2019. Patient characteristics are presented in Table 2. Most patients (66.2%)

presented to urban interventional hospitals, with a quarter of patients presenting to urban non-interventional (25.6%) and 8.2% to rural hospitals. A lower percentage of patients that presented to urban interventional hospitals were Māori, compared to urban non-interventional and rural hospitals (8.1%, 17.0% and 13.0% respectively); however, the reverse occurred for Pacific peoples (7.1%, 1.4% and 1.7%). Compared with interventional hospitals, patients that presented to non-interventional and rural hospitals were also more likely to be older (mean age: 65.6 years, 66.4 years and 67 years respectively) and female (30.4%, 34.8% and 33%).

Findings (including ORs) for the process measures angiography within 3 days and assessment of LVEF are shown in Table 3 and Figure 1. There was a significant ($p<0.001$) interaction between ethnicity and category of hospital for both these two outcome measures.

Invasive coronary angiography within 3 days

Overall, 72.7% of patients received angiography within 3 days; of this, a higher percentage were patients that presented to urban interventional hospitals (78.5%) than rural (60.8%) and urban non-interventional hospitals (63.8%).

For patients presenting to urban interventional hospitals, a lower percentage of Māori (74.3%, OR: 0.78, 95% CI: 0.68 to 0.89) and Pacific peoples (69.3%, OR: 0.75, 95% CI: 0.65 to 0.86) received this investigation compared with non-Māori, non-Pacific peoples (79.8%). For all patients that presented to rural or urban non-interventional hospitals, fewer patients received angiography within 3 days.

Figure 2 shows the time to angiography for each ethnicity and hospital of presentation category.

Assessment of LVEF

Overall, 74.1% of patients received an assessment of LVEF. This percentage was higher for urban interventional (78.5%) compared with rural (66.6%) and urban non-interventional hospitals (65.4%).

A higher percentage of Māori (82.7%, OR: 1.30, 95% CI: 1.12 to 1.51) and Pacific (85.5%, OR: 1.35, 95% CI: 1.14 to 1.62) patients that presented to urban interventional hospitals received an assessment of LVEF compared with non-Māori, non-Pacific peoples (77.5%). However, fewer Māori who presented to urban non-interventional hospitals (68.8%, OR: 0.61, 95% CI: 0.53 to 0.71) and rural hospitals (63.2%, OR: 0.40, 95% CI: 0.31 to 0.52) received this investigation. Similarly, compared to non-Māori, non-Pacific peoples presenting to urban interventional hospitals, fewer non-Māori, non-Pacific peoples who presented to rural hospitals (66.6%, OR: 0.56, 95% CI: 0.50 to 0.62) or urban non-interventional hospitals (64.7%, OR: 0.54, 95% CI: 0.50 to 0.58) received an assessment of the LVEF.

The measured LVEF and the angiography findings were similar across the three categories of hospital and are shown in Appendix 1.

Prescription of secondary prevention medications

Figure 3 and Table 4 present the number, percentage and the unadjusted and adjusted ORs for the prescription of secondary prevention medications at discharge. There were no interactions identified.

Most patients received secondary prevention medications. Nearly all patients had a prescription for aspirin (96.1%), with slightly fewer patients who presented to rural hospitals (95.5%, OR: 0.66, 95% CI: 0.52 to 0.85) or urban non-interventional hospitals (95.1%, OR: 0.89, 95% CI: 0.75 to 1.05) receiving this prescription. A higher percentage of patients that presented to rural hospitals or urban non-interventional hospitals were prescribed beta-blockers (88.3%, OR: 1.34, 95% CI: 1.16 to 1.54 and 86.3%, OR: 1.40, 95% CI: 1.28 to 1.53 respectively) compared with urban interventional hospitals (84.3%).

Adjusting for hospital category of presentation, with the exception of ACEi/ARB (Māori 74.3%, Pacific 78.9%, non-Māori non-Pacific 71.0%), there were no clinically significant differences in the percentage of patients that received a prescription of secondary preventative medication between the three ethnic groups (Appendix 2 and 3).

There were large amounts of missing data (23.5%) for the BMI variable. There were no major differences in the interpretation in any of the outcomes after substituting missing values using multiple imputation (Appendix 4).

Discussion

This national study using the ANZACS-QI registry shows that fewer patients (61% and 63%) who presented to rural hospitals or urban non-interventional hospitals had angiography within 3 days of presentation (and therefore the opportunity for intervention) compared with patients who presented to urban interventional

Table 2: Characteristics of the patients that presented with non-ST segment elevation myocardial infarction according to the rural–urban category of the hospital at presentation.

		Total	Urban interventional hospitals	Urban non-interventional hospitals	Rural hospitals
Total		26,779	17,723 (66.2%)	6,863 (25.6%)	2,193 (8.2%)
Age in years	*Mean (standard deviation [SD])*	65.9 (11.5)	65.6 (11.6)	66.4 (11.1)	67.0 (11.0)
Sex	*Female*	8,496 (31.7%)	5,386 (30.4%)	2,386 (34.8%)	724 (33.0%)
	Male	18,283 (68.3%)	12,337 (69.6%)	4,477 (65.2%)	1,469 (67.0%)
Ethnicity	*Non-Māori, non-Pacific*	22,497 (84.0%)	15,028 (84.8%)	5,599 (81.6%)	1,871 (85.3%)
	Māori	2,885 (10.8%)	1,430 (8.1%)	1,170 (17.0%)	285 (13.0%)
	Pacific	1,397 (5.2%)	1,265 (7.1%)	95 (1.4%)	37 (1.7%)
Body mass index (BMI)	*Mean (SD)*	29.5 (6.1)	29.3 (6.0)	29.9 (6.2)	29.5 (6.1)
	<18.5	176 (0.7%)	124 (0.7%)	43 (0.6%)	9 (0.4%)
	18.5–24.9	4,367 (16.3%)	3,093 (17.5%)	924 (13.5%)	350 (16.0%)
	25–29.9	7,739 (28.9%)	5,336 (30.1%)	1,796 (26.2%)	607 (27.7%)
	30–34.9	5,024 (18.7%)	3,344 (18.9%)	1,299 (18.9%)	381 (17.4%)
	35+	3,187 (11.9%)	2,133 (12.0%)	802 (11.7%)	252 (11.5%)
	Missing	6,286 (23.5%)	3,693 (20.8%)	1,999 (29.1%)	594 (27.1%)
Current smoker		4,505 (16.8%)	2,833 (16.0%)	1,263 (18.4%)	408 (18.6%)
Diabetes		6,793 (25.4 %)	4,629 (26.1%)	1,671 (24.3%)	492 (22.5%)
History of congestive heart failure		1,168 (4.4%)	724 (4.1%)	325 (4.7%)	119 (5.4%)
Prior cardiovascular disease		9,916 (37.0%)	6,471 (36.5%)	2,651 (38.6%)	794 (36.2%)
Prior myocardial infarction		5,662 (21.1%)	3,671 (20.7%)	1,543 (22.5%)	448 (20.4%)
Dialysis		396 (1.5%)	285 (1.6%)	93 (1.4%)	18 (0.8%)
	Missing	1,896 (7.1%)	1,395 (7.9%)	357 (5.2%)	144 (6.6%)
Clinical features					
Heart rate (beats per minute)	Mean (SD)	76 (18.9)	76.1 (18.5)	76.3 (19.8)	74.8 (19.6)
	<60	618 (2.3%)	363 (2.1%)	190 (2.8%)	65 (3.0%)
	60–99	23,488 (87.6%)	15,607 (88.1%)	5,946 (86.6%)	1,935 (88.2%)
	100–149	2,482 (9.3%)	1,643 (9.3%)	668 (9.7%)	171 (7.8%)
	>150	189 (0.7%)	109 (0.6%)	58 (0.8%)	22 (1.0%)

Table 2 (continued): Characteristics of the patients that presented with non-ST segment elevation myocardial infarction according to the rural–urban category of the hospital at presentation.

Admission systolic blood pressure (mmHg)	Mean (SD)	145.0 (26.1)	144.4 (25.6)	145.7 (27.3)	144.8 (26.9)
	<100 mmHg	776 (2.9%)	482 (2.7%)	218 (3.2%)	76 (3.5%)
	100–149 mmHg	16,162 (60.3%)	10,822 (61.1%)	4,037 (58.8%)	1,303 (59.4%)
	150–199 mmHg	9,175 (34.2%)	6,031 (34.0%)	2,391 (34.8%)	753 (34.3%)
	200+ mmHg	664 (2.5%)	387 (2.2%)	216 (3.2%)	61 (2.8%)
	Missing	2 (0.0%)	1 (0.0%)	1 (0.0%)	0
Low density lipoprotein (mmol/L)	Mean (SD)	2.4 (1.4)	2.4 (1.4)	2.5 (1.4)	2.34 (1.5)
	<2	9,437 (35.2%)	6,281 (35.4%	2,304 (33.6%)	852 (38.9%)
	2–3.9	13,501 (50.4%)	8,923 (50.3%)	3,544 (51.6%)	1,034 (47.2%)
	4–5.9	3,609 (13.5%)	2,391 (13.5%)	938 (13.7%)	280 (12.8%)
	>6	217 (0.8%)	122 (0.7%)	71 (1.1%)	24 (1.1%)
	Missing	13 (0.1%)	6 (0.0%)	4 (0.1%)	3 (0.1%)
Initial Kilip group	I—no CHF	24,492 (91.5%)	16,203 (91.4%)	6,262 (91.2%)	2,027 (92.4%)
	II–IV	2,287 (8.6%)	1,520 (8.6%)	601 (8.8%)	166 (7.6%)
Cardiac arrest on arrival		319 (1.2%)	197 (1.1%)	94 (1.4%)	28 (1.3%)
Glomerular filtration rate (GFR) (mL/ min/1.73m^2)	<30	472 (1.8%)	326 (1.8%)	109 (1.6%)	37 (1.7%)
	30–<60	5,266 (19.7%)	3,423 (19.3%)	1,420 (20.7%)	423 (19.3%)
	60+	20,663 (77.2%)	13,707 (77.3%)	5,241 (76.4%)	1,715 (78.2%)
	Missing	378 (1.4%)	267 (1.5%)	93 (1.4%)	18 (0.8%)
Grace score	<1%	8,151 (30.4%)	5,568 (31.4%)	1,935 (28.2%)	648 (29.5%)
	1–<3%	11,182 (41.8%)	7,356 (41.5%)	2,902 (42.3%)	924 (42.1%)
	3%+	7,414 (27.7%)	4,773 (26.9%)	2,023 (29.5%)	618 (28.2%)
	Missing	32 (0.1%)	26 (0.1%)	3 (0.0%)	3 (0.1%)
Anticoagulant use at discharge		1,226 (4.6%)	733 (4.1%)	389 (5.7%)	104 (4.7%)

Table 3: Clinical performance measures by rural–urban hospital category and ethnicity.

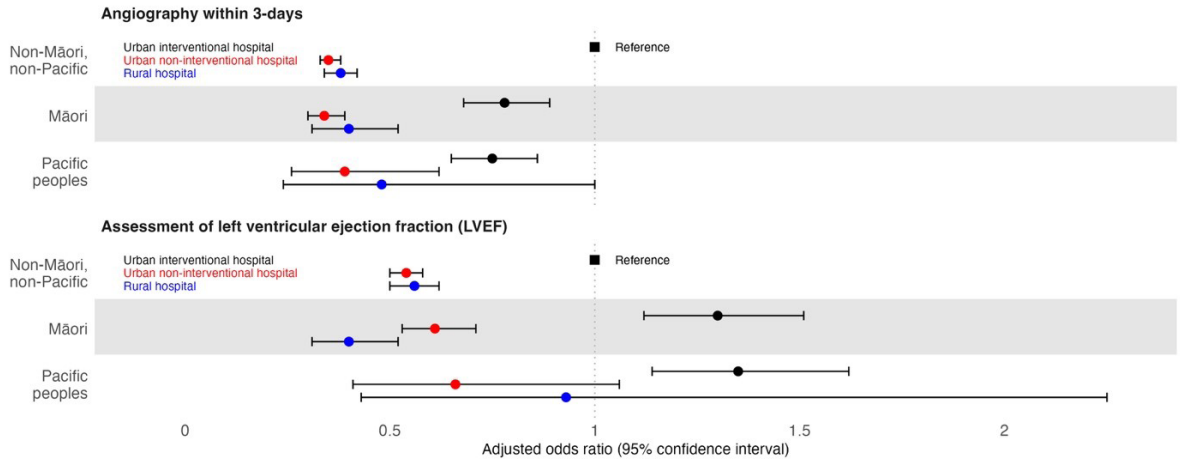
		Total	Urban interventional hospital	Urban non-interventional hospital	Rural hospital
Mean time (days) to angiography *mean (standard deviation [SD])*			2.4 (2.4)	3.4 (2.6)	3.3 (2.5)
Non-Māori, non-Pacific		2.7 (2.4)	2.4 (2.3)	3.4 (2.6)	3.2 (2.6)
Māori		3.22 (2.9)	2.8 (3.0)	3.7 (2.8)	3.4 (2.3)
Pacific		2.9 (2.3)	2.9 (2.4)	3.1 (1.6)	3.1 (2.1)
Angiography within 3 days[†]					
Total		19,477 (72.7%)	13,920 (78.5%)	4,173 (60.8%)	1,384 (63.1%)
Non-Māori, non-Pacific		16,607 (73.8%)	11,981 (79.8%)	3,434 (61.4%)	1,192 (63.8%)
	Unadjusted OR		1 (reference)	**0.40 (0.38, 0.43)**	**0.45 (0.40, 0.50)**
	Adjusted OR[‡]		1 (reference)	**0.35 (0.33, 0.38)**	**0.38 (0.34, 0.42)**
Māori		1,908 (66.1%)	1,063 (74.3%)	677 (57.9%)	168 (58.9%)
	Unadjusted OR		**0.74 (0.65, 0.83)**	**0.35 (0.31, 0.40)**	**0.36 (0.29, 0.46)**
	Adjusted OR[‡]		**0.78 (0.68, 0.89)**	**0.34 (0.3, 0.39)**	**0.40 (0.31, 0.52)**
Pacific		962 (68.9%)	876 (69.3%)	62 (65.3%)	24 (64.9%)
	Unadjusted OR		**0.57 (0.51, 0.65)**	**0.48 (0.31, 0.74)**	**0.47 (0.24, 0.95)**
	Adjusted OR[‡]		**0.75 (0.65, 0.86)**	**0.39 (0.26, 0.62)**	0.48 (0.24, 1.0)
Assessment of left ventricular ejection fraction (LVEF)[†]					
Total		19,861 (74.2%)	13,915 (78.5%)	4,491 (65.4%)	1,455 (66.3%)
Non-Māori, non-Pacific		16,510 (73.4%)	11,645 (77.5%)	3,619 (64.7%)	1,246 (66.6%)
	Unadjusted OR		1 (reference)	**0.53 (0.50, 0.57)**	**0.58 (0.52, 0.64)**
	Adjusted OR[§]		1 (reference)	**0.54 (0.50, 0.58)**	**0.56 (0.50, 0.62)**

Table 3 (continued): Clinical performance measures by rural–urban hospital category and ethnicity.

