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A Case of Congenital Hypertrophic Stenosis of the Pylorus
By J. P. S. Jamieson, Nelson Hospital
Projected stroke volumes to provide a 10-year direction for New Zealand stroke services
Annemarei Ranta
While stroke incidence and mortality are declining due to better management strategies, the overall number of stroke sufferers will rise by 40% over the next 10 years to around 12,000 stroke per annum. This is attributable to projected population growth and more importantly ageing of the population. It is imperative that the health sector implements effective stroke prevention and post-stroke intervention strategies to minimise the impact on human suffering and healthcare expenditure.

Impact of discontinuation of telestroke: the Nelson experience
Annemarei Ranta, Suzanne Busch
Telestroke helps to improve out-of-hour patient access to IV thrombolysis in provincial hospitals through remote expert support using videconference equipment. Telestroke may also help upskill local clinicians. To test the benefit of upskilling local teams, telestroke was discontinued at Nelson Hospital. Following discontinuation the treatment rates dropped to pre-telestroke rates. This shows that telestroke does not result in sufficient local staff upskilling to retain improved treatment rates once remote expert support is withdrawn.

Sexuality and gender identity teaching within preclinical medical training in New Zealand: content, attitudes and barriers
Oscar Taylor, Charlene M Rapsey, Gareth J Treharne
Negative healthcare experiences are common for people with diverse sexual and gender identities. A survey was distributed to staff responsible for curriculum in the pre-clinical years of New Zealand’s medical schools, inquiring about the sexuality and gender content they teach, and their perceived attitudes around this content. Results showed that LGBTQI-specific content is covered minimally and some staff are aware of a gap in teaching content. The staff felt this content would be easy to teach, but finding the time to include it was difficult. Experience with sexuality and gender in a healthcare setting and further faculty support could potentially help with providing the opportunity to facilitate the sensitive inclusion of sexuality and gender content in the medical school curriculum.

Faster Cancer Treatment pathway in gynaecological malignancy: a repeat clinical audit
Minah Ha, Anand Gangji
Faster Cancer Treatment Pathway is a Ministry of Health-led initiative to ensure all cancer patients have their treatment in a timely manner to achieve optimal health outcome, with 31-day target between treatment decision and treatment and 62-day target between specialist referral and treatment. Our study shows 85% of women with gynaecological cancer in Northland are meeting the 31-day target and 45% meeting the 62-day target. This shows an overall improvement in cancer care provision from previous study in 2014–2015, however it still falls short of government targets. Shortage of radiological and theatre resources were the main contributing factors for the delay in commencement of cancer treatment in our women with gynaecological cancer in Northland.
Antimicrobial resistance among Shigella in New Zealand
Helen Heffernan, Rosemary Woodhouse, Chris Hewison, Jillian Sherwood

Shigellosis is a gastrointestinal infection that does not usually require treatment with antibiotics. However, antibiotics are recommended when the patient is severely ill or for patient groups at increased risk of spreading the infection, for example, young children. A recent New Zealand survey found that a high proportion of Shigella, the bacterium that causes shigellosis, are resistant to the antibiotics recommended when cases of shigellosis require treatment. Therefore, it is important that laboratories processing specimens from shigellosis cases include testing to determine which antibiotics will be effective should treatment be required.

The futility of fertility research? Barriers to embryo research in New Zealand
Lucy Goodman, Lynsey Cree, Gareth Jones, Michael Legge, Andrew Shelling, Cindy Farquhar

Research that “uses” viable human embryos cannot currently be conducted in New Zealand. This includes research that uses identical methods to clinical treatments for infertility. This survey reveals that New Zealand researchers feel dissatisfied with the lack of guidance from the Ministry of Health about human embryo research, and that this is a barrier to progressing scientific research in this country. The Minister of Health should direct its ethics committees to develop guidelines on this issue.

Keeping track of antimicrobial resistance for Neisseria gonorrhoeae in Auckland, New Zealand: past, present and future considerations
Gary N McAuliffe, Marian Smith, Mike Brokenshire, Rose Forster, Murray Reid, Sally A Roberts

We looked at how likely gonorrhoea was to respond to available treatments in Auckland over an eight year period. We found that only the currently recommended antibiotic combination was suitable, and that this may also be at risk. We have changed the way we detect resistant gonorrhoea to pick up on potential problems at an earlier stage.

New Zealand’s health workforce planning should embrace complexity and uncertainty
Gareth H Rees, Peter Crampton, Robin Gauld, Stephen MacDonell

New Zealand has recurring shortages of medical professionals, yet many of the solutions implemented have failed to sustainably address the problem. The article suggests that by broadening the range of methods, future workforces could be configured and skilled to meet future expected health needs. By embracing these methods, policy makers can be better equipped to develop options which are more likely to represent future workforce conditions and needs. Including this approach within planning will contribute to the design of more sustainable workforce policies.
The impact of multimorbidity on people’s lives: a cross-sectional survey
Jeannine Stairmand, Jason Gurney, James Stanley, Elinor Millar, Cheryl Davies, Kelly Semper, Anthony Dowell, Dee Mangin, Ross Lawrenson, Diana Sarfati

Multimorbidity is the coexistence of more than one chronic disease. Multimorbidity is increasingly common particularly among those over 65 years, Māori and Pacific people and those living in socioeconomic deprivation. Multimorbidity results in high health service use, competing demands on patients and healthcare professionals, and reduces quality and quantity of life. Multimorbidity research is growing internationally and scarce in New Zealand. This research surveyed a sample of New Zealand primary care patients and describes the prevalence and impact of multimorbidity on their lives.

Audit to investigate junior doctors’ knowledge of how to administer and score the Montreal Cognitive Assessment (MoCA)
Chani Tromop-van Dalen, Katie Thorne, Krystina Common, Garrick Edge, Lisa Woods

The Montreal Cognitive Assessment (MoCA) is a standardised test commonly used by medical professionals to assess cognition. Junior doctors often conduct the MoCA in hospital on patients at risk of cognitive problems, however many have never received formal teaching on how to do so. This audit looked at the ability of junior doctors to administer and score the MoCA before and after a brief teaching session. The results show that a brief teaching session improved junior doctors’ ability to conduct the MoCA, which may have significance for patient outcomes.
Twenty-one years of saving lives: The New Zealand Resuscitation Council

Lachlan McKenzie, Jonathon Webber, Richard Aickin, Julie Considine, Anna Lawson, Lindsay Mildenhall, Kevin Nation, Tonia Nicholson, Gabrielle Nuthall, Tony Scott, Malcolm Stuart

On 26 November 1996, the New Zealand Resuscitation Council was established to set the standard for resuscitation and first aid in New Zealand so that any person in need has the best possible outcome from immediate threat to life and limb. Twenty-one years later, it remains true to its purpose as the advisory body for national guidelines that are evidence-based, have expert clinical input, and which are supported by its 21 member organisations.

Early days
Cardiopulmonary resuscitation (CPR) was officially adopted in 1960 as the preferred method of resuscitating a patient in cardiac arrest. Revolutionary at the time, it involved a cycle of external chest compressions to be delivered, interposed with mouth-to-mouth ventilations. Before this, various other methods of resuscitation were promoted by organisations such as the Royal Life Saving Society and taught by their respective branches in countries like New Zealand and Australia. Since this time, entities have evolved to set best practice resuscitation guidelines that are relevant within the parameters of their local environments and healthcare systems. The founding of the New Zealand Resuscitation Council was, in the words of inaugural chair Peter Leslie, “the ultimate step in a process which began tentatively at a NZ Red Cross Society-coordinated forum on CPR on 5 November 1977”.

Following its inception, the Council quickly set about developing national guidelines that had the support of its 16 foundation members—the Australasian College for Emergency Medicine, Australian and New Zealand College of Anaesthetists, Australian and New Zealand Intensive Care Society, Cardiac Society of Australia and New Zealand, National Heart Foundation of New Zealand, New Zealand Ambulance Board, New Zealand Cot Death Association, New Zealand Defence Force, Order of St John, Paediatric Society of New Zealand, Private Emergency Care Association of New Zealand, Royal Life Saving Society of New Zealand, Surf Life Saving New Zealand, Royal Australasian College of Physicians, Royal Australasian College of Surgeons and Royal New Zealand College of General Practitioners—many of which continue to support the Council.

Aware that guidelines in isolation would be open to interpretation and therefore insufficient to ensure consistent application of recommended treatments, the Council developed training programmes. Its most significant initiative was the Certificate of Resuscitation and Emergency Care, or CORE, a curriculum designed especially for New Zealand health professionals and informed by the Council’s guidelines. CORE was the brainchild of Duncan Galletly, the second chair of the Council. He reports this as his “proudest achievement” from his time with the Council. Previously, the Heart Foundation provided two resuscitation guidelines: one for basic life support (CPR and defibrillation) and another for advanced life support (resuscitation with other interventions). By contrast, Galletly’s vision for CORE was a curriculum that discerns knowledge and skills in resuscitation that different rescuers may need. Different training manuals were developed for different audiences: first aiders, first responders, health professionals, and health professionals who require a deeper understanding of resuscitation and advanced care. In 2016, the CORE programme was revitalised and streamlined, with new course...
options, updated skill assessments and new, modern training manuals. As before, multi-disciplinary teamwork and scenario training is at the heart of the CORE learning experience. The Council now has a network of some 300 trainers who provide CORE around New Zealand, as well as a further 150 trainers who deliver its newborn life support (NLS) course.