Māori		2,168 (75.1%)	1,183 (82.7%)	805 (68.8%)	180 (63.2%)
	Unadjusted OR		**1.39 (1.21, 1.61)**	**0.64 (0.56, 0.73)**	**0.50 (0.39, 0.64)**
	Adjusted OR§		**1.30 (1.12, 1.51)**	**0.61 (0.53, 0.71)**	**0.40 (0.31, 0.52)**
Pacific		1,183 (84.7%)	1,087 (85.9%)	67 (70.5%)	29 (78.4%)
	Unadjusted OR		**1.77 (1.51, 2.09)**	**0.70 (0.39, 0.64)**	1.05 (0.5, 2.47)
	Adjusted OR§		**1.35 (1.14, 1.62)**	0.66 (0.41, 1.06)	0.93 (0.43, 2.25)

† There was an interaction term between hospital category and ethnicity (p<0.001). Patients that presented to urban interventional hospitals and who were non-Māori, non-Pacific were considered the reference group for each outcome measure.
‡ Odds ratio (OR) adjusted for: age, ethnicity, sex, current smoker, diabetes, Killip group, prior myocardial infarction, prior cardiovascular disease, history of congestive heart failure, estimated glomerular filtration rate, admission heart rate, LDL cholesterol, admission blood pressure, LVEF assessment, findings from LVEF assessment, oral anti-coagulant use and region.
§ OR adjusted for: age, ethnicity, Killip group, cardiac arrest on arrival, prior myocardial infarction, prior cardiovascular disease, Grace score, body mass index, heart rate, LDL cholesterol, PCI during admission, referral for coronary artery bypass grafting and region.

Figure 1: The adjusted odds ratios† for the clinical performance indicators grouped by rural–urban hospital category at presentation and ethnicity.



† For each of the two outcome variables, non-Māori, non-Pacific patients that presented to urban interventional hospitals were considered the reference group.

Figure 2: The time to invasive coronary angiography in days for patients grouped by rural–urban category of hospital and ethnicity.

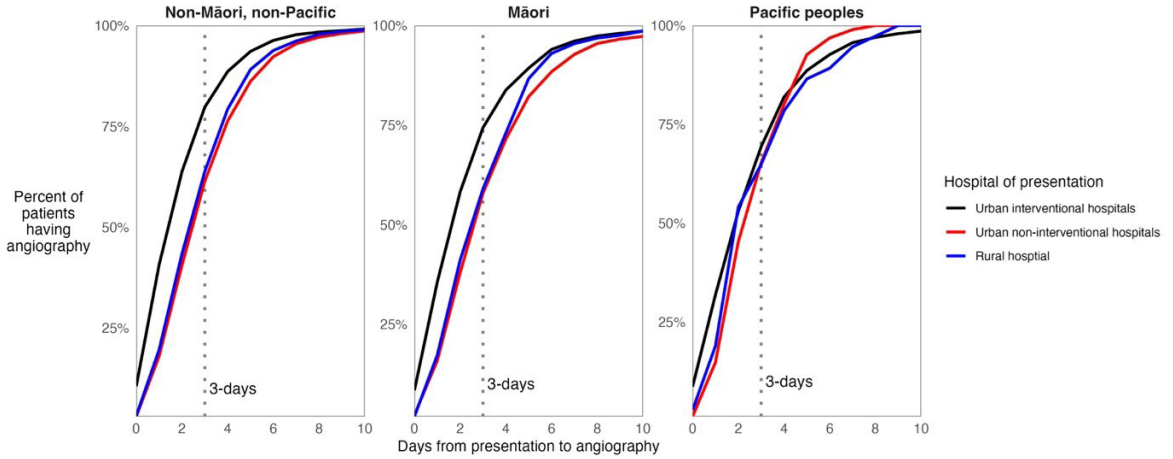
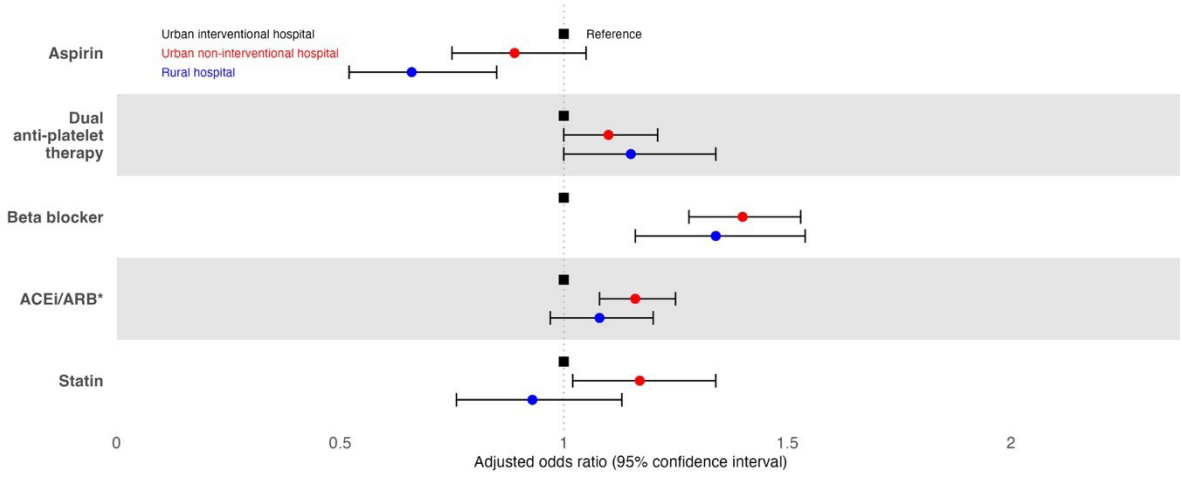


Figure 3: Adjusted odds ratios for the prescription of secondary prevention medications with non-ST segment elevation acute coronary syndrome grouped by the rural–urban category of the hospital at presentation. Urban interventional hospitals were considered the reference.



hospitals (78.5%). Only patients presenting to urban interventional hospitals met the Aotearoa New Zealand target of 70%.[8] In urban interventional hospitals, Māori and Pacific patients were less likely to receive this investigation within 3 days than non-Māori, non-Pacific patients.

A higher percentage of Māori and Pacific patients that presented to urban interventional hospitals received an assessment of the LVEF compared with non-Māori, non-Pacific patients. However, regardless of ethnicity, patients that presented to rural hospitals or urban non-interventional hospitals were less likely to receive this investigation. The Aotearoa New Zealand target (85%) was only met for Pacific peoples presenting to urban interventional hospitals. Overall, the rates of prescribing for secondary prevention medication at discharge were high.

Table 4: Prescription of secondary prevention medications for patients with non-ST segment elevation acute coronary syndrome grouped by the rural–urban category of hospital at presentation.

	Total	Urban interventional hospital	Urban non-interventional hospital	Rural hospital
Aspirin				
Prescribed	25,203 (94.1%)	16,796 (94.8%)	6,339 (92.4%)	2,068 (94.3%)
CI† or not tolerated	542 (2%)	329 (1.9%)	187 (2.7%)	26 (1.2%)
Unadjusted OR‡			***0.67 (0.59, 0.78)***	***0.74 (0.60, 0.92)***
Adjusted OR[1]			0.89 (0.75, 1.05)	**0.66 (0.52, 0.85)**
Dual antiplatelet therapy				
Prescribed	19,826 (74%)	13,134 (74.1%)	5,020 (73.1%)	1,672 (76.2%)
CI or not tolerated	542 (2%)	329 (1.9%)	187 (2.7%)	26 (1.2%)
Unadjusted OR			*0.95 (0.89, 1.01)*	*1.12 (1.01, 1.25)*
Adjusted OR[2]			1.10 (1.00, 1.21)	1.15 (1.00, 1.34)
Beta-blocker				
Prescribed	21,325 (79.6%)	13,896 (78.4%)	5,559 (81%)	1,870 (85.3%)
CI or not tolerated	1,258 (4.7%)	811 (4.6%)	382 (5.6%)	65 (3%)
Unadjusted OR			***1.17 (1.09, 1.26)***	***1.59 (1.41, 1.81)***
Adjusted OR[3]			**1.40 (1.28, 1.53)**	**1.34 (1.16, 1.54)**
ACEi§/ARB¶				
Prescribed	18,348 (68.5%)	12,243 (69.1%)	4,579 (66.7%)	1,526 (69.6%)
CI or not tolerated	868 (3.2%)	568 (3.2%)	257 (3.7%)	43 (2%)
Unadjusted OR			***0.91 (0.86, 0.97)***	*0.96 (0.87, 1.06)*
Adjusted OR[4]			**1.16 (1.08, 1.25)**	1.08 (0.97, 1.20)
Statin				
Prescribed	24,713 (92.3%)	16,454 (92.8%)	6,242 (91%)	2,017 (92%)
CI or not tolerated	560 (2.1%)	324 (1.8%)	197 (2.9%)	39 (1.8%)
Unadjusted OR			***0.87 (0.80, 0.95)***	*0.95 (0.82, 1.10)*
Adjusted OR[5]			**1.17 (1.02, 1.34)**	0.93 (0.76, 1.13)

† Contraindicated
‡ To calculate the odds ratio (OR) for each medication prescribed, the medication was considered prescribed if it was "prescribed" or "contraindicated (CI) or not tolerated"
§ Angiotension converting enzyme inhibitor
¶ Angiotension receptor blocker
1 = OR adjusted for: ethnicity, sex, age, cardiac arrest on arrival, Grace score, diabetes, admission heart rate, LDL cholesterol, admission systolic blood pressure, left ventricular ejection fraction (LVEF) assessment, LVEF findings, angiography within 3 days, angiography findings, oral anticoagulant use, PCI during admission, region.
2 = OR adjusted for: ethnicity, sex, age, current smoker, cardiac arrest on arrival, Grace score, Killip group, prior myocardial infarction, prior cardiovascular disease, dialysis, estimated glomerular filtration rate (eGFR), admission heart rate, admission systolic blood pressure, LVEF assessment, LVEF findings, angiography within 3 days, angiography findings, oral anti-coagulant use, PCI during admission, referred for coronary artery bypass graft (CABG), region.
3 = OR adjusted for: ethnicity, sex, current smoker, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, body mass index (BMI), admission heart rate, admission systolic blood pressure, LVEF findings, angiography findings, oral anti-coagulant use, region.
4 = OR adjusted for: ethnicity, sex, age, Killip group, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, history of congestive heart failure, admission systolic blood pressure, BMI, LVEF assessment, LVEF findings, angiography within 3 days, referred for CABG, region.
5 = OR adjusted for: ethnicity, age, sex, current smoker, Killip group, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, BMI, admission heart rate, LDL cholesterol, admission systolic blood pressure, LVEF assessment, LVEF findings, angiography within 3 days, PCI during admission, referred CABG, oral anti-coagulant use, region.

Invasive coronary angiography

That patients presenting with NSTEACS to rural hospitals or urban non-interventional hospitals waited longer to receive angiography is consistent with Aotearoa New Zealand data in patients diagnosed with STEMI.[1] Other Aotearoa New Zealand studies show a similar trend, where patients that presented with NSTEACS in district health boards (DHBs) without PCI capabilities were also less likely to have angiography within 3 days.[17] These studies did not differentiate rural from urban hospitals and some DHBs will have included hospitals with and without interventional facilities (e.g., Southern).

Inequities in providing timely angiography for Māori and other Indigenous peoples are well documented.[9,18] Our study shows that, regardless of where they present, Māori with NSTEACS wait longer for angiography compared to non-Māori, non-Pacific patients. This disadvantage is worsened for Māori and Pacific peoples who live in urban non-interventional and rural catchments. One potential explanation is the historical lack of angiographic capacity in hospitals that serve large Māori and Pacific populations. We might anticipate this situation could improve with the recent addition of cardiac catheter laboratories to both Whangārei and Middlemore hospitals.[19] It is also likely that institutional racism and biases at multiple levels contribute to the inequities for Māori and Pacific peoples seen in our study.[2,9,20]

Assessment of LVEF

Access to echocardiography varies throughout Aotearoa New Zealand. Hospitals that do not have cardiothoracic services are less likely to offer this investigation.[21–23] Our study shows that patients from urban non-interventional or rural catchments are significantly less likely to have LVEF assessment during their admission, even though all patients were transferred to an interventional centre. This is likely due to a service focus on delivering angiography and maintaining rapid patient throughput in these interventional centres, with patients waiting in rural and urban non-interventional hospitals where access to echocardiography is limited. This finding of fewer patients receiving LVEF assessment in non-interventional hospitals has been previously seen in Australian and Aotearoa New Zealand data.[24] The percentage of patients that presented to these non-interventional hospitals in Aotearoa New Zealand and received an LVEF assessment lags behind many other countries and regions (e.g., Israel 72–87.9%, Europe 78–93%, China 81%).[25,26]

A higher percentage of Māori and Pacific patients who presented to urban interventional hospitals received an assessment of LVEF compared with non-Māori, non-Pacific peoples; however, this was not apparent for Māori who presented to rural hospitals or urban non-interventional hospitals. This is the opposite situation to coronary angiography. The discrepancy could be explained by the presence of well-developed echocardiographic services but the lack of angiography capacity in hospital catchments with large Māori and Pacific populations. Māori patients are also more likely to present with NSTEACS complicated by cardiac arrest or heart failure. In this situation, echocardiography (but not angiography) is prioritised.[20] Where echocardiography is less available, this prioritisation is not possible.

Secondary prevention medication

Regardless of the type of hospital patients presented to, the majority received discharge prescriptions for guideline-directed secondary preventative medications.

While the high overall rate of prescription of these medications is consistent with other Aotearoa New Zealand studies,[27,28] our results are in contrast to international data that shows patients from smaller regional and rural places who have NSTEACS were less likely to receive guideline-directed medications.[24] The lack of meaningful difference in prescribing at the point of discharge between hospital categories doesn't explain the small increase in 2-year mortality seen in a previous study,[2] although long-term maintenance of these medications for patients who live in rural areas requires further examination.

Patients were more likely to get a prescription for beta-blockers if they presented to rural hospitals or urban non-interventional hospitals. International guidelines acknowledge the role of beta-blockers after NSTEACS in patients with reduced ejection fraction,[6] but the role of beta-blockers is uncertain in patients with preserved ejection fraction.[29] This uncertainty may be reflected in the prescribing of specialist cardiologists but not of more generalist doctors, who are also less likely to know the patient's LVEF due to the unavailability of echocardiography. In those that did get echocardiography, there were no differences in the measured LVEF between hospital groups.

Strengths and weaknesses

The strength of this study is the use of the

ANZACS-QI Cath-PCI registry. This has a high level of capture of patients that receive angiography.[12] A potential limitation is that any investigations (e.g., echocardiography) or treatments (including secondary prevention medications) that patients who didn't receive angiography (approximately 40% of patients with NSTEACS) may have accessed were not able to be included in the analysis.[2,17] Additionally, patients were not risk stratified to determine when angiography should occur according to guidelines (e.g., high-risk patients should have angiography within 24 hours).[6] This could be reviewed in future studies. A composite medication outcome wasn't used for this study and so no comparison could be made with the Aotearoa New Zealand target of 85% for this outcome measure.

This study focusses on which type of hospitals patients present to, rather than the rural–urban category of their usual residence. Future studies using the Geographic Classification for Health are planned.[3]

Only investigations and treatments performed during the index admission were considered and it is unknown whether patients had investigations after discharge. Additionally, some patients may have been assessed using non-invasive means, such as CT coronary angiogram.[12]

Policy implications

For patients who present to rural hospitals or urban non-interventional hospitals, especially those who are Māori or Pacific, there are ongoing inequities in the timing of angiography and the assessment of LVEF. However, despite these inequities, the category of hospital that a patient presented to didn't impact mortality or major adverse cardiac events up to 1 year post-NSTEACS.[2] This lack of difference in outcomes might reflect the high prescription rates of secondary medications observed in all three categories of hospital.

The success of quality improvement programmes such as ANZACS-QI is well documented, and ongoing reporting of guideline-driven performance measures should consider differentiation of rural and urban areas and include analyses by ethnicity. These differences are often larger than the differences between regions.[2,30]

Addressing the mechanisms that facilitate timely (but not necessarily immediate) inter-hospital transfer for investigations in patients with NSTEACS should be a priority for Te Whatu Ora – Health New Zealand and Te Aka Whai Ora – Māori Health Authority to ensure that evidence-based investigations and interventions are performed. In particular, clinicians in urban hospitals with ready access to echocardiography should ensure that this is performed before the patient is discharged back to a provincial or rural location, where this investigation might be harder to access. A robust national registry for echocardiography is also required.

Conclusion

Patients who present to rural hospitals or urban non-interventional hospitals are less likely to receive angiography within 3 days or an assessment of LVEF. Fewer Māori received angiography within 3 days regardless of the category of hospital presentation. There are high levels of the prescribing of secondary prevention medications across all three hospital categories.

COMPETING INTERESTS
Nil.
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AUTHOR INFORMATION
Dr Rory Miller: Rural Doctor and Senior Lecturer, Department of General Practice and Health, University of Otago, Dunedin, New Zealand.
Professor Garry Nixon: Rural Doctor and Associate Professor Rural Health, Department of General Practice and Health, University of Otago, Dunedin, New Zealand.
Professor Robin M Turner: Professor of Biostatistics, Biostatistics Centre, University of Otago, Dunedin, New Zealand.
Professor Tim Stokes: Professor of General Practice, Department of General Practice and Rural Health, University of Otago, Dunedin, New Zealand.
Dr Rawiri Keenan: Medical Research Centre, University of Waikato, Hamilton, New Zealand; Department of General Practice and Rural Health, University of Otago, Dunedin, New Zealand.
Dr Yannan Jiang: Senior Research Fellow Statistics, Department of Statistics, The University of Auckland, Auckland, New Zealand; National Institute for Health Innovation, School of Population Health, The University of Auckland, Auckland, New Zealand.
Dr Corina Grey: Public Health Physician, Department of General Practice and Primary Healthcare, The University of Auckland, Auckland, New Zealand.
Associate Professor Sue Wells: Epidemiology and Biostatics, School of Population Health, Faculty of Medical and Health Sciences, The University of Auckland, Auckland, New Zealand.
Dr Wil Harrison: Cardiologist, Cardiology Department Middlemore Hospital, Middlemore, New Zealand.
Professor Andrew Kerr: Cardiologist, Cardiology Department Middlemore Hospital, Middlemore, New Zealand.

CORRESPONDING AUTHOR
Dr Rory Miller: Department of General Practice and Rural Health, University of Otago, PO Box 56, Dunedin 9054, New Zealand. E: Rory.miller@otago.ac.nz

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Appendices

Appendix 1

Appendix 1: Findings from inpatient investigations (angiography and left ventricular ejection fraction [LVEF] assessment) after non-ST segment elevation acute coronary syndrome and interventions (percutaneous intervention and coronary artery bypass graft) performed or referred.

	Total	Urban interventional hospital	Urban non-interventional hospital	Rural hospital
Angiography findings				
No significant coronary artery disease	4,369 (16.3%)	2,676 (15.1%)	1,338 (19.5%)	355 (16.2%)
Single/double vessel disease	13,907 (51.9%)	9,320 (52.9%)	3,430 (50.0%)	1,157 (52.8%)
Three vessel disease	8,503 (31.8%)	5,727 (32.3%)	2,095 (30.5%)	681 (31.1%)
Percutaneous intervention performed during index admission				
	13,661 (51.0%)	9,355 (52.8%)	3,162 (46.1%)	1,144 (52.2%)
Referred for coronary artery bypass graft				
Inpatient	3,692 (13.8%)	2,454 (13.8%)	926 (13.5%)	312 (14.2%)
Outpatient	374 (1.4%)	251 (1.4%)	94 (1.4%)	29 (1.3%)
Findings from LVEF assessment				
Normal (50+)	13,456 (67.8%)	9,501 (68.3%)	2,980 (66.4%)	975 (67%)
Mid-range (40–49)	3,328 (16.8%)	2,335 (16.8%)	739 (16.5%)	254 (17.5%)
Reduced (<40)	2,588 (13.0%)	1,777 (12.7%)	631 (14.1%)	180 (12.4%)
Not quantified further	329 (1.7%)	182 (1.3%)	114 (2.5%)	33 (2.3%)
Missing	160 (0.8%)	120 (0.9%)	28 (0.6%)	13 (0.9%)

Appendix 2

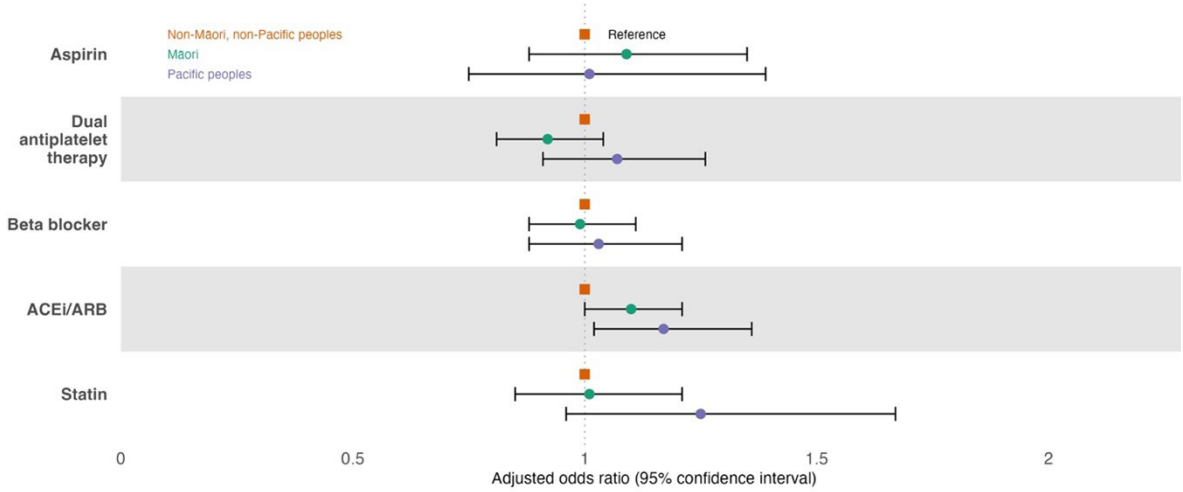
Appendix 2: The number and percentage as well as unadjusted and adjusted odds ratios (OR) of secondary preventative medications prescribed at discharge for non-Māori, non-Pacific, Māori and Pacific patients. Non-Māori, non-Pacific was considered the reference group for all ORs.

	Total	Non-Māori, non-Pacific	Māori	Pacific
Aspirin				
Prescribed	25,203 (94.1%)	21,222 (94.3%)	2,660 (92.2%)	1,321 (94.6%)
CI† or not tolerated	542 (2.0%)	438 (2.0%)	85 (3.0%)	19 (1.4%)
Unadjusted OR‡			***0.76 (0.63, 0.91)***	***0.91 (0.70, 1.21)***
Adjusted OR[1]			1.09 (0.88, 1.35)	1.01 (0.75, 1.39)
Dual antiplatelet therapy				
Prescribed	19,519 (72.9%)	16,645 (74.0%)	*1,969 (68.2%)*	*905 (64.8%)*
CI or not tolerated	542 (2.0%)	438 (2.0%)	85 (3.0%)	19 (1.4%)
Unadjusted OR			*0.76 (0.70, 0.82)*	*0.63 (0.70, 0.82)*
Adjusted OR[2]			0.92 (0.81, 1.04)	1.07 (0.91, 1.26)
Beta-blocker				
Prescribed	21,325 (79.6%)	17,961 (79.8%)	2,284 (79.2%)	1,080 (77.3%)
CI or not tolerated	1,258 (4.7%)	1,019 (4.5%)	163 (5.7%)	76 (5.4%)
Unadjusted OR			***1.03 (0.93, 1.15)***	***0.89 (0.77, 1.03)***
Adjusted OR[3]			0.99 (0.88, 1.11)	1.03 (0.88, 1.21)
ACEi§/ARB¶				
Prescribed	18,348 (68.5%)	15,243 (67.8%)	2,053 (71.2%)	1,052 (75.3%)
CI or not tolerated	868 (3.2%)	730 (3.2%)	88 (3.1%)	50 (3.6%)
Unadjusted OR			***1.18 (1.08, 1.28)***	***1.53 (1.34, 1.74)***
Adjusted OR[4]			1.1 (1.00, 1.21)	**1.17 (1.02, 1.36)**
Statin				
Prescribed	24,703 (92.2%)	20,741 (92.2%)	2,649 (91.8%)	1,313 (94%)
CI or not tolerated	560 (2.1%)	495 (2.2%)	48 (1.7%)	17 (1.2%)
Unadjusted OR			***0.85 (0.72, 0.99)***	*1.17 (0.92, 1.52)*
Adjusted OR[5]			1.01 (0.85, 1.21)	1.25 (0.96, 1.67)

† Contraindicated
‡ To calculate the OR for each medication prescribed, the medication was considered prescribed if it was "prescribed" or "contraindicated (CI) or not tolerated".
§ Angiotension-converting enzyme inhibitor
¶ Angiotension receptor blocker
1 = OR adjusted for: hospital category, sex, age, cardiac arrest on arrival, Grace score, diabetes, admission heart rate, LDL cholesterol, admission systolic blood pressure, LVEF assessment, LVEF findings, angiography within 3 days, angiography findings, oral anticoagulant use, PCI during admission, region.
2 = OR adjusted for: hospital category, sex, age, current smoker, cardiac arrest on arrival, Grace score, Killip group, prior myocardial infarction, prior cardiovascular disease, dialysis, estimated glomerular filtration rate (eGFR), admission heart rate, admission systolic blood pressure, LVEF assessment, LVEF findings, angiography within 3 days, angiography findings, oral anti-coagulant use, PCI during admission, referred for coronary artery bypass graft (CABG), region.
3 = OR adjusted for: hospital category, sex, current smoker, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, body mass index (BMI), admission heart rate, admission systolic blood pressure, LVEF findings, angiography findings, oral anti-coagulant use, region.
4 = OR adjusted for: hospital category, sex, age, Killip group, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, history of congestive heart failure, admission systolic blood pressure, BMI, LVEF assessment, LVEF findings, angiography within 3 days, referred for CABG, region.
5 = OR adjusted for: hospital category, age, sex, current smoker, Killip group, Grace score, diabetes, dialysis, eGFR, prior cardiovascular disease, BMI, admission heart rate, LDL cholesterol, admission systolic blood pressure, LVEF assessment, LVEF findings, angiography within 3 days, PCI during admission, referred CABG, oral anti-coagulant use, region.

Appendix 3

Appendix 3: Adjusted OR of secondary preventative medications prescribed at discharge for non-Māori, non-Pacific, Māori and Pacific patients. Non-Māori, non-Pacific was considered the reference group for all ORs.



Appendix 4: Sensitivity analysis for missing data—multiple imputation

The R-package "mice: Multivariate Imputation by Chained Equations in R (MICE)" was used to create a multinomial regression model using five imputations with 50 iterations each to fill the missing data within the body mass index variable (BMI). This was checked graphically to ensure that the distribution with the imputed data was consistent with the original data. All regression models that incorporated the BMI variable were then re-run using each of the five imputed datasets. The pooled OR and 95% confidence intervals were then determined and compared to the calculated OR, where the missing data were categorised separately.