**International relations**

Throughout its history, representatives on the Council have been involved in the International Liaison Committee on Resuscitation's (ILCOR) task forces. These task forces are charged with reviewing and evaluating the evidence for treatments and issuing consensus recommendations that may or may not be adopted by resuscitation councils in their own guidelines. This has given the Council considerable status among an international community of resuscitation clinicians and researchers.

Of all its international partners, the Council's strongest relationship is with the Australian Resuscitation Council through the Australian and New Zealand Committee on Resuscitation (ANZCOR). This partnership has enabled both countries to enjoy representation on ILCOR. Wherever possible, the two countries share guidelines and algorithms. The advantage is that rescuers in both countries are more likely to have a common understanding of how to respond to resuscitation events.

**Key achievements**

Current chair Richard Aickin agrees with Galletly that the Council's success as the national authority on resuscitation is due to the buy-in from members. Guidelines and algorithms inform many healthcare providers' local protocols (examples include the Council's flowcharts displayed in healthcare facilities across the country, and thousands who attend first aid training every year are taught to respond to medical emergencies using the Council's DRSABCD management plan). Increasingly the Council is approached for media comment. This is particularly important in a culture that advocates for health, safety and wellness, and in a growing public awareness of CPR and first aid.

Education has also been a key achievement of the Council. There has been nationwide adoption of its training programmes, with many healthcare providers, professional organisations and colleges using its CORE and NLS course as their required standard of resuscitation training. The Council's training manuals are recognised as ‘go to’ reference texts for resuscitation. Biennial scientific meetings have also gone from strength to strength. These now attract 350 delegates from New Zealand and overseas, and delegates get to hear first-hand from international keynote speakers.

**What next for the New Zealand Resuscitation Council?**

Medical emergencies such as cardiac arrest most often occur in the community, so community training programmes and public access defibrillation are vital to lifting survival rates. Aickin says the Council is ready to back initiatives that promote CPR training, awareness, bystander CPR and public access defibrillation such as the recently launched GoodSAM (Good Smartphone Activated Medics) community first responder app: www.stjohn.org.nz/goodsam. “Only by embracing new technologies, and working with members, government, healthcare providers, researchers and educators are we going to realise our goal that more people survive resuscitation with good neurological outcomes”, says Aickin. Whereas the Council has previously been oriented towards in-hospital resuscitation, Aickin says it is now time to work with its community-facing member organisations, as these rescuers often provide immediate backup at resuscitation events. The Kids Save Lives statement, which was endorsed by ILCOR and the World Health Organization, calls for all school children over the age of 12 to receive two hours of CPR training annually and Aickin is similarly adamant that CPR be a skill to which all New Zealand youth are exposed at some time.

Twenty-one years on, the Council continues its fight to save as many lives as possible through providing best-practice guidelines for resuscitation and first aid. It continues to look for opportunities to inform, advise and educate rescuers—be they health professionals or others—so that all New Zealanders are ready, willing and able to play their part in responding to life-threatening medical emergencies.
Competing interests:
Nil.

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Organised stroke care to improve survival and independence: New Zealand perspectives

Mark Weatherall

The New Zealand Medical Journal carries two reports related to organised stroke care. Firstly is a report on the effect of establishing and then withdrawal of technological support for administration of thrombolysis for early ischaemic stroke. Secondly is a report describing realistic projections of the number of people likely to require stroke treatment in New Zealand.

Individual interventions for any health condition can be evaluated by rigorous assessment through high-quality randomised controlled trials or other forms of scientific exploration which examine causality with a low risk of bias and high precision. Stroke is an important and common condition with an annual incidence of between 0.5 and 1% of those aged over 65 and about 3% of those aged over 85. As highlighted in the subsequent discussion, stroke is associated, even with best possible care, with a very high rate of death or dependence in activities of daily living. In stroke, interventions that preserve life and improve independence have had rigorous evaluation and the findings support thrombolysis for acute ischaemic stroke and organised inpatient care once a stroke has occurred.

The evidence supporting administration of thrombolysis in the early phases of ischaemic stroke is available as a systematic review and meta-analysis through the Cochrane Library.1 The analysis identified a reduced risk of death or dependence; odds ratio for the probability of poor health outcome: 0.85 (95% CI 0.78–0.93); for treatment administered within six hours of onset of symptoms. Treatment had a greater effect if administered within three hours of onset of symptoms: 0.66 (0.56–0.79). For the six-hour figure this was based on 54.8% of participants in the combined thrombolysis arms and 58.9% of participants in the control arms having an event. The equivalent proportions for those in the three-hour window were 57.4% and 67%. A crude estimate of the number needed to treat (NNT) to prevent one bad health outcome defined as death or dependence for the three-hour window is about 10; based on an absolute risk difference of about 10%.

The first paper in the Journal describes a ‘natural experiment’ in which a regional hospital in New Zealand had access to a method of improving clinician confidence and patient receipt of thrombolysis for acute ischaemic stroke. In that paper is described the proportion of patients with acute ischaemic stroke who received thrombolysis before, during and after availability of support for senior clinicians called on to decide about administration of thrombolysis. This clinical decision is potentially not straightforward as there is a wide differential diagnosis for early ischaemic stroke including diagnoses directly related to intracerebral haemorrhage. Also the treatment itself carries a small but important risk of directly causing intracerebral haemorrhage. This decision making can be facilitated by access to clinicians more experienced in the administration of this treatment and advice can be given in a prompt way to support this treatment. The authors highlight that in the pre- and post-telestroke environment about 11/134 (8%) of people presenting with stroke received this treatment compared to 14/61 (23%) during availability of telestroke; an absolute difference of 15%. If the crude estimate of NNT applies to this situation this suggests at least one person may have had died or had important dependence...
in that regional hospital in relation to the absence of this adjunct to thrombolysis therapy. In this sense there is evidence that an organised approach across the whole health system to allow for administration of an individual treatment in a more coherent way may, in the real world of clinical management in New Zealand, save lives and improve independence.

Organised inpatient care for stroke also reduces mortality and improves independence. Another systematic review and meta-analysis from the Cochrane Library synthesises the high-quality evidence supporting this intervention. One year after randomisation to organised inpatient care the odds ratio for death was 0.81 (95% CI 0.69–0.94) and for death or dependency at the end of scheduled follow-up (as in the stroke thrombolysis synthesis) it was 0.79 (0.68–0.90). For this latter comparison, based on organised stroke unit compared to general medical wards, the bad outcome occurred in 1,027/1,829 (56.2%) of those randomised to stroke unit care compared to 1,034/1,681 (61.5%) of those randomised to general medical ward care. The absolute risk difference here is 5.3%; with a NNT of about 19 over the time course of scheduled follow-up.

The second paper in the Journal describes use of administrative datasets to project the absolute number of New Zealanders who are likely to experience a stroke, taking into account issues such as the absolute growth in the population and the ageing of the New Zealand population. The New Zealand population still has a relatively young population structure, particularly in comparison to Europe and developed Asian nations. In the 2013 Census there were a little over 600,000 New Zealanders aged 65 and over, about 14.3% of the total New Zealand population; and of this 600,000 about 73,000 (12.1%) were aged over 85. The 20-year projections to 2033 are that there will be nearly 1.2 million New Zealanders aged over 65, about 21% of the total population; and that there will be over 170,000 over age 85, around 15% of the older cohort. Although widespread use of anti-hypertensives (about 70% of older New Zealanders) and other interventions such as anti-coagulants for atrial fibrillation are likely to reduce stroke risk now compared to previous cohorts of older adults, the increased prevalence of diabetes, and perhaps different susceptibility to stroke for the evolving ethnic structure of New Zealand (fewer older adults of European ethnicity and more older adults of Māori, Pacific, and Asian ethnicity), will also play a role in determining the number of New Zealanders who experience a stroke in the future. The current number of people recorded as having been discharged after a stroke in New Zealand (2015) was nearly 8,500. In relation to anticipated numbers of patients in 2038 based on the analysis of the paper this is likely to be 14,200. The simple thesis of the projections is that health service planning needs to provide for the optimal care of the additional patients and because of the lead-time in developing and sustaining services that this needs to happen now.

Organised stroke care improves survival and independence and these two papers provide support for a systematic approach across the health system in New Zealand.
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Projected stroke volumes to provide a 10-year direction for New Zealand stroke services

Annemarei Ranta

ABSTRACT

AIMS: Stroke incidence and mortality are declining due to effective public health initiatives and modern healthcare advances. However, due to population growth and ageing, the burden of stroke continues to rise worldwide. This paper aims to provide stroke volume projections for the next 1–2 decades and explores potential solutions to anticipated challenges.

METHODS: Health administrative, where available epidemiological, and New Zealand Statistics data was used to model stroke service demand up to 2028.

RESULTS: Despite improvements in stroke prevention and management, stroke volumes are projected to increase by 40% by 2028 due to population growth and, more importantly, ageing. Associated with this increase will be a need for more hospital beds and staff resources.

CONCLUSION: Efforts to optimise stroke service performance and, increasingly, stroke prevention are required to ensure that the New Zealand Health Service will be able to manage the increased volumes of patients. Better data is required to validate the presented figures, which are largely based on unvalidated health administrative data.

Stroke is a leading cause of death and disability worldwide. In New Zealand, it has been estimated that around 8–9,000 people have a stroke each year and 50,000 people live with the consequences of stroke. The current annual cost has been estimated to sit at $NZ 700 million. Reducing the burden of stroke is a key goal to improve health outcomes in New Zealand.