		Urban interventional hospital	**Urban non-interventional hospital**	**Rural hospital**
Angiography within 3 days				
Non-Māori, non-Pacific	*Adjusted OR*	1 (reference)	**0.35 (0.33, 0.38)**	**0.38 (0.34, 0.42)**
	MICE	1 (reference)	**0.35 (0.33, 0.38)**	**0.38 (0.34, 0.42)**
Māori	*OR*	**0.78 (0.68, 0.89)**	**0.34 (0.3, 0.39)**	**0.40 (0.31, 0.52)**
	MICE	**0.78 (0.68, 0.89)**	**0.34 (0.3, 0.39)**	**0.40 (0.31, 0.52)**
Pacific peoples	*OR*	**0.75 (0.65, 0.86)**	**0.39 (0.26, 0.62)**	0.48 (0.24, 1.00)
	MICE	**0.75 (0.65, 0.86)**	**0.39 (0.25, 0.61)**	**0.48 (0.24, 0.97)**
Assessment of LVEF				
Non-Māori, non-Pacific	*OR*	1 (reference)	**0.54 (0.50, 0.58)**	**0.56 (0.50, 0.62)**
	MICE	1 (reference)	**0.54 (0.5, 0.58)**	**0.56 (0.5, 0.62)**
Māori	*OR*	**1.30 (1.12, 1.51)**	**0.61 (0.53, 0.71)**	**0.40 (0.31, 0.52)**
	MICE	**1.29 (1.12, 1.51)**	**0.61 (0.53, 0.71)**	**0.40 (0.31, 0.52)**
Pacific peoples	*OR*	**1.35 (1.14, 1.62)**	0.66 (0.41, 1.06)	0.93 (0.43, 2.25)
	MICE	**1.35 (1.14, 1.61)**	0.66 (0.41, 1.05)	0.93 (0.41, 2.11)
		Urban hospital with PCI	**Urban hospital without PCI**	**Rural hospital**
Aspirin	*OR*	1 (reference)	0.89 (0.75, 1.05)	**0.66 (0.52, 0.85)**
	MICE	1 (reference)	0.89 (0.75, 1.05)	0.66 (0.52, 0.85)
Dual antiplatelet therapy	*OR*	1 (reference)	1.10 (1.00, 1.21)	1.15 (1.00, 1.34)
	MICE	1 (reference)	1.01 (1.00, 1.21)	1.15 (0.99, 1.33)
Beta-blocker	*OR*	1 (reference)	**1.40 (1.28, 1.53)**	**1.34 (1.16, 1.54)**
	MICE	1 (reference)	**1.40 (1.27, 1.52)**	**1.34 (1.16, 1.55)**
ACEi/ARB	*OR*	1 (reference)	**1.16 (1.08, 1.25)**	1.08 (0.97, 1.20)
	MICE	1 (reference)	**1.15 (1.08, 1.24)**	1.08 (0.98, 1.20)
Statin	*OR*	1 (reference)	**1.17 (1.02, 1.34)**	0.93 (0.76, 1.13)
	MICE	1 (reference)	1.17 (1.02, 1.34)	0.93 (0.76, 1.13)

Call to action—the urgent need for a heart health plan in New Zealand

Gerry Devlin, Collin Tukuitonga, Corina Grey, Mark Richards, Anna Rolleston, Rob Doughty, Malcolm Legget, Jim Mann

ABSTRACT

Cardiovascular diseases are responsible for almost 10,000 deaths annually in Aotearoa New Zealand. Almost a quarter of these are avoidable, increasing to half of all cardiovascular deaths for Māori and Pacific people. Health system reforms are an opportunity to set clear ambitious goals for improved heart health. This has been done for smoking, a cancer plan, mental health and diabetes among other health conditions. Given the scale of avoidable heart disease and avoidable heart health inequity, much of it due to people simply not accessing existing treatment options, there is no excuse not to deliver a national heart health action plan and we urge health policy makers to put it on the agenda.

Cardiovascular disease is responsible for a third of all deaths and is the leading cause of health loss in Aotearoa New Zealand. The current health system reform presents a once in a generation opportunity to address how our health system works for all. This includes addressing the gap in heart health outcomes[1] systematically and fairly to allow hundreds of thousands of affected New Zealanders to live longer and healthier lives.

When the Government released Te Pae Tata Interim New Zealand Health Plan 2022 it was disappointing that a clear commitment to reducing the burden of heart disease and stroke was not evident.[2]

In 2020, the Heart Foundation first called for a national heart health action plan. Since then, almost 30,000 New Zealanders have lost their lives to heart disease and stroke. We estimate 7,000 of those deaths were premature and avoidable.[3] These deaths could have been avoided through better prevention and improved and timely access to evidence-based healthcare.

The Heart Foundation is reiterating the urgent need for a national action plan for heart health, advocating for ambitious and achievable goals for better and more equitable heart health outcomes, by delivering a better heart health system. This starts with better prevention from early childhood and extends across the life course from assessing, understanding and managing heart disease risk, timely access to heart healthcare, improving survival following a heart event and planning for a sustainable skilled workforce delivering world-class care in a timely manner and where it is most needed.

In Aotearoa New Zealand there are huge and avoidable disparities in heart health outcomes. Māori, Pacific people and those living in the most deprived parts of the country are more likely to be exposed to risk factors such as smoking, and to face multiple barriers to accessing care including cost, transport, discrimination and systemic racism.[4,5,6] This results in under and delayed diagnosis and subsequent management and support. Urgent work is required to better understand and remove these barriers.[7]

Reasons for these disparities are complex, and include historical injustices, prejudice and mistrust in the health system, struggles for resources including health workforce, health literacy and geographical isolation.[8] In addition those regions with the greatest need for better heart healthcare are those with poorest access to healthcare, particularly delivered close to home.[9]

Progress on recommendations to improve heart health outcomes since 2020 has been poor. There have been some areas to celebrate including aggressive action towards a Smokefree 2025, some access to new drug treatments and the funding of a new centre of research excellence in heart health.[10] However, progress has been piecemeal, rather than bound by a clear and integrated strategy for achieving better outcomes.

Access to basic cardiovascular risk assessments and to cardiology services remains inconsistent and lacking for many New Zealanders. There are restrictions and limitations on access to cost-effective and evidence-based treatments, and cardiac arrest survival rates are hampered by inconsistent access to CPR and community defibrillators.[11]

Elements of the health system of Aotearoa New

Zealand aimed at heart health are not currently working for everyone, especially for Māori, Pacific people, people living in areas of high deprivation and rural New Zealanders. About half of cardiovascular deaths in these populations are avoidable, meaning we could significantly reduce the impact of heart disease and stroke and improve health equity if our prevention and health care systems were working fairly for all.[12]

We have seen how ambitious targets can achieve results, in particular the substantial progress towards Smokefree 2025.[13]

The updated Heart Foundation white paper recommends that a national heart health action plan sets bold targets for better heart health and identifies six key areas that build on current strengths and have the potential to significantly reduce the impact of heart disease and stroke on all New Zealanders. It proposes that a national action plan has high level goals to reduce the rate of avoidable heart disease mortality and morbidity for all New Zealanders by at least 50% by 2050, and by 2040 for Māori and Pacific people.

Achieving these goals will require a life course approach with a balance between addressing outcomes for those at most immediate risk of heart disease by improving access to care and support, building a strong approach to heart disease risk screening and management, and ensuring better large-scale and sustainable outcomes longer term through effective prevention.

Our six priorities for a national heart health action plan are:

1. Reduce the risk of heart-related disease through prevention

Goal 1: reverse the declining trends in consumption of healthy food and physical activity and achieve minimal smoking for all populations by 2025.

A stronger prevention system needs to urgently address the personal and systemic financial and environmental barriers families face in accessing healthy food and undertaking regular physical activity.[4,14] A system where all children and families have the same access and rights to a healthy learning environment connected to their community is vital to set up young New Zealanders for heart-healthy lives.

2. Early detection and management of heart disease

Goal 2: 95% of eligible New Zealanders are risk assessed for cardiovascular disease (heart disease and stroke) and advised on appropriate risk management.

Manatū Hauora – Ministry of Health published the standard for cardiovascular disease risk assessment and management in primary care in 2018. It set out new guidelines recommending beginning cardiovascular risk assessments for men from age 45 and women from age 55. For Māori, Pacific and South Asian populations, risk assessment is recommended to start 15 years earlier than in other population groups.[15] Guidelines also set out standards for managing risk, and were accompanied by New Zealand's own cardiovascular risk prediction equations for use in primary care.[16] Five years later, there is still no systematic approach to risk assessment, and management of cardiovascular risk.

For example, close to one in five adults have elevated blood pressure (>140/90mm Hg),[15] yet fewer than one in three New Zealanders with elevated blood pressure have it well controlled. This is well behind the OECD average.[17] Routine risk assessment, and identifying and managing those with risk—especially high blood pressure—is highly cost effective and will have an almost immediate impact on improving cardiovascular health in New Zealand.[18]

3. Timely access to evidence-based and effective care and support

Goal 3: reduce hospitalisations for acute cardiac presentations and stroke by 50% by 2040, with a particular focus on Māori, Pacific and South Asian populations.

People are often not able to access the heath system until forced to by an emergency, and even then delays in seeking and receiving care are common. A third of New Zealanders who had a heart attack in 2022 waited more than 2 hours to call for help.[19] A deterioration in timely access to angiography following an acute coronary syndrome presentation was also noted in 2022.[20]

There is significant regional variation in access to specialist opinion, diagnostic services including echocardiography, CT angiography, electrophysiology and invasive angiography with resultant variation in revascularisation, cardiac surgery and valve intervention.[21] Often these variations are inconsistent with need, with reduced access and longer wait times affecting communities at highest risk of poor heart health outcomes.

Aotearoa New Zealand is falling behind other

countries with respect to access to effective evidence-based and recommended medicines. Current examples include restricted access to new diabetes drugs that improve heart health outcomes, which are currently only available to high-risk populations by special authority. SGLT-II inhibitors are a recommended foundation pillar of heart failure care in international guidelines[22] (Level I A) and are not currently funded for this indication in Aotearoa New Zealand. Sacubitril-Valsartan is a recommended foundation pillar for heart failure (Level I B) but is available with restricted access only.[22,23]

The delays in reaching care in the first place, delays in subsequent treatment and access to evidence-based care and medications are an entirely preventable failure of the health system. It requires a focus on early risk management and treatments, and on working with communities to remove the barriers to heart healthcare. Access to effective heart healthcare needs to match up with communities with the highest need, and the current situation where New Zealanders lack access to proven and cost-effective heart health medications must urgently be addressed.

4. Increase survival rates for out-of-hospital cardiac arrest

Goal 4: increase the survival rates for out-of-hospital cardiac arrest by 25% by 2030.

More than 2,300 people experienced a cardiac arrest in the community or at home in the year ending June 2022. Only one in 10 people who suffered an out-of-hospital cardiac arrest survived to hospital discharge compared to 1 in 7 in 2018.[19] We can reverse this trend by increasing access to life-saving CPR (cardiopulmonary resuscitation) and ensuring community defibrillators are where they are needed most, and by addressing regional and local disparities in access.[11] Aotearoa New Zealand should join nations like the United Kingdom, Germany, China, Norway, Sweden and the majority of states in the United States where teaching CPR in schools is mandatory. Teaching CPR and AED (automated external defibrillator) skills in schools is a simple addition to the curriculum that will increase rates of bystander CPR, improve access to early defibrillation and achieve better outcomes for people suffering out-of-hospital cardiac arrest.[24]

5. A more transparent and accountable health system

Goal 5: set clear accountable goals for heart disease risk management and outcomes and provide adequate resourcing and incentives to achieve them.

Currently, around one in eight health dollars are spent on heart disease and stroke, and the wider costs associated with disability and death reaches many hundreds of millions of dollars.[25] Acting on heart health is highly cost effective—just improving on the sub-optimal management of high blood pressure alone would reduce the lifetime cost to the health system by several million dollars.[18]

A transparent health system requires clear accountability to those most at risk of heart disease, and uses data systematically to measure and improve impact. While we can measure risks, such as smoking, and outcomes, such as hospitalisations and deaths, there are limited systematic measures of prevention and management of heart disease, with some areas of the heart health journey better covered than others. For example, Te Whatu Ora – Health New Zealand fund the All New Zealand Acute Coronary Syndrome Quality Improvement programme (ANZACS-QI), collecting data from secondary care allowing for benchmarking of services provided, which also highlights quality improvement opportunities. Data on planned care wait times can be accessed, and drug dispensing is available via Pharmac.[26,27] However, these are reported largely independent of each other, and not in the context of an overarching strategy for cardiovascular disease. A heart health strategy must pull this together in order to cohesively drive and measure improvement across the health continuum, and be accountable and transparent to patients and the public. For example, drawing on the experiences from Aotearoa New Zealand's world-leading COVID-19 reporting.[28]

Aotearoa New Zealand needs accessible, coordinated and quality national data that report accurate, timely information on the burden of heart disease, monitors and guides efforts and, in particular, increases transparency and accountability for closing the heart health equity gap.

6. Support a world-class health workforce to translate research into practice

Goal 6: attract and maintain a world-class health workforce delivering world-class heart healthcare in Aotearoa New Zealand.

Aotearoa New Zealand has world-class heart research programmes both domestically and through international collaborations. Developing and resourcing stronger pathways from research to practice and closing the evidence-to-action gap will ensure that New Zealanders are benefitting from research.

Putting research findings into action requires supporting and sustaining a high-quality workforce and providing resources for implementation. Currently New Zealand faces a future health workforce shortage and limited representation in our heart health workforce including doctors, nurses, cardiac physiologists and echosonographers. There are around 160 cardiologists practicing in Aotearoa New Zealand, of whom an estimated 2.5% are Māori or Pacific. Eighteen percent are women.[29,30] Māori and Pacific nurses are also under-represented in cardiac specialties.[31] There are also significant inequalities in FTE numbers of the heart health workforce across regions. More promotion of heart health as a career pathway, to build a sustainable, skilled and diverse workforce that represents the Aotearoa New Zealand population, is urgently required. It will build expertise for the future and create a workforce that is connected and relevant to patients.

In summary, cardiovascular disease remains responsible for a third of all mortality and is the leading cause of health loss in Aotearoa New Zealand. More New Zealanders are living with heart disease than ever before. There are huge disparities in timely diagnosis, treatment and outcomes in heart health, most of which is avoidable. Aotearoa New Zealand is a world leader in many aspects of heart research, but translation into outcomes for our population remains inconsistent, unequal and unfair, and is falling behind international best practice. Movement beyond the current disconnected and *ad hoc* approach is needed.

Aotearoa New Zealand urgently needs an action plan to focus on reducing the avoidable and inequitable burden of heart disease. Health system reforms are a critical opportunity to address the lack of coherent strategy for heart health and bring together clinicians, health planners, policy makers, communities and Māori and Pacific health leaders to develop a roadmap for better outcomes.

This has been done for smoking, cancer, mental health and diabetes, among other health conditions. Given the scale of avoidable heart disease and avoidable heart health inequity, much of it due to people simply not accessing existing treatment options, there is no excuse not to deliver a national heart health action plan and we urge health policy makers to put it on the agenda.

COMPETING INTERESTS
Nil.

AUTHOR INFORMATION
Gerry Devlin: Medical Director, New Zealand Heart Foundation, New Zealand.
Sir Collin Tukuitonga: Associate Dean Pacific, Faculty of Medical and Health Sciences, The University of Auckland, New Zealand.
Corina Grey: Senior Research Fellow, Faculty of Medical and Health Sciences, The University of Auckland, New Zealand; Pacific Health Data and Insights Lead, Auckland District Health Board, New Zealand.
Mark Richards: Director, Christchurch Heart Institute, New Zealand.
Anna Rolleston: Co-director Manaaki Manawa Healthy Heart for Aotearoa Centre for Research Excellence, The University of Auckland, New Zealand.
Rob Doughty: Heart Foundation Chair of Heart Health, The University of Auckland, New Zealand.
Malcolm Legget: Cardiologist and Associate Professor Faculty of Medical and Health Sciences, The University of Auckland, New Zealand.
Sir Jim Mann: Professor in Human Nutrition & Medicine, Edgar National Centre for Diabetes & Obesity Research, University of Otago, New Zealand.