Global and New Zealand stroke epidemiological studies have found important trends in stroke incidence and mortality over the past several decades. When comparing New Zealand to other high-income countries, stroke incidence is relatively high. For example, the age-adjusted incidence rate is reported to be 119 per 100,000 in Auckland compared with 76 per 100,000 in Adelaide. Mortality was also higher in New Zealand compared to other countries such as Australia. However, other less developed countries have incidence rates of 250 per 100,000.

The longitudinal Auckland Regional Community Stroke (ARCOS) studies have explored stroke incidence and mortality in the greater Auckland region over the past three decades and provide the most up-to-date high-quality local data. Overall stroke incidence has decreased by 23% and stroke mortality by 62% from 1981 to 2012. Māori and Pacific groups had a slower rate of decline and continue to experience stroke at a significantly younger age (mean ages 60 and 62 years) compared with New Zealand Europeans (mean age 75 years). The 28-day stroke case fatality has also dropped by 14% and this was seen across all ethnic groups.

It is reassuring that modern day public health initiatives, primary care preventive strategies, and secondary and tertiary level acute health interventions have made a difference. However, in light of a growing and ageing population the burden of stroke is likely going to increase despite these advances and initiatives. In addition, just like...
there are international variations in stroke incidence one can anticipate that there are geographic variations within New Zealand not readily captured by the ARCOS data.

This paper uses health administrative data to define the current stroke incidence across New Zealand, exploring geographic variation, and will provide future projections based on epidemiological trends. Potential solutions to address future challenge will be explored and discussed.

Methods

Building a model

The New Zealand demand for stroke services is primarily based on the incidence and prevalence of stroke in New Zealand. These in turn are influenced by demographic changes, lifestyle changes, risk factor management and efficacy of post-stroke intervention over time. Other contributing factors that influence demand include baseline population growth. Complexity and availability of diagnostics and interventions also impacts demand. Supply of stroke services depends largely on the workforce availability, which depends on training, immigration and attrition/retirement, but is also influenced by use of technology and shifting models of care to potentially more efficient approaches to patient management. Figure 1 presents a graphic model summarising the factors that impact stroke volumes.

Data sources

Up-to-date nationwide New Zealand stroke audit or epidemiological data is not available. The analyses presented are based on Ministry of Health (MoH) National Minimal Dataset (NMDS) hospital discharge data. Over 95% of patients with stroke are now hospitalised, making the NMDS reasonably comprehensive, however data collection relies on hospital coders and does not undergo validation for accuracy introducing some limitation. For this reason, data from the high-quality ARCOS studies will be referenced at times. ARCOS data is limited to greater Auckland and is now several years old (last data collection 2011/12), making it unsuitable as the main data source for this project. International data is referenced also, but does not readily apply to New Zealand due to significant inter-country variations in stroke incidence.

MoH data for the period from 1 July 2015 through 30 June 2016 (latest full financial year data available at the time of this analysis) was used to determine ‘current’ stroke volumes. Data is grouped by district health board (DHB) population, age and ethnicity.

Populations figures are based on the most recent (2013) national census data. Where available, New Zealand statistics projection estimates for 2015/16 were used (50th percentile figures). DHB-stratified population data was only available for 2013 without published projections and thus the 2013 actual numbers had to be used for the DHB-based rate estimates.

The ARCOS data included for comparison purposes was collected 1 March 2011 through 29 February 2012.

Stroke diagnoses included in this analysis are ICD-10-AM I61 (intracerebral haemorrhage), I63 (cerebral infarction) and I64 (stroke unspecified). Subarachnoid haemorrhage is excluded, as this is generally managed by neurosurgical rather than acute stroke services. TIA is excluded because many TIA patients are managed as outpa-
tients and thus not captured in discharge data, resulting in too many missing data points to allow for accurate modelling. Modelling for future stroke services

Future stroke volume projections were modelled by adjusting for population growth by domicile and age. First, all of New Zealand data was calculated applying both the 2011/12 ARCOS stroke incidence rate and the 2015/16 raw MoH incidence rate by New Zealand population projections in five-year brackets until 2068. Then the current rate of strokes under versus over 65 years of age were calculated, thus arriving at current age-adjusted incidence rates. This allowed projection of stroke rates incorporating New Zealand statistics age bracket prediction for future years. This data was then compared to the ARCOS age-adjusted incidence figures.

Population growth will not occur evenly across New Zealand. To account for such geographic variation, locality specific predictions presented by New Zealand statistics over the next 20 years were explored. For each locality, growth over the next 10 and 20 years is expressed as a factor of 1.0. If the number is less than 1.0 it indicates a drop in population and if greater than 1.0 growth. The decimal digits indicate percentage change (for example 1.15 indicates a 15% growth and 0.95 a 5% drop).

Figures were normalised around 1.0 to depict relative growth difference between DHBs. These figures were then combined with age-adjusted growth to arrive at individual DHB projections for stroke admission volumes in 2028 and 2038. Because growth data by urban area was not available for DHBs, some assumptions had to be made. For example, it was assumed that the main urban centre in each DHB is the main driver of population change based on highest population volume. Generally speaking, the spread across localities within DHBs was minimal (eg, Palmerston North 1.06 and Feilding 1.05 in MidCentral DHB). Overall growth was normalised across all DHBs, meaning the total number of strokes remains accurate. However, it is possible that estimates are off by a few patients in either direction for each DHB.

Modelling future secondary stroke services

The estimates of hospital bed occupancy were derived by multiplying the stroke volumes per DHB by average length of stay (LOS) for acute (6 days) and rehabilitation (21 days). The rehabilitation figure was multiplied by 0.28 to reflect that on average only 28% of stroke patients are transferred to inpatient rehabilitation (2016/17 MoH DHB reporting data). Aged residential care bed requirements were estimated by multiplying the total number of strokes by 0.15 to reflect an average discharge rate of 15% to these facilitates multiplied by the average duration patients reside at ARC facilities. A figure for this is not available specifically for stroke patients. General median LOS prior to dying or discharge was between 5 and 25 months depending on publication. For the purposes of this analysis a figure of 12 months was used.

Final annual figures were divided by 365 days and multiplied by 0.15 to allow for optimum patient flow. This is a conservative figure with international work indicating that optimal patient flow to maximise cost-efficiency and patient safety is achieved by inflating bed numbers by up to 40%. Flow is less critical in longer-stay facilities and ARC bed days were increased by only 5% accordingly.

Staffing levels can be estimated by looking at the number of patients admitted per year averaged per day, proportion of patients seen by a given clinician, duration of consultations, number of assessments per week, shift length and coverage (ie, number of shifts covered per day/week). Non-clinical/administrative time also needs to be factored in. There are available online stroke unit staff calculators available to assist with this (eg, http://www.stroke-education.org.uk/staff-calculators/).

Modelling for future tertiary services

Much of stroke care provided at New Zealand tertiary centres mimics the care provided at secondary hospitals. A notable exception is endovascular clot retrieval (ECR). This is a key new intervention
provided by acute stroke services that is anticipated to have a significant impact on the future of stroke care provision. Clot retrieval modelling is complex due to several key features: (1) clot retrieval is time critical, needing to be commenced within hours of symptom onset;16 (2) clot retrieval is technically challenging, requiring highly skilled interventionalists;17 (3) clot retrieval needs to be available 24 hours per day to avoid treatment gaps requiring a 1:3–1:4 roster; and (4) clot retrieval volumes are relatively low, making it unfeasible to currently offer this service safely at more than three centres in New Zealand.

To achieve equitable provision of clot retrieval, the National Stroke Network has recently produced a National Clot Retrieval Strategy that identifies Auckland, Wellington and Christchurch as the three tertiary centres to offer this service until volumes increase to support a fourth centre. This paper explores projected clot retrieval numbers into the future.

Results

Current stroke volumes

As of 2015, the estimated New Zealand population overall was 4,567,000 people. Per the National Minimum Dataset data there were 8,450 stroke discharges (ICD10-AM I61, I63 and I64) in 2015, resulting in a hospital admission rate for stroke (primary discharge diagnosis) of 185/100,000. This data differs from the ARCOS data, which found a stroke incidence of 147/100,000 new stroke in 2011/2012 in the greater Auckland region. This discrepancy could be explained by several factors. Auckland is not representative of all of New Zealand; the discharge data contains coding errors, captures some people with stroke admissions that include readmissions for the same stroke event, or the ARCOS data missed some patients.

Because this report aims to provide an all of New Zealand perspective with a primary focus on health service utilisation to assist with service modelling, the MoH figures will be used although ARCOS figures will be referred to at times. The limitations are acknowledged and future studies should aim to provide better data to improve the accuracy of such models as are presented here.

Strokes are not evenly distributed across New Zealand. Table 1 shows the stroke admissions per 100,000 by DHB and Figure 2 shows ethnic distribution of stroke admissions by DHB.

The above regional differences correlate with high number of non-New Zealand European populations and likely social deprivation, but this was not explored in detail for this project.

Future stroke volume projections

Per New Zealand statistics, the population will grow to 5,389,700 by 2028, 5,769,800 by 2038, and 6,060,500 by 2048. If stroke incidence remains static, the associated volumes of stroke admissions per annum respectively can thus be anticipated: 9,972, 10,675, 11,213.

However, the population is ageing (see Figure 3) and accordingly one would expect an associated disproportionate increase over time rather than a static incidence across the population.

Adjusting for a disproportionate increase of patients >65 years of age and in light of the fact that 76% of stroke occur in this age group, a more accurate estimate would be the following admission volumes for 2028, 2038 and 2048 respectively: 11,828, 14,282 and 15,532. A breakdown of anticipated stroke volumes by age is depicted in Table 2.

There is also an anticipated growth of Māori and Pacific sub-populations. As the stroke incidence is higher in these ethnic groups (with earlier age of onset) these groups will become increasingly important to consider with an anticipated growth from 836 Māori and 470 Pacific stroke patients in 2015 to 976 Māori and 589 Pacific in 2028 and 1,195 Māori and 725 Pacific patients in 2038. Interestingly the ARCOS data suggests an even greater disparity with an anticipated 1,700 Māori and 1,180 Pacific stroke sufferers in 2028. However, there is no particularly disproportionate growth within this sub-population and the ethnicity spread was thus not further included in subsequent modelling.

Population growth is not evenly distributed. Auckland will experience the greatest growth with up to 72% increase in population in some localities over the next 20 years. Other areas will stay, by comparison, relatively stable (see Table 3).
Table 1: Current stroke volumes by DHB.

<table>
<thead>
<tr>
<th>DHB</th>
<th>Strokes*</th>
<th>Population†</th>
<th>Strokes per 100K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland</td>
<td>553</td>
<td>436,341</td>
<td>127</td>
</tr>
<tr>
<td>Bay of Plenty</td>
<td>422</td>
<td>205,995</td>
<td>205</td>
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<tr>
<td>Canterbury</td>
<td>874</td>
<td>482,178</td>
<td>181</td>
</tr>
<tr>
<td>Capital and Coast</td>
<td>389</td>
<td>283,704</td>
<td>137</td>
</tr>
<tr>
<td>Counties Manukau</td>
<td>697</td>
<td>469,293</td>
<td>149</td>
</tr>
<tr>
<td>Hawkes Bay</td>
<td>303</td>
<td>151,692</td>
<td>200</td>
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<td>Hutt Valley</td>
<td>202</td>
<td>138,378</td>
<td>146</td>
</tr>
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<td>Lakes</td>
<td>192</td>
<td>98,187</td>
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<td>MidCentral</td>
<td>247</td>
<td>162,564</td>
<td>152</td>
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<td>Nelson Marlborough</td>
<td>235</td>
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<td>Northland</td>
<td>352</td>
<td>151,692</td>
<td>232</td>
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<td>South Canterbury</td>
<td>100</td>
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<td>Southern</td>
<td>489</td>
<td>297,423</td>
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<td>Tairawhiti</td>
<td>68</td>
<td>43,653</td>
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<td>Taranaki</td>
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<td>109,752</td>
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<td>Waikato</td>
<td>723</td>
<td>359,310</td>
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<td>Wairarapa</td>
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<td>525,555</td>
<td>166</td>
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<tr>
<td>West Coast</td>
<td>52</td>
<td>32,148</td>
<td>162</td>
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<tr>
<td>Whanganui</td>
<td>128</td>
<td>60,120</td>
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<tr>
<td>Overseas</td>
<td>70</td>
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<tr>
<td>Grand total</td>
<td>7,231</td>
<td>4,241,718</td>
<td>170</td>
</tr>
</tbody>
</table>

*NMDS figures for 12 months starting 1 July 2015.
†Statistics NZ figures for DHB population based on 2013 census data.

Figure 2: Ethnic distribution by DHB.
Figure 3: New Zealand Population age estimated 2008–2068.

Table 2: Projected stroke volumes adjusted by age.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total people</th>
<th>Population</th>
<th>Strokes</th>
<th>Population</th>
<th>Strokes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aged 0 to 64</td>
<td>ARCOS</td>
<td>MoH</td>
<td>Aged 65+</td>
<td>ARCOS</td>
</tr>
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</tr>
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<td>4,116,800</td>
<td>2,264</td>
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<td>747,900</td>
</tr>
<tr>
<td>2023</td>
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<td>2,169</td>
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</tr>
<tr>
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<td>4,344,700</td>
<td>2,390</td>
<td>2,206</td>
<td>1,045,000</td>
</tr>
<tr>
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<td>4,413,000</td>
<td>2,427</td>
<td>2,240</td>
<td>1,182,000</td>
</tr>
<tr>
<td>2038</td>
<td>5,769,800</td>
<td>4,466,400</td>
<td>2,457</td>
<td>2,267</td>
<td>1,303,400</td>
</tr>
<tr>
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<td>4,552,900</td>
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<td>2,311</td>
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<tr>
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<td>4,634,800</td>
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<td>2,353</td>
<td>1,425,800</td>
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<tr>
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<td>1,637,200</td>
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<tr>
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<tr>
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<td>4,677,700</td>
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<td>2,375</td>
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</table>
Table 3: Population growth by geographic location over next 20 years.

<table>
<thead>
<tr>
<th>Geographic Location</th>
<th>2013</th>
<th>2018</th>
<th>Growth</th>
<th>2028</th>
<th>Growth</th>
<th>2038</th>
<th>Growth</th>
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<td>214,800</td>
<td>233,000</td>
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<td>259,700</td>
<td>1.21</td>
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<td>12,600</td>
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<tr>
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<td>28,500</td>
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<td>28,300</td>
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<tr>
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<td>1.02</td>
<td>13,800</td>
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</tr>
<tr>
<td>Auckland</td>
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<td>13,000</td>
<td>1.07</td>
<td>14,500</td>
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<td>15,700</td>
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<td>1.05</td>
<td>381,600</td>
<td>1.09</td>
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</table>
While some especially large urban centres will experience disproportionate population growth, the effect of ageing of the population represents a more significant driver of projected stroke volumes than other factors such as immigration. Table 4 projects DHB-based stroke volumes in 2028 adjusting for both age- and locality-specific anticipated growth—some of which is driven by immigration.

Projected stroke-related resource needs

Based on these projected figures, estimates on anticipated bed requirements and staffing levels are possible. Table 5 shows some staffing estimates for 2028. This list is not exhaustive, focuses on only some professional groups limited to acute inpatient care, and is based on untested assumptions around the time spent with patients per day. This is illustrated as a potential tool to develop comprehensive workforce strategies, but requires further validation before using this data to guide service implementation.

Projected regional tertiary stroke volumes

Regional services will have to be formalised by 2028 to ensure New Zealanders can access endovascular clot retrieval.

Table 4: Stroke volumes (age adjusted) by DHB accounting for regional variation in projected population growth.

<table>
<thead>
<tr>
<th>DHB</th>
<th>Current stats 2015</th>
<th>Population growth by 2028</th>
<th>Projected stroke volumes (age adjusted) by 2028</th>
<th>2015 to 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population</td>
<td>Strokes</td>
<td>Age unadjusted</td>
<td>Age adjusted</td>
</tr>
<tr>
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<td>436,341</td>
<td>553</td>
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<td>1.0402</td>
</tr>
<tr>
<td>Bay of Plenty</td>
<td>205,995</td>
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<td>1.08</td>
<td>1.02</td>
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<tr>
<td>Canterbury</td>
<td>482,178</td>
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<td>389</td>
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<td>0.98</td>
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<td>Counties Manukau</td>
<td>469,293</td>
<td>697</td>
<td>1.1</td>
<td>1.04</td>
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<td>Hawkes Bay</td>
<td>151,692</td>
<td>303</td>
<td>1.03</td>
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<td>Hutt Valley</td>
<td>138,378</td>
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<td>98,187</td>
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<td>MidCentral</td>
<td>162,564</td>
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<td>1.04</td>
<td>0.98</td>
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<tr>
<td>Nelson Marlborough</td>
<td>136,995</td>
<td>235</td>
<td>1.05</td>
<td>0.99</td>
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<td>Northland</td>
<td>151,692</td>
<td>352</td>
<td>1.07</td>
<td>1.01</td>
</tr>
<tr>
<td>South Canterbury</td>
<td>55,626</td>
<td>100</td>
<td>1.02</td>
<td>0.96</td>
</tr>
<tr>
<td>Southern</td>
<td>297,423</td>
<td>489</td>
<td>1.03</td>
<td>0.97</td>
</tr>
<tr>
<td>Tairawhiti</td>
<td>43,653</td>
<td>68</td>
<td>1.03</td>
<td>0.97</td>
</tr>
<tr>
<td>Taranaki</td>
<td>109,752</td>
<td>182</td>
<td>1.06</td>
<td>1</td>
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<tr>
<td>Waikato</td>
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<tr>
<td>Wairarapa</td>
<td>41,112</td>
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<td>Waitemata</td>
<td>525,555</td>
<td>872</td>
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<td>1.04</td>
</tr>
<tr>
<td>West Coast</td>
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<td>1.01</td>
<td>0.95</td>
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<td>Whanganui</td>
<td>60,120</td>
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<td>0.93</td>
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<tr>
<td>Overseas</td>
<td>70</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Grand total</td>
<td>4,241,718</td>
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<td>1.05</td>
<td>1</td>
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</tbody>
</table>

*Locality adjusted = volumes adjusted by age and population growth taking into account variation in population growth across the country.
Clot retrieval treatment volumes can best be estimated by looking at intravenous alteplase treatment rates. This is because approximately one-third to one-fourth of alteplase-treated patients are eligible for clot retrieval. This number needs to be increased by 10–20% to account for the patients who are not eligible for alteplase but were still included in some of the studies (eg, patients presenting after the 4.5 hour intravenous alteplase window or who were taking dabigatran).