CORRESPONDING AUTHOR
Gerry Devlin: Medical Director, New Zealand Heart Foundation, New Zealand.
E: GerryD@heartfoundation.org.nz

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No fixed abode: a case report highlighting the complexities of schizophrenia and homelessness in the context of diminishing access to psychiatric rehabilitation

Matthew Tennant, Cameron Lacey

In a recent *New Zealand Medical Journal* editorial, Frizelle highlighted the plight of homeless people in New Zealand, bringing to our attention the growth in homelessness which disproportionately affects Māori, Pasifika and those with major mental illness and addiction.[1] This case highlights some of the complexities of treating people with schizophrenia who are homeless in New Zealand.

Case history

A 41-year-old Māori man (iwi: Ngā Puhi, Ngāti Porou) self-presented to an emergency department because he felt "unsafe". He described auditory hallucinations and a belief that he was being controlled by an external force, along with insomnia and poor nutrition. He was homeless, estranged from whānau, unemployed and receiving no benefits.

His parents had migrated to the South Island when he was young, and he had since felt disconnected from his iwi.

He had one previous psychiatric admission 7 years earlier and was diagnosed with schizophrenia. After 2 years he was "lost to follow-up", with no fixed abode, and had no mental health care for 5 years. Over this time, he moved between transient accommodation and living on the street. His whānau had only intermittent contact with him and they described fluctuating psychosis complicated by use of cannabis and synthetic cannabinoids.

Prior to his presentation, whānau attempted to provide support and shelter; however, at the time he experienced paranoia and carried a knife. It soon escalated into a physical altercation with his brother and, as a result, he became estranged from his whānau.

He was admitted voluntarily for 3 weeks. He responded well to risperidone and then to paliperidone depot every 4 weeks. Efforts to arrange suitable accommodation while he was an inpatient were unsuccessful. Due to bed pressure, he was discharged despite having "no fixed abode" and taken to a homeless shelter.

On remission of his psychosis, the man described sudden lucidity regarding his illness, estrangement from family and isolation from society. At this point he developed a depressed mood with suicidality.

For the last 4 months since discharge, he has reported no symptoms of psychosis. He has taken his paliperidone regularly and is not using illicit substances. Despite persistent advocacy, he still has no permanent accommodation and is on a waiting list with Kāinga Ora.

Discussion

This man had 5 years of untreated psychosis perpetuated by homelessness and lack of mental health care.

Approximately 21% of homeless people have psychotic disorders.[2]

Māori men are disproportionately affected by schizophrenia and homelessness.[1,3] Factors likely to have contributed to this disadvantage include colonisation, marginalisation, migration and racism.[4]

Inconsistent or unsafe accommodation is destabilising for those with schizophrenia and limits access to psychiatric case management.[3] Being discharged from a psychiatric hospital to "no fixed abode" adversely impacts one's health and dignity.[5] Inadequate access to accommodation for those with schizophrenia is arguably a breach of the Code of Health and Disability

Services Consumers' Rights, right 4 (3,4,5).[6] Negative stereotypes have been used to justify inaction by viewing accommodation as out of the scope of institutional responsibility.[7]

Waitaha Canterbury's psychiatric rehabilitation beds have reduced from 39 beds (over two units) to 16 beds (in one unit), which serve a population of approximately 594,000. This will mean less support is available for those with severe psychotic disorders. Research is needed into how reduced psychiatric rehabilitation impacts on Māori who are discharged to "no fixed abode".

Alongside assertive pharmacological treatment, stable accommodation, physical health, vocational rehabilitation and cultural support should all be a priority in the treatment of schizophrenia.[3]

COMPETING INTERESTS
Nil.

AUTHOR INFORMATION
Dr Matthew Tennant: Senior Lecturer, Department of Psychological Medicine, University of Otago, Christchurch, New Zealand.
Dr Cameron Lacey: Associate Professor & Director, Māori/Indigenous Health Institute, University of Otago, Christchurch, New Zealand.

CORRESPONDING AUTHOR
Dr Matthew Tennant: Senior Lecturer, Department of Psychological Medicine, University of Otago, Christchurch, New Zealand.
E: Matthew.tennant@otago.ac.nz

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Increasing isolation of non-toxigenic Corynebacterium diphtheriae in Aotearoa New Zealand

Shivani Fox-Lewis, Sharmini Muttaiyah, Sally Roberts

Diphtheria is rare in Aotearoa New Zealand, largely due to successful vaccination (three primary series doses and two booster doses in the childhood immunisation schedule, and two adult booster doses).[1] There have been international outbreaks, particularly in regions without effective vaccination programmes. The highest number of cases worldwide is in the World Health Organization South-East Asia region (data from 2000 to 2017).[2]

Diphtheria is a bacterial infection caused by toxigenic strains of *Corynebacterium diphtheriae*, *C. ulcerans* and *C. pseudotuberculosis*, with the first being the most common human pathogen. Toxigenic *C. diphtheriae* can cause respiratory diphtheria with nasal, pharyngeal or laryngeal involvement and formation of the pathognomonic grey pseudomembrane, or non-respiratory diphtheria e.g., cutaneous diphtheria (non-healing ulcers). Distant complications of toxigenic *C. diphtheriae* include myocarditis, neuropathy and renal impairment.[3] Non-toxigenic strains generally cause less severe disease, although bacteraemia and endocarditis have been reported.[4]

Diphtheria is a notifiable disease.[5] Isolates from around the country are sent to the national reference laboratory (Institute of Environmental Science and Research [ESR]) for polymerase chain reaction (PCR) testing for the *tox* gene. If positive, the isolate is reported as toxigenic.

Recent reports from Australia suggest an increasing number of cases of diphtheria notified to public health, particularly since 2011.[6] Most cases were cutaneous. Within a clonal outbreak of 29 cases of toxigenic *C. diphtheriae* in Queensland, Australia, there were eight respiratory cases.[7] In the Northern Territories, Australia, all 148 *C. diphtheriae* isolates in 2022 were from polymicrobial cutaneous samples. Of 41 isolates tested, none were toxigenic.[8] Overall there is variation in the reports across Australia.

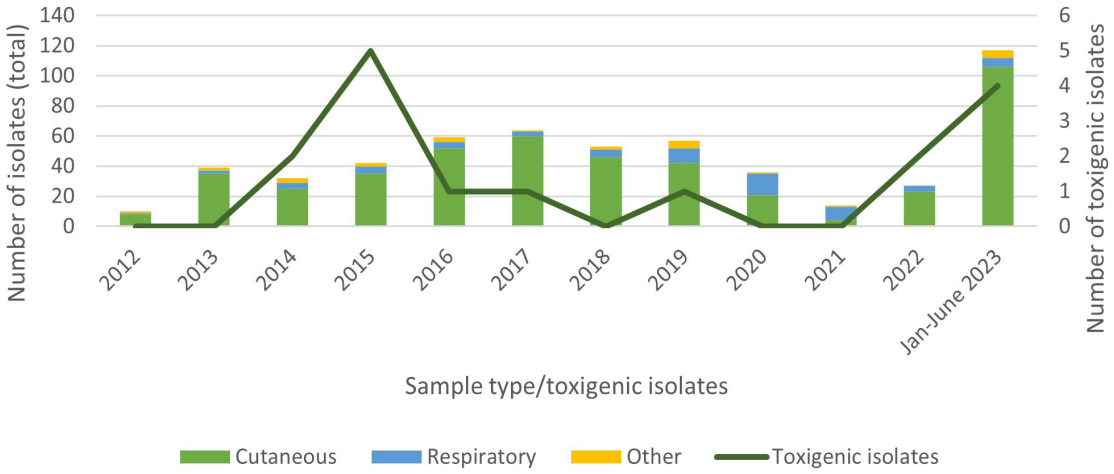
We sought to obtain an overview of the situation in Aotearoa New Zealand to determine the likely source of *C. diphtheriae* isolates, and the proportion that are toxigenic.

From 2012 to June 2023, a total of 550 isolates were referred to ESR. *C. diphtheriae* accounted for 538 (98%) of them. Auckland contributed 324 (59%), and Canterbury contributed 107 (19%) isolates. One fifth (117) of the isolates were referred in 2023 (up to June 2023). Of the 550 isolates, 16 (3%) were toxigenic, all *C. diphtheriae*. The trend over time in toxigenic isolates does not clearly show a rise above previous years (Figure 1). Of note, there was a decline in the number of isolates referred in 2020–2021 during the time of restricted international travel.

We sought to characterise the antimicrobial susceptibility pattern of all *C. diphtheriae* isolates from a tertiary hospital in Auckland. From 2012 to June 2023, LabPLUS Auckland City Hospital had 43 unique *C. diphtheriae* isolates. Antimicrobial susceptibility testing was performed according to the Clinical & Laboratory Standards Institute (CLSI) method until 2015, after which the European Committee on Antimicrobial Susceptibility Testing (EUCAST) method was followed. EUCAST provided interpretive criteria for *Corynebacterium* species until 2023, when species-specific interpretive criteria were provided for *C. diphtheriae*. Since there are now interpretive criteria for *C. diphtheriae* specifically, the historic susceptibility data were re-interpreted using the new criteria (Table 1). The EUCAST method did not change over this time. Testing was performed either by disk diffusion resulting in a zone diameter, or broth microdilution resulting in a minimum inhibitory concentration (MIC) of antibiotic.

Of the 43 unique *C. diphtheriae* isolates, 37 had penicillin susceptibility testing performed; all but one were categorised as "susceptible increased exposure" (I). All isolates were not tested using the same method; 19 isolates underwent MIC testing, and 26 isolates underwent disk diffusion testing. Eight isolates were tested via both methods. The minimum inhibitory concentration of penicillin

Figure 1: The number of isolates referred to ESR from 2012 to June 2023 by sample type and the number of toxigenic isolates.



The histogram depicts the number of isolates referred to ESR per year by the type of sample. "Other" includes blood culture isolates and unknown sample type. The dark green line shows the number of toxigenic isolates per year.

Table 1: Penicillin susceptibility test results for all LabPLUS *C. diphtheriae* isolates from 2012 to June 2023.

Penicillin susceptibility test result	**MIC (mg/L) n=19**					**Zone diameter (mm) n=26**			**Interpretation n=37**		
	0.12	0.25	0.5	1.0	4.0	<12	12–50	≥50	**S**	**I**	**R**
Number of isolates	1	7	9	1	1	1	25	0	**0**	**36**	**1**

Eight isolates had both MIC and zone diameter results. For all these eight isolates the MIC and zone diameter resulted in the same categorical interpretation. Isolates with MIC >1.0mg/L or zone diameter <12mm to penicillin are categorised "resistant". Isolates with MIC <0.001mg/L or zone diameter ≥50mm are categorised "susceptible". Isolates with MIC or zone diameter results within these ranges are categorised "susceptible increased exposure". The interpretation column provides the overall interpretation of the penicillin susceptibility based on MIC and zone diameter results for all 37 isolates. S is susceptible, I is susceptible increased exposure and R is resistant.

at which 50% (MIC_{50}) and 90% (MIC_{90}) of isolates were inhibited were both 0.5mg/L.

Of the 43 isolates, four were toxigenic. These isolates had penicillin MICs in the range 0.25mg/L to 0.5mg/L. These penicillin MIC data observed are consistent with international reports.[9,10]

The management of diphtheria includes antibiotics, antitoxin for toxigenic strains, public health notification and infection prevention and control measures (droplet precautions for respiratory diphtheria and contact precautions for cutaneous diphtheria). Close contacts may be offered prophylaxis with penicillin or a macrolide.[11] Our data show that almost all isolates were "susceptible increased exposure" to penicillin, so we expect penicillin treatment to be effective, although the specific regimen would depend on each individual case. Our macrolide susceptibility testing data were limited; it was not possible to draw conclusions on macrolide susceptibility.

Limitations of this analysis include that antimicrobial susceptibility data were available from one Auckland hospital laboratory only. However, we expect the results to be generalisable across the country, as most isolates in the national dataset are from Auckland. Laboratories performing in-house *tox* gene PCR may only refer PCR positive isolates, so the total number of isolates referred

to ESR may not represent the true total number of isolates nationwide. Growth of *C. diphtheriae* in polymicrobial cultures may be missed without appropriate clinical details to guide laboratory scientists, contributing to under-reporting. It is unclear to what extent this may impact the data, although the impact should be consistent over time, so the trends observed would remain unchanged.

In conclusion, toxigenic *C. diphtheriae* isolates remain uncommon in Aotearoa New Zealand; we have not seen an increase in the number of toxigenic isolates over the past 11.5 years. We report a recent increase in non-toxigenic cutaneous cases. These are likely to be travel-related, particularly to tropical Australia and Pacific Island Countries and Territories.[7,8,12,13] Clinicians should have a high index of suspicion in patients returning from tropical regions with chronic skin lesions and provide a documented travel history to inform laboratory scientists of the potential for uncommon pathogens such as *C. diphtheriae*.

With international travel we are likely to see non-immune travellers with respiratory or cutaneous presentations from countries that do not have effective vaccination programmes. This reinforces the importance of maintaining good vaccine coverage across our population. The public health and treatment implications of toxigenic strains necessitates careful risk assessment of cases while awaiting a *tox* gene PCR result, including risk assessment for respiratory symptoms, likely country of acquisition of infection and the patient's vaccination history.[11]

COMPETING INTERESTS
Nil.

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AUTHOR INFORMATION
Shivani Fox-Lewis: Clinical Microbiology registrar, Microbiology, LabPLUS, Auckland City Hospital, Auckland, New Zealand.
Sharmini Muttaiyah: Clinical Microbiologist, LabPLUS, Auckland City Hospital, Auckland, New Zealand.
Sally Roberts: Clinical Microbiologist, Head of Department Microbiology, LabPLUS, Auckland City Hospital, Auckland, New Zealand.

CORRESPONDING AUTHOR
Shivani Fox-Lewis: Microbiology LabPLUS PO Box 110031, Auckland City Hospital, Auckland 1148, New Zealand. Ph: 021 860 120. E: sfoxlewis@adhb.govt.nz

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Exophthalmic Goitre.