Intravenous thrombolysis treatment numbers in 2015 were 125 in the Northern, 101 in the Midland, 103 in the Central, and 76 in the South Island Regions.\(^1\)\(^8\) Based on these figures, and using the above assumptions, one would expect 50 patients to be treated with clot retrieval in the Northern region, 40 patients in the Midland and Central regions and 30 in the Southern region, per year, without any change in current thrombolysis rates.

These numbers will increase over the next 10 years for at least two reasons. Firstly, as presented above, stroke volumes will increase. Second, with greater regional organisation, access to acute therapies including thrombolysis and clot retrieval will increase as was demonstrated in the Telestroke Pilot evaluation.\(^1\)\(^9\) See Table 6 for projections. This is corroborated by data from a South Australian study,\(^2\)\(^0\) that estimates that 7% of ischaemic stroke patients are eligible. Based on current volumes this would mean about 400 clot retrieval-eligible patients in New Zealand now and 500 in 2028.

### Table 5:Projected institutional stroke resource needs by 2028.

<table>
<thead>
<tr>
<th>DHB</th>
<th>Stroke in 2028</th>
<th>Acute beds</th>
<th>Rehab beds</th>
<th>ARC</th>
<th>Medical (FTE)*</th>
<th>CNS (FTE)</th>
<th>PT (FTE)</th>
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*FTE = Full time equivalents based on a 40-hour work week = 1.0 FTE; ARC = aged residential care; CNS = clinical nurse specialist; PT = physiotherapist.
Table 6: Projected stroke and clot retrieval volumes by DHB in 2028.

<table>
<thead>
<tr>
<th>DHB</th>
<th>All stroke</th>
<th>Ischaemic strokes</th>
<th>tPA if 10%†</th>
<th>Clot retrieval volumes at 10% tPA rates</th>
<th>tPA (20%)††</th>
<th>Clot retrieval volumes at 20% tPA rates</th>
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<td>284</td>
<td>95</td>
<td>568</td>
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<td><strong>Midland Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>35</td>
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<td>58</td>
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<td>7</td>
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<td>15</td>
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<td>Taranaki</td>
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<tr>
<td><strong>Total</strong></td>
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<td>Whanganui</td>
<td>167</td>
<td>133</td>
<td>13</td>
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<td>Hawkes Bay</td>
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<td>23</td>
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<td>Hutt Valley</td>
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<td>25</td>
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<td>49</td>
<td>16</td>
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<tr>
<td>Capital and Coast</td>
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<td>399</td>
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<td><strong>Total</strong></td>
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<td>1,514</td>
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<tr>
<td>South Canterbury</td>
<td>134</td>
<td>106</td>
<td>11</td>
<td>4</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>Nelson Marlborough</td>
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<td>274</td>
<td>27</td>
<td>9</td>
<td>55</td>
<td>18</td>
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<tr>
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<td>659</td>
<td>66</td>
<td>22</td>
<td>132</td>
<td>44</td>
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<tr>
<td>West Coast</td>
<td>71</td>
<td>60</td>
<td>6</td>
<td>2</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td>1,098</td>
<td>110</td>
<td>37</td>
<td>220</td>
<td>73</td>
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<td><strong>Grand total</strong></td>
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<td>847</td>
<td>282</td>
<td>1,694</td>
<td>565</td>
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</tbody>
</table>

†IV tPA = intravenous tissue plasminogen activator refers to ‘thrombolysis’ depicting projected volumes assuming a 10% rate (current national target).

†† Thrombolysis rates will increase through improved access via use of telestroke and other changes in model of care resulting in a likely much higher rate of around 20% in 2028 used in the subsequent column to provide a less conservative projections of anticipated clot retrieval volumes for 2028. These are not actual thrombolysis volumes. Each DHB is aware of their own current volumes and can use the above table to estimate current clot retrieval volumes based on their actual thrombolysis rate.
Furthermore, very recent studies already indicate that patient inclusion criteria will expand over time, resulting in more patients being eligible for this intervention.\textsuperscript{21} The impact of this remained uncertain at the time of submission of this paper and accordingly was not included in the below table.

As explained in the Methods section, centralisation of clot retrieval services in New Zealand is unavoidable. It is vital therefore that regional hyperacute stroke pathways are established so that there is equitable provision of acute stroke therapy across the country, rather than simply being available to populations living close to large tertiary hospitals. Achieving this will require systems reorganisation across all district health boards, in partnership with ambulance service providers.

**New stroke models of care**

Technological and scientific advances in the past three decades have seen the development of more specialised interdisciplinary stroke units, although it is not always possible to offer these in small rural centres.

A number of studies have shown that decentralised thrombolysis services (telesstroke, mobile stroke units, local stroke-ready health centres) can achieve similar thrombolysis rates and door-to-needle times for rural populations as a centralised system can achieve for an urban population.\textsuperscript{19,22} However, especially in the metropolitan setting when one includes other key therapeutic components and considers both patient outcomes and cost-efficiency, centralised systems tend to fare better.\textsuperscript{23}

An example of this was the London Hyper-Acute Stroke Model, which consolidated the treatment of all early-phase (first 72 hours) acute stroke patients in London previously treated at 30 local hospitals into eight specialised high-volume centres designated hyperacute stroke units, or “HASUs”. Paramedic crews would no longer bring suspected acute stroke patients to their local hospital by ambulance, but instead to the nearest HASU, driving past multiple local hospitals that previously would have received them and even bypassing emergency departments.

An evaluation found that this new model of care resulted in a 25% reduction in mortality rates, marked improvement in processes of care, a rise in thrombolysis rate from 4% in 2010 to 11% in mid-2012, all while the costs of treating each stroke patient were reduced by 6%.\textsuperscript{24}

Despite London’s unpredictable traffic conditions, 98% of patients arrive at the HASU within 30 minutes of being picked up by ambulance. Reports from patients about their experience with the new pathway have been largely positive even considering being cared for ‘further away from home’.\textsuperscript{24,25}

A similar model is currently being implemented at night and on weekends in Auckland. Additional infrastructure and coordination resources are required to achieve this change in model of care, but it is well justified based on available data. Another area within New Zealand that would likely benefit from such collaborative centralisation is the Wellington metropolitan area by combining Hutt Valley and Capital & Coast DHB stroke services.

The value of centralisation in more rural areas remains uncertain. Because care is becoming more complex, access to specialists is becoming more important and the use of telemedicine for both acute stroke and rehabilitation will help bridge this gap as has already been demonstrated.\textsuperscript{19} Reducing clinician and patient travel times is also of benefit from an economic perspective, freeing up resources for other activities as patient volumes increase.

Use of registries and mobile devices can also help connect clinicians, monitor patient outcomes and service performance, and assist with ongoing service improvement to drive positive change. This will become increasingly important as volumes and patient complexity rise.

Stroke rehabilitation services have had limited attention over the past decades. To improve rehabilitation efficiency, inter-disciplinary teams need to be fully staffed and include all required professional groups to offer comprehensive and timely therapy. Similarly, investing more resources into community stroke services to support earlier and better support of patients in the community will help to reduce rehabilitation bed demand. New models of care, including the use of telerehabilitation to link patients in their homes to practitioners, alternate providers (eg, therapy assistants) and increasingly, self-care strategies, need to be developed and implemented in the stroke rehabilitation space.
It has been suggested that 90% of the world's stroke burden is attributable to modifiable risk factors and that achieving control of behavioural and metabolic risk factors could avert more than three-quarters of strokes worldwide. In Oceania, the top five modifiable risk factors contributing to the stroke burden were high blood pressure, high body mass index, diet low in fruits, smoking and diet low in vegetables in order of impact. National policy changes and public awareness campaigns as well as new ideas as to how to best address these issues are vitally needed.

Finally, with increased complexity of care, care pathways, integration of care, and clear and open discussions around ceilings of care and advanced care planning are harder investments to quantify but should not be forgotten.

Discussion

Based on the available data, stroke incidence and mortality has reduced over the past three decades although internationally New Zealand stroke outcome performance lags behind other OECD countries. The New Zealand population is growing and ageing, and if further reductions in stroke incidence are not achieved stroke volumes can be anticipated to increase by 40% from 7,231 in 2015 to 10,112 in 2028. Care will be further complicated by a disproportionate growth in volumes in rural areas with high degrees of social deprivation and disadvantaged ethnic population. There will also be an increasing need to centralise stroke services due to the complexity of modern stroke therapies.

Centralisation is inevitable in metropolitan areas and requires technology support in geographically dispersed areas to ensure that the disparity gap does not widen further.

Improving access to acute intervention and rehabilitation services is essential to ensure mortality and disability continue to decline and minimise the societal (and individual) impacts of the New Zealand's increasing stroke burden. Upfront investments in these interventions, including workforce development, will maximise the possibility of containing health service resource requirements within capacity. Investments in prevention will become increasingly important. We need to achieve a 30% reduction in stroke incidence to keep stroke volumes stable. This will require public policy consideration and massive public awareness campaigns.

This report has several limitations. The greatest limitation is that the main data source is ICD-10-AM hospital coding data that has not been validated. Coding errors are common in these types of data sources and thus the data has to be interpreted keeping this in mind. Prospectively collected proper epidemiological or registry data is not available in New Zealand beyond the Auckland region and even that data is now six years old. International data is too dissimilar to be used in its place. Also, data obtained from New Zealand statistics population data does not always correlate well with the NMDS data as regards time frames or localities, and potential inaccuracies are possible introducing further errors. Much of the projections are based on assumptions and hypothetical scenarios. New Zealand data on models of care is limited. Telestroke and stroke unit care have been found to be effective. However, there is no data around centralisation of stroke care, comparative analyses of different models of stroke unit care, or service models such as early supportive discharge in New Zealand. This makes extrapolations to the New Zealand setting tenuous and better New Zealand data is needed.

Conclusion

New Zealand stroke care improvements are not as prominent as in other OECD countries, but significant improvement has certainly been observed and more recent efforts will not be captured in the presented data. Nonetheless, while incidence rates have reduced, the anticipated population growth and ageing over the next decade will see a 40% increase in stroke admissions unless stroke incidence is further reduced through effective national primary prevention programmes. Long-term stroke burden due to disability and aged residential care requirements could be reduced through improved acute and rehabilitation stroke care, but this will require upfront service investments.
Competing interests:
Nil.

Acknowledgements:
The author would like to acknowledge the contribution of James Greenwell from the Ministry of Health who provided the NMDS data that underpinned this analysis and provided helpful suggestions and Virginia Westerberg who provided a summary of the London Acute Stroke Model that was edited to be included in this paper and prepared Figure 3, but was unavailable to provide input into the overall/final manuscript. Finally, thanks to Ailsa Jacobsen and John Ranta for proof reading the final manuscript.

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URL:

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Impact of discontinuation of telestroke: the Nelson experience
Annemarei Ranta, Suzanne Busch

ABSTRACT

AIM: In 2016, five Central New Zealand hospitals piloted a successful telestroke service that has since transitioned to ‘business as usual’. Nelson Hospital elected to opt out of the service after completion of the pilot. This paper reports the impact of telestroke service discontinuation on service provision within a regional and national context.

METHODS: This is a sequential comparison of three time periods: six months pre-telestroke, six months during telestroke and six months post-telestroke pilot. Main outcomes were thrombolysis rate and door-to-needle time comparing the period with telestroke to the periods without.

RESULTS: Over the 18-month period the thrombolysis rate was 8.5% (6/71) over the six months pre, 23.0% (14/61) over the six months during and 7.9% (5/63) over the six months post the use of telestroke support. The odds ratio (95% CI) of being thrombolysed with versus without telestroke support was 3.33 (1.41–7.86); p=0.006. Patients receiving thrombolysis within 60 minutes of arrival were 50% before, 64% during and 20% after telestroke (OR (95%CI) 3.15 (0.61–16.3); p=0.16). Other hospitals that continued with telestroke maintained their rates and door-to-needle times between pilot and post-pilot periods.

CONCLUSION: These findings indicate that the transient implementation of telestroke was insufficient to upskill provincial hospital generalist clinicians to sustain high thrombolysis rates.

Stroke thrombolysis with intravenous alteplase reduces post-stroke disability and is cost-effective.1,2 In New Zealand, treatment rates of 20–25% of ischaemic strokes are achieved in some centres. Nationally, the rate continues to rise, however, some centres continue to struggle achieving the national target of 8% (due to increase to 10% in 2018/19).3 This inter-hospital variation in treatment rates has been attributed, in part, to limited access to stroke expert physicians, especially out of hours.3

The American Stroke Association recommends telestroke as the best alternative to face-to-face expert assessments if access barriers exist.4 Telestroke involves the provision of remote expert decision support using videoconferencing equipment. The remote stroke expert uses modern technology to connect with the patient and the front-line clinical team virtually. The benefit of using videoconferencing is that the remote expert can directly engage with the entire team, patient and family, observe or conduct a neurological examination, appraise the situation holistically including continuous view of vital sign monitors and medication preparation to avoid drug errors, and is able to personally obtain treatment consent from the patient. It very much simulates the expert being on site at the time when he or she has to make important treatment decisions.

In 2016, the first regional New Zealand telestroke service was piloted involving Wellington Hospital as the ‘hub hospital,’ ie, the service provider of telestroke, and Palmerston North, Hawke’s Bay, Nelson and Wairau Hospitals as the service recipient or ‘spoke’ hospitals. The service only operated during the vulnerable out-of-hour periods and was associated with an increase in thrombolysis rate from 10/68 (7.1%) to 33/161 (20.5%) (OR 4.07 (95 CI 1.93–8.58; p=0.0001) across the region.5
Following the six-month pilot period, the participating DHBs developed a regional business case and received funding approval for the continuation of a regional telestroke service. Since that time, two additional centres decided to join the network with Wairarapa Hospital joining in early 2017 and Whanganui Hospital in April 2018.

One pilot site, Nelson Hospital, elected to opt out of continued participation after the completion of the pilot. They intended to test whether important learnings and gained experience by the local team during the telestroke pilot could be maintained without ongoing remote expert support.

This paper presents the impact of the discontinuation of the telestroke service to Nelson Hospital and places the Nelson experience in both a regional and national context.

Methods

Service description

The telestroke service consists of on-call Wellington neurologists using 4G iPads® or their desktops or laptops to link into the patient-end battery powered, Wi-Fi Polycom videoconferencing (VC) units using Polycom RealPresence®. The neurologists use Citrix® remote desktop to log into their work computers to view radiological images, record clinical/technical data in a secure hospital based Microsoft Access® database, and generate patient reports emailed via secure DHB emails to the provincial hospitals. The network is provided by Vivid Solutions. The remote support is limited to out-of-hour periods (ie, Monday through Friday 4pm to 7:59am and all weekends and public holidays). During regular working hours, the local teams manage patients with on-site support from their local stroke specialist.

The Nelson thrombolysis service without telestroke support consists of a stroke physician who is available part-time during regular hours and who is one of nine general physicians on the out-of-hour roster. All stroke patients are managed by one of these nine general physicians on call. All involved physicians have experience with the provision of stroke care as would be usual for general physicians, however, due to the low patient volumes, each individual has only thrombolysed a handful of patients (on average one per year). The single stroke physician is the only doctor to have attended formal thrombolysis training. The others have had exposure to in-house teaching sessions from the stroke physician and one other has participated in some online training.

Study methods

This is an observational study using a sequential comparison design looking at pre-telestroke (December 2015 through May 2016), telestroke (June 2016 to November 2016) and post-telestroke (December 2016 to May 2017) service performance. The pre-specified main outcome variables were Nelson Hospital thrombolysis rate of ischaemic stroke patients and door-to-needle times with versus without support from the telestroke service.

Patient data were captured prospectively in the National Thrombolysis register. Data captured and analysed included: patient age, treatment rates, arrival time, door-to-CT time, door-to-needle time and rate of intracerebral haemorrhage. Data was supplemented with MoH data capturing stroke discharges to calculate a thrombolysis rate. Denominator figures for MidCentral and Hawke’s Bay DHB for the post-pilot period were only available by quarter and are thus offset by one month.

The denominator for thrombolysis rate uses all admissions coded as ischaemic (ICD-10-AM code I63) and unspecified stroke (I64) as is standard practice in New Zealand. Unspecified strokes are included as the vast majority of these have been found to be ischaemic strokes when audited.

Data analysis was completed in Stata® 13.0. Variables were analysed using linear and logistic regression. For time frames, medians (interquartile range) are reported. National and regional figures from the National Thrombolysis Register are reported for comparison purposes.

Results

Over the 18-month period, 25 of 195 admitted ischemic stroke patients were thrombolysed at Nelson Hospital. Patient age was similar between study groups (mean age 71.5 pre, 73.3 during, and 72.3 years post). The majority of patients presented
out-of-hours during and after telestroke (71% and 80% respectively) with 50% presenting out-of-hours before telestroke. There were no reported symptomatic intracerebral haemorrhages on post-thrombolysis CT scans over the 18-month study period, although some patients did not undergo post-thrombolysis imaging.

The thrombolysis rate was 8.5% (6/71) over the six months pre-telestroke, 23.0% (14/61) over the six months during the telestroke pilot, and 7.9% (5/63) over the six months immediately after discontinuation of telestroke support from Wellington Hospital. The odds of being thrombolysed while telestroke remote expert support was in place was 3.33 (95% Confidence Interval (CI) 1.41–7.86); p=0.006). During the same time period, hospitals that continued to receive out-of-hour support through telestroke experienced continued increases in treatment rates (Figure 1).

Door-to-needle times also fluctuated across the three study periods. Of those thrombolysed, 50% of patients received thrombolysis within 60 minutes or less pre-telestroke, 64% during the telestroke pilot and 20% after telestroke was discontinued. The odds of achieving thrombolysis within the target time frame of 60 minutes from arrival in hospital was 3.15 (95% CI 0.61–16.3; p=0.16) in the setting of telestroke support compared with periods when there was no expert support via telestroke. Door-to-needle and door-to-CT time are depicted in Table 1.

Careful review of patients not treated

<table>
<thead>
<tr>
<th></th>
<th>Door-to-CT time</th>
<th>Door-to-needle time</th>
<th>Treated within 60 minutes of arrival</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median (IQR)</td>
<td>Median (IQR)</td>
<td>%</td>
</tr>
<tr>
<td>Pre-telestroke</td>
<td>26 (23, 29)</td>
<td>61 (51,77)</td>
<td>50</td>
</tr>
<tr>
<td>During telestroke pilot</td>
<td>27 (14, 34)</td>
<td>61.5 (43,74)</td>
<td>64</td>
</tr>
<tr>
<td>Post-telestroke</td>
<td>37 (30,41)</td>
<td>92 (65, 116)</td>
<td>20</td>
</tr>
</tbody>
</table>

*IQR=Inter-quartile range
After discontinuation of telestroke by two stroke experts revealed that nine additional patients met inclusion criteria and would have likely been treated had a stroke specialist been involved in the decision-making process. Had these nine patients been treated, the post-telestroke thrombolysis rate would have been 22% (14/63).