NZMJ, 1923

(*Delivered before the Wellington Division, British Medical Association, on* 1*st June.*)

The great weakness of modern medicine is that everyone is so busily occupied in acquiring new facts, recording observations, trying out new methods and developing new theories that one often forgets to think. This is further conduced to by the bewildering multiplicity of modern developments in the many sciences which are now the handmaidens of medicine. We are so preoccupied in studying the charms of these ladies that we are apt to forget that one function of the priest is to withdraw into the temple at times and indulge in meditation. *Sir William Gairdner* wrote a delightful essay some 50 years ago in which he asked in all seriousness whether medicine had made any advance at all since the days of *Hippocrates*, and he answered the question in the negative. One of the most brilliant researches made in recent times is the work of *Marine* and *Kemball* showing that endemic goitre can be prevented in school children by giving iodine, but *Hippocrates* had anticipated this, because he gave the ash of seaweed, which is rich in iodine, in order to reduce the goitrous neck. His knowledge was probably derived in turn from the Vedic physicians who practised on the tablelands of Asia 1000 years before *Hippocrates*. The great Greek physician also recommended in cases of consumption that the patient should drive a cow up to the hilltops and live there, drinking the milk of the cow. Up till quite recently we had made no advance on this treatment. Some 30 years ago a small band of Russian scientists went to Thibet to find out if there was anything in the fabled wisdom of the East. They had to study laboriously for years before they gained admission to the monasteries, and what they learnt there interested them so much that they stayed 30 years, and during that time attracted 25 more of their countrymen to study with them. The two leaders have now returned to Europe, and have set up a school of philosophy in the forest of Fontainebleau. They say that in three subjects of study the East is far ahead of the West. These subjects are :— First, Psychology (and when you think how puny are the efforts of even our best psychologists in elucidating the working of the human mind, that is not surprising). The second is Music, and they say that Mozart was a child in rhythm and harmony compared to the Yogis. The third subject is Medicine, and that is a staggering statement. How can the priests in a Thibetan monastery have greater knowledge than the awe-inspiring masters of European medicine? Well, *Gurdieff* explains it in this way. He doesn't say that they can cure an ordinary cold by means of a vaccine for £20, or that they can remove a healthy appendix for double that sum, but he says that we know that the pneumococcus and other germs, which we all harbour as domestic pets, occasionally turn and rend us by causing pneumonia. We do not know why, but the Yogi does. We know that out of 100 hyperplastic thyroids a few only will cause *Graves'* disease, and the Yogi can tell us why. And these statements are made, not by gullible ignoramuses, but by a band of men who knew everything that Western science could teach before they went to study in far Cathay.

I am sorry that I cannot expound this Forest Philosophy. All that I propose to do to-night is to try to take stock of our knowledge of exophthalmic goitre, and it is an inviting subject of study because it appeals alike to the pathologist, the biochemist, the epidemiologist, the radiologist, and, further, it furnishes one more jousting-place where the surgeon and the physician in turn throw down the glove to each other.

The function of the thyroid is to control the metabolism of the body and to mobilise its resources for any emergency, and it seems clearly established that it cannot do these things without a sufficient supply of iodine, which it utilises in the form of thyroxin or organic iodine. *Marine* and *Kemball* have proved beyond the cavil that the development of goitre in school children can be prevented by the exhibition of iodine. They give it as iodine of sodium, grs. 30, twice a year, or it can be given merely by hanging up a wide-mouthed jar containing tincture of iodine in the classroom. The thyroid does not need a great deal of iodine as one hundredweight of fresh gland

yields only 7 grains of thyroxin, nor is it expended rapidly. Now let me outline briefly our present knowledge of the thyroid. We know that all goitres occur more frequently in women than in men in the proportion of about 4 to 1. In women the thyroid increases in size at puberty, during menstruation, at marriage, during pregnancy and lactation and at the menopause. That is to say all conditions which make an extra demand on the sexual and nervous apparatus of women result in over-activity of the thyroid gland, and, as the sexual changes are much more important in women, it is easy to see why they should be more liable to goitre. We know, further, that the function of the thyroid is stimulated by infective conditions, especially by syphilis, by diseased teeth and tonsils, and by alimentary toxæmia, and also by all emotional shock or nervous strain. We know that a goitrous mother is apt to bear children who are goitrous or who later become either myxoedematous or Basedowian. Above all, we know that pure dysthyroidism is not the usual condition, but that other glands such as the adrenals, the pituitary or the gonads share the disordered function of the thyroid. Quite recently a new light has been shed on our knowledge of thyroid disorders by the investigations of *McCollum*, *McCarrison* and the *Mellanbies*. Let me summarise what has been elicited by these workers. First there is the confirmation of the observation that feeding iodine diminishes goitre, and prevents the formation of it. This does not prove that goitre is due solely to a deficiency of iodine. There are many things that will make a jibbing motor-car go smoothly besides filling the petrol tank, but still I think it is extremely likely that iodine is the motor spirit of the thyroid gland, calcium is the lubricating oil, and the vitamines are the sparking plugs. We should remember that it is only a few years since the experiments of *McCarrison*, in feeding goats on the fæces of goitrous patients, seemed to prove that goitre was simply an infection. *McCarrison* now realises that when iodine deficiency is present an infection may act as the determining cause of goitre. Then *Mellanby* has shown that cod liver oil is the only fat which keeps the thyroid normal or nearly normal, which is an interesting scientific justification for what some clinicians had recently come to regard as the unnecessary punishment of growing children. *Mellanby* has found that if you feed puppies on flour and butter or any fat containing free oleic acid, the resulting hypertrophy of the thyroid is five times as great if you substitute cod liver oil for the butter. If you increase the butter still more the hypertrophy is 14 times as great, and in all cases the increase in the size of the gland is not a simple hypertrophy but an actual hyperplasia such as is met with in *Graves'* disease. Cod liver oil contains iodine, but that is not the only factor, because if chopped fresh green stuffs are added to the diet of the puppies, there is much less hypertrophy, showing that vitamines are essential for normal thyroid activity. Cod liver contains more vitamine than butter and is probably less apt to cause a relative deficiency in iodine. The most interesting observation of all was that puppies which got plenty of fresh air and sunlight developed goitre to a much less extent than those which were confined. The great practical lesson which emerges from all this is that we must insist on better hygienic conditions for our children in the schools if we wish to rid the Dominion of the disfiguring and disabling goitres which are now so common. Further, we must encourage the use of an anti-goitrous dietary, which should contain iodine and be rich in vitamines. The article of diet that stands highest in these respects is spinach, and it has the advantage of being pleasant to eat if cooked in the French way, but not if boiled á la New Zealand in an excess of water. Moreover, it grows practically all year round, and its cultivation should be encouraged in school gardens along with salad plants because iodine is better taken in an organic form along with vitamines than swallowed from a medicine bottle.

I do not propose to discuss the pathology of the goitre further than to insist that pathology is chiefly of interest to clinicians when it is characterised by altered function. Thus an adenomatous thyroid may disorder function by mechanical pressure on the trachea or oesophagus producing dyspnoea or dysphagia, on the laryngeal nerves producing cough or dysphonia or by becoming toxic and thus leading to hyperthyroidism. But as a rule goitre does not mechanically cause gross change in function in the same way as an enlarged pituitary does.

Clinically, hyperthyroidism may be considered under three heads. The first is simple hyperthyroidism, which is undoubtedly very common, and this is not surprising when we remember that goitre is so common, and that dietary changes alone may cause not only increase in the size of the gland but actual hyperplasia with irregular acini and a change in the cells from cuboid to columar. It has been suggested to distinguish this

group from *Graves'* disease by the absence of eye symptoms, but *von Graefe's* sign is not uncommon in the *forms frustes* or simple hyperthyroidism; or again by a pulse limit of 120 with an increased basal metabolic rate of 40 per cent. But I think if any hard and fast line must be drawn it should be at the commencement of definite myocardial change. When the heart begins to dilate the case is definitely one of *Graves'* disease, and not of simple hyperthyroidism and I think *Lewis* is right in regarding percussion as a very fallacious method of determining cardiac dilatation. He relies on the orthodiagram, paying special attention to the A-B ratio, and it is the left ventricle, or B area, which first increases in *Graves'* disease. *Lewis* has found, by checking his observations with the orthodiagram, that the point of maximal impulse at the apex is the most reliable guide to the border of the left ventricle. If the cardiac condition is untreated the case may go on to auricular fibrillation or paroxysmal tachycardia, with the development in either case of extreme myocardial degeneration, loss of reverse force, oedema, ascites, etc.

The general symptoms are unfortunately familiar to everyone, and I need not discuss the tremor, the exophthalmos and eye signs, the skin changes, leukoderma, vitiligo, etc., dry mouth, dank hands, palpitation, nausea, diarrhoea, loss of hair, pigmentation, dermographism, increased pilomotor reflex, polyuria, glycosuria and the increase in the gland itself which it is well to remember may be masked. In the nervous system there are no organic changes but the reflexes are brisk, the pupils dilated and, in fact, the response to all stimuli—physical, mental or aesthetic—is increased as in all sympatheticotonic people. There is always some mental change which may vary from mere irritability and loss of memory and concentration to the fully developed hyper-emotive syndrome of *Dupré*, and in about 10 per cent. of cases there is a definite psychosis which may take the form of melancholia, fixed delusions, or even delirium, but the commonest condition is that of anxiety neurosis. The symptoms of anxiety neurosis are practically those of *Graves'* disease with the addition of terrifying dreams, and this has led *Stoddart*, who used to be a sound alienist, to enunciate the extreme view that *Graves'* disease is anxiety neurosis and nothing else. The extreme view on the other side is that of some physiologists, biochemists and laboratory workers, who hold that all goitres, including the exophthalmic form, are simply a deficiency disease and that the nervous symptoms are secondary manifestations of a lack of iodine. All extreme views are unsound. Emotional shock alone never causes *Graves'* disease nor does want of iodine, but hypersecretion must be due in the first place to nervous influence. The *via media* is the safest course to pursue. Nervous strain causes *Graves'* disease in people whose thyroids have become hyperplastic from iodine or other deficiency, and the symptoms may be relieved by treating the anxiety condition.

"J.R., a young married woman, was admitted to Dunedin Hospital for acute *Graves'* disease. On being questioned she admitted frequent dreams, but would not describe them as they were so silly. On being pressed she said they were all about kissing, and that in her dreams she saw her husband kissing another woman. This worried her as she and her husband were very fond of each other and very happy. As her dreams dated from six months previously she was asked to carry her mind back to that period and try to remember if she had been jealous of her husband at that time. After a little she recollected having been jealous of a young girl, but, as she trusted her husband implicitly she deliberately drove the idea out of her mind, and that, of course, is the usual way in which the seeds of an anxiety neurosis are sown. When the cause of her disturbing dreams was explained to her she rapidly improved, and left the hospital in less than a week."

Many such cases should be quoted illustrating the value of psycho-therapy in *Graves'* disease, especially when anxiety symptoms are prominent. With regard to diagnosis, it is claimed by *Crile* and others that this can be determined only by finding an increased basal metabolism. But some of these workers have shown, in an analysis of several thousand cases, that the pulse rate increases *pari passu* with the basal metabolism while the weight varies inversely, so that the pulse chart and the weighing machine can safely be relied on to save the use of the apparatus and calculations required for working out the basal metabolism rate. Estimation of the urea N, and the ammonia and xanthin base N, may be used as a further check. For these reasons I do not think that the estimation of the basal metabolism is ever likely to become a popular clinical diversion. What is necessary is to exclude other causes of tachycardia such as gross lesions of the heart and lungs. Diabetes is the only other disease in which loss of weight is accompanied by increased appetite, and it is easily excluded.

In exophthalmic goitre carbo-hydrate tolerance is lowered, the blood sugar is increased, and the kidney threshold for sugar is raised so that the mobilised sugar will not be lost, but one is likely to confuse the occasional glycosuria of *Graves'* disease with true diabetes. In early tuberculosis there is usually diminished appetite and the basal metabolism is lowered. Cases of D.A.H. simulate exophthalmic goitre very closely, and present considerable difficulty. Every now and then one comes across cases of supposed *Graves'* disease in which rest in bed does not reduce the tachycardia, and in such cases the exercise tolerance is usually found to be good. They are best treated by a short intensive course of digitalis (using a standardised preparation), and then putting the patient on to graduated exercises first in bed and then outside. You will often get improvement in this way showing that, whether hyperthyroidism is present or not, much of the tachycardia is due to D.A.H., and should be treated by physical jerks. Where neurasthenia is confused with exophthalmic goitre it is probably what *Hurst* calls hormone neurosis, *i.e*., a mixed case of neurasthenia and *Graves'* disease.

For treatment all cases of definite *Graves'* disease should be given prolonged rest in bed on light diet. Any anxiety element should be treated *secundum artem*. I usually give digitalis as recommended by *Trousseau* and *Mott*, not simply to slow the heart, but because digitalis, in stimulating the vagus, acts in a way as the physiologic antidote to an irritated sympathetic. I have never been able to fathom the reason for giving adrenalin in *Graves'* disease, as it stimulates the sympathetic, but probably it acts as small doses of iodine often do, *i.e*., by lessening the symptoms and increasing the size of the goitre, on the principle I suppose of a hair of the dog that bit him. Thymus gland has a distinct action in diminishing the size of ordinary goitre. Arsenic is of undoubted value, especially if given with phosphoric acid, or it may be given as the iodide of arsenic. Bromides may be given, but should not be pushed too far, and the best preparation to use is hydrobromate of quinine. I have never seen much benefit result from the use of the vaunted serum preparations. The diet should be light and easily digestible, avoiding too much meat. Electrical treatment is of distinct benefit, and may be used in the form of galvanism by passing a current beginning at one milliamp, and not exceeding three milliamps, through the neck. The first case in which I tried this some 15 years ago gave marvellous results, but I must confess that this promise has not been fulfilled. Faradism may be used in the form of baths with good effect and a useful variant is to use tampons on the heart, the neck, the carotids and even on the eyes. Light massage is useful in treating restlessness.

And now we come to the vexed question—when to operate? I suppose all are agreed that a toxic adenoma when present should be dealt with surgically. By this is meant an adenomatous enlargement of the thyroid which has been present for some time and has suddenly taken on a toxic aciton, usually under the influence of stress or shock. But it is not always easy to say clinically what is an adenoma, and there is some danger of the phrase—toxic adenoma—becoming a sort of magic touchstone to excuse surgical rashness. In all cases where medical treatment has been fairly tried and failed or where relapse has soon occurred, recourse should be had to operation, with this proviso, in which I think all surgeons will concur, that it is not safe to operate on cases which are rapidly becoming worse, in which there is high blood pressure (especially high diastolic pressure) or in which serious involvement of the myocardium has already taken place. It may also be stated that manual workers need operation more than brain workers. *Crile* is quite frank in his statement of the case for surgery. He says that the indication for operation is the diagnosis of hyper-thyroidism. That, I think is a doctrine which is absolutely indefensible. I would as soon think of recommending excision of the ileum at the commencement of a typhoid fever. As there seems to be reasonable hope of preventing, or at least enormously diminishing, the incidence of goitre in the next generation, surely the present one may be allowed to work out its own salvation without resort to such an heroic measure. In suitable cases where the choice lies between prolonged and repeated periods of rest in bed and a speedy relief by safe operation, I think few people would hesitate, especially in view of the impatient temperament that usually accompanies the disease. But radiology offers a middle course. This treatment is not favoured by the surgeon, in fact it is roundly condemned by *Crile*, on account of the resulting fibrosis which renders a subsequent operation much more difficult. We must then enquire whether radiology is a safer process than surgery, and whether the end results are at least equally satisfactory. I have been using radiology much more often lately, and on the whole have had very good reason to be satisfied with the

results. My cases are not numerous enough or of sufficiently long standing to justify the quotation of statistics, and so I prefer to give you those of *Professor Murray* of Manchester. But first let me quote two cases.

"G.R., 45, farmer. Unable to work for a year. Exophthalmos medium. Pulse 120. L.. ventricle ¾ inch outside nipple line. Came to town for operation, but decided to try treatment. After three applications of X-ray was able to resume full work on farm. Reported well three months later."

"M.T., married woman, 31. Marked goitre and exophthalmos. Pulse 144. Heart one inch outside nipple line. Refused treatment and went to Naseby against advice (as these cases do badly in the rarified air of high inland country). Returned with orthopnoea, oedema, auricular fibrillation and increase dilatation. Went into nursing home for two weeks and had intensive course of digitalis. Has since had two applications of X-ray and is now (six weeks later) walking about feeling quite well."

Murray finds that under rest and medicinal treatment about 25 per cent. of cases are fatal, the same number recover and the other 50 per cent. improve more or less. Of 100 cases treated by X-ray all are living, and 76 recovered completely or regained good functional activity suitable for ordinary life. Myxoedema occurred in only one case, so that too much has been made of that bogey, and moreover it sometimes follows exophthalmic goitre without the intervention of X-rays. In the matter of dosage *Murray* is almost surgical. He gives two full doses in the first week, continues with weekly doses for some time, and extends his treatment to as many as 100 doses. Probably it is safer to rely on three-weekly doses for three or four sittings but *Murray* does not mention any cases of burning in his 100 cases. Radium is also used, but statistics are not given. It is undoubtedly true that operation often gives a rapid cure and thus saves serious damage to the myocardium, but we must not forget that a number of cases, varying from two per cent. upwards according to the climate, make note a rapid cure but a rapid exit. Some cases are on record of aggravation and death after X-ray treatment, but apparently *Murray* had none. I asked to see one such case just before he died, but he had auricular fibrillation and had had no preliminary medical treatment. It is claimed that it is difficult to dose the X-rays so as to avoid over-treatment, but the same thing applies to surgery, where it is difficult to decide exactly how much gland to remove in each case. *Murray* quotes on case which still had marked symptoms ten years after two partial thyroidectomies had been performed, and the symptoms subsided under X-rays. Moreover, symptoms do recur after operation just as after medicinal treatment. I believe that our hopes for the future lie in prevention and in early treatment by X-rays.

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Hypogonadism following testicular cancer

Veronica Boyle,[1,2] **Maiea Mauriohooho,[2]** Jade A U Tamatea,[1,2] Michael Jameson,[1,3] Alvin Tan,[3] Marianne S Elston[1,2]

[1]Waikato Clinical Campus, The University of Auckland, Hamilton, New Zealand; Departments of [2]Endocrinology & [3]Medical Oncology, Te Whatu Ora Waikato, Hamilton, New Zealand

BACKGROUND

Testicular cancer is the most common malignancy affecting young men, and Aotearoa New Zealand has one of the highest rates of testicular cancer in the world. Survival rates, even in those who present with metastatic disease, are high, with often >95% long-term survival. As such, long-term treatment complications and quality of life are particularly important. Hypogonadism has been reported to occur in 5–25% of men with a history of testicular cancer and surveillance guidelines recommend regular assessment of testosterone levels.

AIM

To determine the proportion of men who had assessment of gonadal function prior to any treatment for testicular cancer and at each of the four recommended timepoints, and the rates of hypogonadism.

METHODS

A retrospective review of patients with a new diagnosis of testicular cancer at Waikato Hospital during a 20-year period from the 1 January 2000 to 31 December 2020. Patients who had a single testis at the time of diagnosis, who had already received treatment for testicular cancer prior to 1 January 2000 or who were already receiving exogenous testosterone replacement were excluded.

RESULTS

A total of 518 cases were eligible for inclusion. Of these, 151 men (29%) had a testosterone level measured at least at one timepoint. There was no difference by age, ethnicity, BMI, tumour stage or treatment between those men who had a testosterone measured and those who did not. Of these 151 men, 69 (45%) had a testosterone level below the lower limit of the reference interval (9nmol/L). These men were more likely to have received radiotherapy (p=0.05); no other differences were identified. Of the 69 men who had at least one low testosterone level, no further action was taken in 17, seven had a repeat that was normal, nine had a repeat value consistent with hypogonadism but no further action was taken, and 37 were referred to endocrinology with 28 started on testosterone replacement. Nine did not receive treatment (repeat levels normal [n=5], waiting to be seen by endocrinology [n=3], referral declined requesting repeat morning test first [n=1]).

CONCLUSIONS

Subnormal testosterone levels are common in men who have previously received treatment for testicular cancer, but assessment of testosterone levels in this group is low. This may mean a missed opportunity to improve quality of life for these men.

Outcomes and access to angiography following non-ST segment elevation acute coronary syndromes in patients that present to rural or urban hospitals

Rory Miller,[1] Garry Nixon,[2] Tim Stokes,[3] Robin Turner,[4] Yannan Jiang,[5] Rawiri Keenan,[6] Corina Grey,[7] Andrew Kerr[8]

[1]Rural Doctor and Senior Lecturer, Department of General Practice and Health, University of Otago, Dunedin, New Zealand
[2]Rural Doctor and Professor of Rural Health, Department of General Practice and Health, University of Otago, Dunedin, New Zealand
[3]Professor of General Practice, Department of General Practice and Rural Health, University of Otago, Dunedin, New Zealand
[4]Professor of Biostatistics, Biostatistics Centre, University of Otago
[5]Senior Research Fellow—Statistics, Department of Statistics, The University of Auckland, Auckland, New Zealand; National Institute for Health Innovation, School of Population Health, The University of Auckland, Auckland, New Zealand
[6]Medical Research Centre, University of Waikato,

Hamilton, New Zealand; Department of General Practice and Rural Health, University of Otago, Dunedin, New Zealand
[7]Public Health Physician, Department of General Practice and Primary Healthcare, The University of Auckland, New Zealand
[8]Cardiologist, Cardiology Department, Middlemore Hospital, Middlemore, New Zealand

AIM

In New Zealand patients with non-ST segment elevation acute coronary syndrome (NSTEACS) may present to rural hospitals, or to an urban hospital with or without routine access to percutaneous intervention (PCI). The aim of this study is to determine if there are differences in access to angiography and health outcomes for patients with NSTEACS associated with presenting to these three categories of hospital.

METHODS

First admissions for patients with NSTEACS to a New Zealand public hospital between 1 January 2014 and 31 December 2017 were included. Logistic regression was used to determine whether there was difference between the three categories of hospitals for the outcome measures: angiography performed within 1 year; 30-day, 1-year and 2-year all-cause mortality; and readmission to hospital within 1 year of presentation with either heart failure, a major adverse cardiac event or major bleeding.

RESULTS

There were 42,923 patients included in the study. The adjusted odds of a patient receiving an angiogram were reduced by 25% and 18% for urban hospitals without routine access to PCI (odds ratio [OR] 0.75: 95% confidence interval [CI] 0.71–0.79) and rural hospitals (OR 0.82: 95% CI 0.75–0.90) respectively. Patients that presented to urban hospitals without PCI had increased odds of readmission with a major adverse cardiac event (OR 1.10: 95% CI 1.03–1.16). There was a 16% increase in the odds of dying within 2 years for patients presenting to a rural hospital (OR 1.16: 95% CI 1.05–1.29).

CONCLUSION

Patients who do not present to hospitals with routine access to PCI are less likely to receive angiography. There is a small increase in 2-year mortality for patients who present to rural hospitals that may reflect poorer access to cardiac rehabilitation and secondary prevention.

Breast cancer grade—multi-institutional audit

Archana Pandita,[1] Reena Ramsaroop,[2] Gavin Harris[3]

[1]Department of Anatomic Pathology, Waikato Hospital, Hamilton, New Zealand
[2]Department of Anatomic Pathology, North Shore Hospital, Auckland, New Zealand
[3]Department of Anatomic Pathology, Canterbury Hospital, Christchurch, New Zealand

PURPOSE

Breast carcinoma is the second most common malignancy in women after colon and lung. The breast staging is based on consideration of multiple factors such as size of the tumour, number of lymph nodes involved by the metastatic carcinoma and distant metastases. Although not included in the staging of the breast carcinoma, histological grade for breast carcinoma is strongly associated with both breast cancer-specific survival and disease-free survival. Multivariate analysis have shown that histological grade is an independent predictor of both overall survival and disease-free survival in inoperable breast cancers. This can also help oncologists decide on management. Histological grading is now a part of minimum dataset for breast cancer pathology reporting included by the Royal College of Pathologists of Australasia, the United Kingdom Royal College of Pathologists, the College of American Pathologists, and is endorsed by the World Health Organization.

The national breast cancer registry shows a steady decline in the reporting of grade 3 breast cancers in the regional Waikato Hospital. Multi-institutional breast audit was undertaken to compare the grading in the three regions.

MATERIALS AND METHODS

A total of 105 de-identified slides with breast carcinoma from Waikato Hospital were sent to two different centres (centre A and centre B) for grading of the breast cancers. Pathologists (1–2) from both the centres agreed to look at these slides for grading. The slides were selected randomly from the previous year and same sets were sent to both the centres with no other information available to the grading pathologists to avoid the bias. The slides were sent in sets of three (25, 40 and 40 each) to avoid the extra workload for the pathologists, who are already busy with their routine schedule.

The clinical pathological variables were compared using contingency tables results.

RESULTS

A total of 45 cases were concordant between three institutions. There was some discordance in the grading of the remaining breast cancer slides

in the three institutions. The concordant number of cases between Waikato and Centre A was 27 in total. Centre A upgraded 15 of the Waikato cases and downgraded 11 cases. There were 10 concordant cases between Waikato and Centre B. Centre B upgraded seven Waikato cases and downgraded 33 of these cases. When comparing Centres A and B, the number of concordant cases was 13. Centre A upgraded two cases of Centre B and downgraded 33 of the Centre B cases. There were 10 cases not included for the study when comparing all the centres because of the difficulty in differentiating between invasive and *in situ* carcinoma or cutting artefact in the tissue.

The Waikato cases were further reviewed by one pathologist after a long wash-out period, strictly using the Nottingham breast cancer scoring system. This was done randomly to avoid bias. It was noted that the discordance in grade assignment was mostly resulting from borderline morphological features. The number of cases upgraded from grade 2 to grade 3 was 12, from grade 1 to grade 3 was one and only one case was upgraded from grade 1 to grade 3; however, there were 3 cases that were downgraded to grade 2, and two cases that were downgraded to grade 1.

DISCUSSION

The breast grading is determined using the three variables including tubule formation, nuclear morphology and mitoses using a universal scoring system.

There are few factors that may affect the grade reported in different studies that can be explained by difference in the patient cohorts including age distribution, symptomatic versus chronic population, early versus advanced breast cancer or tissue fixation. There have been many studies looking at the inter-observer and intra-observer agreement of breast cancer histological grade and the value ranges from 0.43–0.83 in different studies. The range for grade 1 measures ranging between 11 and 38%, for grade 2 varies from 37 to 49% and for grade 3 ranges from 24 to 46%.

Waikato Hospital deals mostly with the breast screening cases. This is the most likely cause for lower grade 3 reporting. It was interesting to note quite a significant variation in the grading of the breast cancers across the New Zealand regions. The Waikato grading was seen to be close to Centre B grading when compared to Centre A grading.

The various measures that can be taken to get the appropriate grading is proper fixation. Spending extra time on the slide to look at the periphery or the advancing edge of the tumour may also resolve the issue where usually increased mitoses are seen. It is better to count mitoses from hot spot areas as tumour heterogeneity can be responsible for grading discordance.

CONCLUSION

Histological grade is an important, strong predictor of outcome in patients with invasive breast cancer and therefore it is important that the grading is done correctly, and that steps should be taken in the department to achieve that. Critical evaluation of these issues with recommendations from good practice guidelines with regular educational activities and associated external quality assurance can improve the discordance in the grade reporting. This will improve reproducibility and give consistent results. Work is being done in the field of artificial intelligence and digital pathology to improve the grading outcomes for breast cancers.

Quad bike is not a toy for kids

Sayanthan Balasubramaniam,[1] Emily Lancastle,[2] Mathew Crowther,[2] Udaya Samarakkody[3]

[1]*Department of Paediatric Surgery, Te Whatu Ora Waikato, Waikato Hospital, New Zealand*
[2]*University of Edinburgh, United Kingdom*
[3]*Waikato Clinical Campus, The University of Auckland, Hamilton*

BACKGROUND

Quad bikes are useful vehicles for outdoor activities and farming in New Zealand. They are lightweight and have a high centre of gravity. Their appearance and function are very attractive to children. We aim to analyse the mechanism, type of injuries and complications associated with quad bike accidents in children.

METHODS

We collected the data of children under 15 years admitted to Te Whatu Ora (TWO) Waikato – Health New Zealand who sustained quad bike injuries from January 2013 to January 2023 (10 years). The data were analysed with SPPS-22. The Clinical Audit and Safety Unit approved this project.

RESULTS

Eighty-five records were reviewed. Notably, Māori were not represented in this cohort. Sixty-two (72.9%) children were drivers, and 20 (23.5%) were passengers. Thirty-two children had accidents on a farm, 17 at home, 10 on the road, and 26 in "other" locations. Mean age was 10.2, with a range of 1–15 years (standard deviation 3.9) with 52% without helmets. The commonest injury was to limbs (n=60), followed by head injuries (n=20) and abdominal

injuries (n=13). Fractures were more common in the upper limbs (n=26) than in the lower limbs (n=15). Twelve had severe concussions, and three had significant intracranial haemorrhage. Eleven children had solid abdominal organ injuries. Four had multiple injuries, including head and abdominal trauma. Thirty-four children underwent surgical interventions, four requiring ICU admission. The average hospital stay was 2.1 days. Overall, 29.4% (n=25) had minor disabilities. The majority (n=60, 58.8%) needed parental support for activities of daily living at discharge.