Nationally the thrombolysis rate continues to rise with a rate of 8.4% in 2015/16 that has risen to 9.5% in 2016/17. At the same time, door-to-needle times continue to gradually reduce (Figure 2) with 43% treated within 60 minutes nationally in 2016/17. This compares with a thrombolysis rate of 13% and a rate of 30% of patients treated under 60 minutes in Australia during the 2017 Australian stroke audit. It is noteworthy that the Australian audit is voluntary and captures data from only 78.5% of eligible and self-selected services compared with the New Zealand registry data, which is mandatory with all 20 DHBs contributing.

Treatment rates vary by region with the Central Region showing the highest rates and most significant increases over the last three years (Figure 3).

Figure 2: National door-to-needle times depicted by quarter.

Figure 3: Regional thrombolysis rates over the past three years.
Discussion

The greatest predictors of improved patient outcomes in the setting of stroke thrombolysis are higher treatment rates and reduced door-to-needle times.\textsuperscript{7,8}

Telestroke has been proposed to improve patient access to stroke thrombolysis, and the thrombolysis rate at Nelson Hospital rose from 8.5\% to 23\% after the initiation of an out-of-hour telestroke service with remote expert support from Wellington neurologists. Similar increases were seen at other telestroke ‘spoke’ hospitals during the Central Region telestroke pilot.

The transient expert support at Nelson Hospital may have helped upskill the local team to be able to sustain this rise in treatment rate even after discontinuation of expert support. The findings presented here, however, indicate that this was not the case as the rate reverted to 7.9\% following the discontinuation of telestroke support.

This strongly supports the notion that ongoing telestroke support helps to maintain optimal thrombolysis rates as measured by international standards. It is reassuring that the complication rate was low even in the setting of higher treatment rates.

Furthermore, treatment delays increased after telestroke discontinuation. It may be initially surprising that time delays were worse after telestroke than before, but it is likely that this is attributable to the disproportionately higher number of patients who presented out-of-hours after the pilot compared with before. This is likely random, but does affect time delays. When patients present out-of-hours, fewer staff are on site and CT technicians have to drive in from home. However, it is noteworthy that out-of-hour patients were also very frequent during the telestroke pilot, yet reasonable door-to-needle times were achieved. The reduced door-to-needle time in the setting of expert care is likely attributable to faster decision making, focus on a parallel rather than sequential approach to managing required steps before treatment can be safely started and greater experience with prioritising some essential tasks over others.

It is overall encouraging that across New Zealand, treatment rates and speed of access have improved, which seems largely to have been driven by the implementation of telestroke in the central region although other initiatives including the National FAST campaigns, the launch of a national ambulance destination protocol and individual DHB efforts to streamline ED processes all have contributed.

New Zealand is keeping up internationally with treatment rates and door-to-needle times and is one of the only countries in the world that collects national census data on stroke reperfusion intervention rates as part of the National Thrombolysis Register. However, more progress has to be made and to that end a telestroke sub-pilot has been completed in the Midland Region with results awaited, and the South Island is starting an implementation project for telestroke there as well. Nelson is now considering rejoining the Central network.

These efforts will link into regional clot retrieval services to help optimise patient selection and help achieve timely access to the best available reperfusion options for all New Zealanders experiencing a stroke.
Competing interests:
Nil.

Acknowledgements:
We would like to acknowledge all of the physicians and nurses who contribute to the management of acute stroke patients at the mentioned hospitals. Their continuous dedication to achieving best patient care and outcomes make all the difference.

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REFERENCES:
Sexuality and gender identity teaching within preclinical medical training in New Zealand: content, attitudes and barriers

Oscar Taylor, Charlene M Rapsey, Gareth J Treharne

ABSTRACT

AIMS: To investigate inclusion of sexuality and gender identity content, attitudes and barriers to inclusion of content in preclinical curricula of New Zealand medical schools from the perspective of key teaching staff.

METHOD: Staff responsible for curriculum oversight at New Zealand’s two medical schools were invited to complete a mixed-methods survey about sexuality and gender identity content in their modules.

RESULTS: Of 24 respondents, the majority included very little content relating to sexuality or gender identity (33%) or none at all (54%). This content was deemed important by most participants (69%), and none believed there should be less such content in their curriculum. Time was reported to be the main barrier limiting inclusion of such content.

CONCLUSIONS: Our finding of limited content is consistent with international literature. Our findings extend the literature by revealing that barriers to greater inclusion of content are not due to overt negative attitudes. Staff responsible for preclinical medical curriculum oversight have positive attitudes about content relating to sexuality and gender identity but perceive curriculum space to be a limiting barrier. This is important as it informs approaches to change. Future interventions with medical schools should focus on methods to increase diverse content as part of existing teaching, education to increase knowledge of LGBTQI relevant material and potentially incorporate strategies used to address unconscious bias. Addressing the perceived barriers of time constraints and lack of relevance is required to ensure medical students receive training to develop the competencies to provide positive healthcare experiences for all patients regardless of sexuality and gender identity.

People with marginalised sexual and gender identities face many health inequities across diverse areas, including cancer, addiction and mental health difficulties, domestic violence and sexual health. Research indicates negative healthcare experiences are common for lesbian, gay, bisexual, transgender, queer/questioning and intersex (LGBTQI) individuals. These experiences include assumptions about sexuality alongside minimal options for disclosure, the use of incorrect gender pronouns, discriminatory statements regarding the person’s identity and even refusal of treatment. The recent Ministry of Health commissioned report, “Mental Health promotion and prevention to gay, lesbian, bisexual, transgender and intersex population in New Zealand”, emphasised that not all doctors are equipped to provide appropriate care for these populations. For example, one participant reported, “...I guess where I met hostility is within hospitals when I have been ill and doctors (not normally nurses) do not know how to cope with my partner being my partner or us being close or wanting information from them and sharing it with my partner.”
Fear of negative experiences and lack of trust in a doctor’s understanding of LGBTQI needs may result in individuals being reluctant to disclose their sexuality or gender identity, perpetuating health inequalities through compromising integrated healthcare. Additionally, patients may not be aware of the value in disclosing their gender identity, sexuality or sexual behaviours to doctors, further emphasising the need for doctors to sensitively elicit this information. Medical training must address issues of diversity in sexuality and gender to counter the many health inequalities resulting from marginalisation and dissatisfaction with medical care among LGBTQI individuals.

International research investigating teaching staff’s perspective of medical education related to LGBTQI health indicates significant gaps. A recent survey of key curriculum staff from 14 medical schools in Australia and one in New Zealand found that 60% of schools include five or fewer hours of LGBTQI content in preclinical education. Specific figures are not reported for the one New Zealand school that responded and the survey was limited by including only one key staff member from each school, which is unlikely to be someone with detailed knowledge of the content of all modules. In a review of LGBTQI content in North American medical schools, the median time dedicated to this content was five hours over the entire programme of study. The majority of institutions surveyed had some LGBTQI content but mainly in preclinical years. However, when asked about the quality of their institution’s LGBTQI content in the surveys from North America and Australia/New Zealand, around half of staff felt it was fair and around a quarter felt it was poor. Although international evidence shows some LGBTQI-specific content exists in medical programmes, there is a need to understand how to ensure this content is more than poor or fair, and it is pertinent to consult teaching staff to explore their confidence to include relevant LGBTQI content at appropriate points in the curriculum.

Overall, there is a lack of evidence regarding medical school teaching staff’s attitudes and confidence in teaching LGBTQI healthcare and what barriers they perceive to effectively educating medical students about LGBTQI healthcare. The purpose of this study was to survey module conveners within New Zealand medical schools to investigate what is currently taught about LGBTQI healthcare and to determine conveners’ attitudes to teaching LGBTQI healthcare, given an increasingly secular and politically accepting climate in New Zealand. Same-sex marriage was legalised in New Zealand in 2013 and there is less conflict between religion and sexual diversity in New Zealand than in Australia, North America and the UK, but not universal acceptance. This makes New Zealand medical schools a pertinent location to explore coverage of LGBTQI content and barriers to coverage.

**Methods**

**Participants**

All 38 academic staff responsible for preclinical curriculum oversight at New Zealand’s only two medical schools were contacted regarding participating in the study. The University of Auckland School of Medicine and the Otago Medical School provided a list of contact details for relevant staff. University of Otago Ethics, Category B, approval was given.

**Survey**

A mixed methods design was used, in which quantitative and qualitative data were collected using the Qualtrics online survey platform. The survey included questions informed by Otago Medical School curriculum and previously validated measures. Some questions were adapted to include questions specific to a participant’s module, to suit teaching staff rather than students, and using the acronym LGBTQI to encompass a wide scope of identities.

Quantitative data were collected by asking participants to indicate how LGBTQI content is taught in their module, their attitudes surrounding the level of such coverage and barriers encountered when trying to include such content in their module (see below for question wording). Qualitative data were collected in response to the question “Do you have any comments about the teaching of LGBTQI content?” This question was primarily included to help explain the
responses to closed questions but also to allow participants to raise issues not covered in those questions. The study is thus a concurrent QUAN + qual mixed method with the capitalised QUAN signifying the primary emphasis on the quantitative data.