CONCLUSION

Quad bikes can be a dangerous recreational activity for children, causing major health hazards.

The fatigue after infusion or transfusion pilot trial and feasibility study: a three-armed randomised pilot trial of intravenous iron versus blood transfusion for the treatment of postpartum anaemia

Esther Caljé,[1] Joy Marriott,[2] Charlotte Oyston,[2,3] Lesley Dixon,[4] Frank H Bloomfield,[1] Katie M Groom[1,5]

[1]Liggins Institute, The University of Auckland, Auckland, New Zealand
[2]Department of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, The University of Auckland, Auckland, New Zealand
[3]Middlemore Hospital, Auckland, New Zealand
[4]New Zealand College of Midwives, Christchurch, New Zealand
[5]National Women's Health, Auckland City Hospital, Auckland, New Zealand

BACKGROUND/AIM

There is a lack of high-quality evidence for the management of moderate-to-severe postpartum anaemia, with significant variation in clinical practice. A randomised trial is needed, although recruitment may be challenging. The primary objective was to determine the recruitment rate for a randomised trial of intravenous (IV) iron and/or red blood cell transfusion (RBC-T) for postpartum anaemia.

METHODS

A randomised pilot trial with surveys for women, clinicians and stakeholders. Inclusion criteria: postpartum haemoglobin 65–79g/L; haemodynamically stable. Exclusion criteria: ongoing heavy bleeding; already received or known contraindication to IV-iron/RBC-T. Intervention/control: IV-iron; RBC-T; or IV-iron and RBC-T. Primary outcome: recruitment rate (those approached, and overall). Secondary outcomes: fatigue, depression, baby-feeding and haemoglobin, at 1, 6 and 12 weeks; ferritin at 6 and 12 weeks. A health equity lens was applied to support Māori and Pacific participation.

RESULTS

Over 16 weeks from 16 October 2022 to 29 January 2023 at Auckland, Waikato and Canterbury hospitals, 26 women consented to randomisation. The proportion of those approached who were randomised was 26/34 (76%), including 8/26 (31%) Māori and one (3%) Pacific women. The proportion of all broadly eligible women was 16% (26/167). Key enablers for participation were altruism and study relevance. For clinicians and stakeholders, availability of research assistance was the key barrier/enabler. No significant differences were found for fatigue or depression amongst intervention arms. Significant differences were found between RBC-T vs (favouring) IV-iron and RBC-T for haemoglobin at 6 ($p=0.0116$) and 12 ($p=0.0234$) weeks; and for ferritin at 6 ($p<0.0001$) and 12 ($p=0.0483$) weeks. No significant differences were found between IV-iron vs IV-iron and RBC-T for haemoglobin and ferritin.

CONCLUSION

The recruitment rate indicates that a trial of IV-iron and RBC-T for postpartum anaemia is feasible. Dedicated research assistance will be critical to the success of an adequately powered trial to examine the effectiveness of postpartum anaemia interventions.

The use of kaiāwhina and technology (continuous glucose monitors) for glycaemic management in type 2 diabetes (T2D) in high-risk Māori populations

Rebekah Crosswell,[1] Salem Waters,[1] Hamish Crockett,[1] Donna Foxall,[1] Suzanne Moorhouse,[2] Helen Morton,[3] Michael Oehley,[4] Ryan Paul,[4] Lynne Chepulis[3]

[1]Waikato Medical Research Centre, University of Waikato, Hamilton
[2]Hauraki PHO, Hamilton
[3]Raukura Hauora o Tainui Māori
[4]Te Whatu Ora Waikato

AIMS AND OBJECTIVES

Type 2 diabetes (T2D) is a chronic, multi-systemic condition. Despite established guidelines for the management of patients with T2D, they continue to have suboptimal glycaemic control. Additionally,

Māori populations are disproportionally represented in the statistics compared to non-Māori. The aim of this study is to examine whether continuous glucose monitors (CGM) use can drive behaviour change and improve diabetes management in Māori patients with high-risk diabetes (HbA1c <80mmol/L). The study has not been completed; however, progress will be reported to date at the 3-month and 6-month periods.

METHODS

Research methodology included a Te Ao Māori focus, with whakawhanaungatanga and tikanga being at the forefront. Recruitment and study design were driven by a multi-disciplinary working group, including early and mid to late career researchers and clinicians. Twenty-two participants have been recruited, all through to completion of the 3-month period. Referrals were clinician-centred from a Māori health provider. Glycated haemoglobin (HbA1c) was used as a measure of diabetes management, taken at baseline. Other data collected included lipids, eGFR and uACR. Participants wore a CGM for 4 weeks at baseline and 3-month periods. Participants were visited by Māori research kaiāwhina every few days while wearing the device, and provided with self-management education on T2D, libre use, exercise, kai and lifestyle advice.

RESULTS

Results at 3 months show an average change of 18mmol/L across all participants. For HbA1c, while some patients increased or were stable, these can be explained on a case-by-case basis with disease progression and comorbidities (e.g., kidney failure, development of metastatic cancer). To date, there is much variability in the lipid profiles.

CONCLUSIONS

Delivering care that is based on Kaupapa Māori principles, with research kaiāwhina, education and technology enables Māori patients with T2D to self-manage their condition. This is a promising model of care that leads to significant changes in glycaemic control.

Recurrence of inguinal hernia in the paediatric population

Sayanthan Balasubramaniam,[1] Amanpreet Singh,[1] Udaya Samarakkody[1]

[1]*Department of Paediatric Surgery, Te Whatu Ora Waikato, Waikato Hospital, New Zealand*

BACKGROUND

Inguinal hernia recurrence necessitates further surgical interventions increasing the burden on health resources. Our study aimed to assess paediatric inguinal hernia recurrence, identify risk factors, refine surgical techniques and evaluate the outcomes.

METHODS

A retrospective study was conducted on patients under the age of 15 years of age undergoing an inguinal herniotomy at Waikato Hospital between November 2012 to June 2023. Data were retrieved from the Paediatric Surgical Database and Theatre Enterprise Reporting after approval from the Clinical Audit Support Unit. The demographic information, age at time of surgery, surgical method, recurrence rate, interval from surgery to recurrence and rate of metachronous hernia were documented. Statistical analysis was performed by the SPSS software program.

RESULTS

We identified 1,093 patients, with 966 undergoing open repair; the remaining 127 patients underwent laparoscopic repair. Boys made up the majority, accounting for 85% of the cases (n=930). Additionally, Māori children constituted 40.4% of the patient population. Thirteen patients presented with inguinal hernia recurrence. Of these, 11 had primary repair by open approach (1.18%) and two by laparoscopic (1.57%) approach. Eight had comorbidities: gastroschisis, omphalocele, extreme low birth weight (ELBW<750g) and respiratory distress syndrome (RDS). Notably, Māori accounted for 46% of the recurrence cases. The earliest recurrence was repaired on day zero, while the latest was repaired on day 1,452. The metachronous contralateral inguinal hernia rate was 4.2%. Among 930 boys, 11 had recurrence and two of 163 females had recurrences with no statistical significance (p=0.962). Children under 1 year had a high recurrence rate (p=0.001).

CONCLUSION

The rate of inguinal hernia recurrence was 1.18%, with no significant difference between the open and laparoscopic group. Incidence rates of inguinal hernia and recurrence were higher in Māori. This recurrence and metachronous inguinal hernia rate are consistent with accepted international standards.

Characteristics and disease course of patients with sarcoidosis in Te Whatu Ora Waikato

Liam Petrie, Eskandarain Shafuddin

Department of Respiratory Medicine, Te Whatu

Ora Waikato, Hamilton, New Zealand

BACKGROUND

Sarcoidosis is a multi-system granulomatous inflammatory disease of unknown cause with substantial racial differences in epidemiology in some countries. A study conducted in Auckland suggested that Māori patients tended to have different clinical features than NZ Europeans.

AIM

To characterise the clinical and radiological features, treatment and disease course of sarcoidosis in patients in Te Whatu Ora Waikato and to compare between Māori and NZ European patients.

METHODS

Attendees of Waikato respiratory outpatient clinics from January 2019 to December 2020 were retrospectively screened and those with a confirmed diagnosis of sarcoidosis were included in this audit. Data including extra-thoracic features, lung function, radiology findings, treatment received, hospitalisation and all-cause mortality were collected from January 2019 to November 2021. Annualised changes in lung function and changes in chest radiographs and CT were analysed. We analysed the differences in clinical and radiological features, changes in lung function and radiology, hospitalisation and mortality between Māori and NZ European patients.

RESULTS

One hundred and fifty-eight patients were included: 27 (17%) Māori and 110 (70%) NZ Europeans. Fifty-five (35%) were newly diagnosed during the study period. Sixty-two (39%) had extra-thoracic involvement, most commonly ocular and cutaneous. Most patients had radiographic stage 4 (39 [25%]) and thoracic lymphadenopathy on CT (120 [78%]). There were improvements in annualised DLCO in radiographic stage 0 and 1, but the changes were <20%. Twenty-two patients (14%) had at least one respiratory-related hospitalisation and six patients (4%) died. Thirty-three patients (14%) were started on new treatment, had no clinically significant changes in lung function, and most did not have deterioration in radiology. Of the 66 patients who were on treatment during the study period, only five (8%) stopped treatment due to intolerance and none caused hospitalisation or death. Māori patients tended to be younger, female and had more extra-thoracic sarcoidosis than Europeans (15/27 [56%] vs 38/110 [35%], p=0.045). Even though Europeans had more lung fibrosis on imaging, there were no differences in baseline lung function. There were no significant differences in the changes of lung function, imaging, respiratory-related hospitalisations and all-cause mortality.

CONCLUSION

Our cohort of sarcoidosis patients have heterogeneous staging and extra-thoracic manifestations. Systemic treatment is well tolerated but steroid-sparing agent use is sparse. Māori patients have greater extra-thoracic involvement and are less like to have lung fibrosis than Europeans.

Management of type 2 diabetes in New Zealand: a scoping review of interventions

Sara Mustafa,[1] Kimberley Norman,[2] Tim Kenealy,[3] Ross Lawrenson,[1,4] Lynne Chepulis[1]

[1]*Medical Research Centre, University of Waikato, Te Huataki Waiora School of Health, Hamilton, New Zealand*
[2]*School of Primary and Allied Health Care, Monash University, Melbourne, Australia*
[3]*The University of Auckland, Auckland, New Zealand*
[4]*Te Whatu Ora – Health New Zealand, Hamilton, New Zealand*

BACKGROUND

Type 2 diabetes (T2D) is an increasingly concerning public health crisis, particularly affecting Indigenous Māori and Pacific populations in New Zealand. With higher prevalence rates, financial strains on healthcare and pronounced health disparities, the urgency for effective T2D management is evident. This scoping review aims to investigate the interventions addressing T2D management in New Zealand, their impact on clinical outcomes and the factors that support and hinder the effectiveness, acceptability and feasibility of interventions.

METHODS

Three databases (PubMed, Web of Science and Scopus) were searched for articles on T2D management between January 2000 and July 2023. Articles that did not include clinical outcomes, focussed on T2D prevention or were not conducted in New Zealand were excluded. Stakeholder interviews further identified T2D interventions published in grey literature. Study characteristics, clinical outcomes and supporting and hindering factors identified by study authors were extracted.

RESULTS

A total of 11 articles were included, with most interventions focussing on education (n=10) in combination with lifestyle advice (nutrition + exercise; n=5), a dietary plan (n=3) or an exercise plan (n=1). Seven studies delivered educational sessions via healthcare professionals, of which two were delivered by a Māori or Pacific health professional.

The most common supporting factors were clinical or peer support (n=8), whānau engagement (n=6), flexible interventions (n=5) and participant relationship building (n=4). Hindering factors included disliking the intervention (n=4), high costs (n=4) and being time-intensive (n=3). HbA1c, BMI and waist circumference measures improved by 6 months in most studies, but no change was found at >12 months compared to baseline. Minimal or no improvement was reported in lipid profile, renal profile and blood pressure by 24 months.

CONCLUSION

Future interventions should prioritise a holistic approach with strategies to address the barriers to improve the feasibility and acceptability of interventions, while addressing the complexity of T2D management to achieve long-term improved clinical outcomes.

Characteristics of diabetes among youth and young adults: a cross-sectional study of the Waikato/Auckland Region of Aotearoa New Zealand

Sara Mustafa,[1] Ryan Paul,[1,2] Mark Rodrigues,[1] Rawiri Keenan,[1] Lynne Chepulis[1]

[1]*Medical Research Centre, Te Huataki Waiora School of Health, University of Waikato, Hamilton, New Zealand*
[2]*Te Whatu Ora – Health New Zealand, Hamilton, New Zealand*

BACKGROUND

Diabetes is the one of the most common metabolic disorders in the world, with rates increasing steadily. Type 2 diabetes (T2D) is predominantly diagnosed in adults, but increasingly occurs among youth and young adults alongside type 1 diabetes (T1D) diagnoses. This study aims to investigate of the characteristics of T1D and T2D among individuals aged <25 years including clinical information and use of diabetes-related medications.

METHODS

A cross-sectional study was conducted of patient data collected via de-identified clinical records from four primary healthcare organisations in the Waikato and Auckland regions. Demographic and clinical data for individuals <25 years with diabetes were extracted for the period of February 2021 and July 2022. Dispensed medication information was obtained from the national pharmaceutical collection. Descriptive analyses were conducted, and Chi-squared tests were used to assess for associations between patient characteristics and medication dispensed.

RESULTS

A total of 1,261 youth were coded with diabetes, of which 863 (68.4%) had T1D, 335 (26.6%) had T2D, and 63 (5.0%) were unknown. Youth with T1D had a mean age of 16±5.6 years, were more likely to be European (66.4% vs 17.1% for Māori; $p<0.05$), and nearly half had a healthy BMI (43.6%). In contrast, the mean age of T2D was 20.4±3.4 years, and youth were more likely to be Māori (38.2%) or Pacific (31.0%) (vs 20.3% for European; $p<0.05$), and to have obesity (84.5%). Median HbA1c was 75.0 mmol/mol (interquartile range [IQR]: 63.0–91.5) in T1D and 62.5 mmol/mol (IQR: 48.0–88.0) in T2D patients, with variation by ethnicity. The most dispensed medication among T1D was insulin (94.7%), metformin (5.6%) and ACEi (3.4%), while metformin (68.7%), GLPR1A/SGLT2i (32.8%) and vildagliptin (29.9%) were dispensed in individuals with T2D.

CONCLUSIONS

Diabetes is a concern for New Zealand youth, with at least a quarter of patients now having T2D. Appropriate management and prevention strategies are urgently required.