Coverage of LGBTQI content
Participants were asked “How much LGBTQI content is taught in your module?” with five response options ranging from ‘None at all’ to ‘A great deal’. Those who did include LGBTQI content were then asked how the content was covered in the module (‘Mostly interspersed throughout various parts of the curriculum’, ‘Mostly taught in discrete modules’, ‘Not officially taught’). Finally, all respondents were presented with a list of 25 content areas and asked to indicate which were relevant to their module. Content areas, displayed in Table 1, were selected using a curriculum map of content areas included in the current preclinical curriculum at the Otago Medical School. Participants were asked whether medical students in their module are provided with education in the previously selected content areas relevant to LGBTQI people.

Attitudes
Participants were asked how important they believe it is to educate medical students in the selected content areas relevant to their module, in relation to LGBTQI people. Response options ranged from ‘Very important’ to ‘Not at all important’. Participants indicated the extent they agreed that their module had good coverage of LGBTQI content, with response options ranging from ‘Strongly agree’ to ‘Strongly disagree’ (see Table 2). Finally, they were asked how much more or less time they felt should be dedicated to LGBTQI content in their module, with response options ranging from ‘Much more’ to ‘Much less’ (see Table 2).

Barriers
Participants were asked about barriers that could influence their inclusion of LGBTQI content in their module, including whether their school of medicine provided faculty development for teaching LGBTQI content, with response options being ‘yes’, ‘no’ or ‘don’t know’ and how easy or difficult they found teaching, finding time to teach and accessing resources to help teach LGBTQI using a 7-point scale ranging from ‘Extremely easy’ to ‘Extremely difficult’ (see Table 3).

Data collection and analysis
Data were collected from Otago Medical School in January 2017 and from the University of Auckland School of Medicine across April and May 2017. The survey was distributed by email using Qualtrics. A generic link was used rather than tracking responses from individual participants. Participants were informed that completing the survey indicated that they had provided consent. One reminder email was sent. A total of 24 staff (63%) gave consent and began the survey, with 21 completing the survey (55%). Responses of those who began but did not complete the survey were included in analyses where they had provided data. The response rates for participants completing the survey at the Auckland School of Medicine and the Otago Medical School were comparable (57% and 53% respectively).

The data are described as the percentage of participants selecting each response option. Due to the small sample size, standard error and confidence intervals would not be reliable and have not been included in this report. In order to analyse the qualitative data we applied a form of thematic analysis based on the phases and distinctions described by Braun and Clarke. In terms of these distinctions, our thematic analysis: i) aimed to provide a comprehensive description of the dataset of comments, ii) was data-driven (ie, inductive), iii) applied an essentialist/realist epistemology (ie, that participants’ comments provide a direct reflection of their experiences and intended meanings) and iv) sought semantic themes (ie, interpreting the surface meanings of comments). Of those who responded to the survey, 13 provided comments (54% overall; 38% from Auckland and 62% from Otago).
Results
Quantitative results

Content
When asked how much LGBTQI content was included in their module, 54% responded ‘None at all’; 33% responded ‘A little’; few responded ‘A moderate amount’, ‘A little’ or ‘A great deal’ (one participant each). LGBTQI content was reported to be taught in discrete blocks in 70% of these 11 modules (29% of all modules) and interspersed throughout various parts of the curriculum in 20% of the 11 modules (8% of all modules). A convenor of one of these 11 modules responded that LGBTQI content was ‘Not officially taught’, and another did not respond.

Participants were next provided with the list of the 25 curriculum content areas and asked to select areas relevant to their module (Table 1). For 50% of areas selected as relevant to their module, participants responded that students were provided with LGBTQI-specific education, whereas for 36% of areas selected as relevant to their module participants reported that students were not provided LGBTQI-specific education. For the other 14% of selected content areas, respondents did not know whether LGBTQI-specific education was provided in their module. For all 25 content areas, at least one participant responded that students are provided with education in relation to LGBTQI people in their module.

Table 1: Curriculum content areas and responses when participants were asked to select all the content areas that may be relevant in their module and whether their module provided education in relation to LGBTQI people in the content areas they had selected as relevant.

<table>
<thead>
<tr>
<th>Content area</th>
<th>Content area relevant to their module</th>
<th>Covered in relation to LGBTQI people in their module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Barriers to accessing healthcare</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Alcohol, tobacco or other drug use</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Safe sex</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Sexually transmitted infections (not HIV)</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>HIV</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Chronic disease risk</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Gender identity</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Disclosure of identity</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Intersex/disorders of sex development (DSD)</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Transitioning (eg, male-to-female, female-to-male)</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Sex reassignment surgery</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Adolescent healthcare</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Mental health</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Body image</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Unhealthy relationships (eg, abuse within and outside the family)</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>How your own values, attitudes and morals affect patient care</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Development of sex characteristics</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Requesting sexual health information/taking a sexual history</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Requesting information about a patient’s personal history</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Doctor-patient relationship</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Geriatric care</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Reproductive health</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Requiring community/family support</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>None are relevant</td>
<td>2</td>
<td>N/a</td>
</tr>
<tr>
<td>Total</td>
<td>171</td>
<td>70</td>
</tr>
</tbody>
</table>
Attitudes
In content areas selected as being relevant to the module they convene, participants responded that educating students in LGBTQI content was ‘Extremely important’ for 37% of selected content areas, ‘Very important’ for 32%, ‘Moderately important’ for 12%, ‘Slightly important’ for 11% and ‘Not at all important’ for 8% of selected content areas.

When asked to indicate whether their module had good coverage of LGBTQI content, the majority of participants disagreed (see Table 2), although one-third neither agreed nor disagreed. When asked whether more or less time should be dedicated to LGBTQI content in their module, no participants responded that there should be less, while the majority felt there should be the same and the rest felt that there should be more LGBTQI content (see Table 2).

Table 2: Participants’ responses to the questions regarding their attitudes about LGBTQI coverage in their module.

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the whole, your module has good coverage of relevant LGBTQI content.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Much more</td>
<td>Moderately more</td>
</tr>
<tr>
<td>How much more/less time do you feel should be dedicated to LGBTQI content, on the whole, in your module?</td>
<td>5%</td>
</tr>
</tbody>
</table>

Barriers
When asked how easy or difficult it is teaching LGBTQI content, the majority of participants responded that it is neither easy nor difficult (see Table 3), while 30% found it to be varying degrees of easy to teach, and 15% found it moderately difficult to teach.

Around half of participants reported finding the time to teach LGBTQI content to be difficult (see Table 3). Only 16% found it easy to find the time, and 37% found it neither easy nor difficult finding time. Just over half of participants responded that it was neither easy nor difficult accessing resources to help with teaching LGBTQI content (see Table 3), and 20% and 25% responded that it was easy or difficult, respectively.

When asked whether their school of medicine provided faculty support for teaching about LGBTQI healthcare, the

Table 3: Participants’ responses to the questions regarding ease of teaching LGBTQI content in their module.

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>How easy/difficult is it:</td>
<td>Extremely easy</td>
</tr>
<tr>
<td>Teaching LGBTQI content?</td>
<td>0%</td>
</tr>
<tr>
<td>Finding time to teach LGBTQI content?</td>
<td>0%</td>
</tr>
<tr>
<td>Accessing resources to aid with teaching LGBTQI content?</td>
<td>0%</td>
</tr>
</tbody>
</table>
majority of participants responded that they did not know whether their school of medicine provided faculty support (74%), while 17% responded that there was no faculty support and 9% responded that there was support.

Qualitative results
Conveners have positive attitudes about LGBTQI content
Comments from participants indicated that they perceived the inclusion of LGBTQI content in the preclinical curriculum as an important and positive content area. An increased amount of LGBTQI content in the curriculum over recent years was described, as was the desire to further increase the amount of LGBTQI content.

“There was no LGBTQI content previously but I have put some content in this year and hope to improve it next year.”

Conveners perceive LGBTQI content as not relevant in their module
Despite the positive attitudes about including LGBTQI content in the preclinical curriculum, conveners commented that they did not believe their module was the place to include such content, and it was better taught elsewhere in the curriculum. Participants often expressed that LGBTQI content is not relevant in their module as sex, gender and sexuality is not important at the academic level their module covers, and that content would be more relevant in modules with a greater focus on patient work, and later in the curriculum.

“There absolutely believe it is an important part of the curriculum, I don’t believe [module] is the place to teach it in any depth. [Module] is focused on basic principles and very cellular/molecular. Very little distinction is made on the basis of sex or gender at this stage. Introducing the LGBTQI content at a stage where the students are more focused patient-based learning would seem more appropriate.”

Designated areas for teaching LGBTQI content exist
Participants also suggested that specific areas for teaching LGBTQI content are included in the curriculum. Entire modules were identified for teaching LGBTQI content, as were discrete blocks within modules dedicated to LGBTQI content.

“[Module] is an elective course [...] It is entirely dedicated to teaching LGBTQI healthcare content.”

“We have two lectures and a two hour small group session of teaching [LGBTQI content].”

Discussion
The findings of this survey suggest that there is some coverage of LGBTQI content across various content areas in the preclinical curriculum in New Zealand medical schools, with around a third of respondents believing that good cover has been achieved. However, participants’ responses suggest that in a number of areas coverage is brief and insufficient. Participants were aware of this brief coverage in their modules, nevertheless fewer than 50% believed that more content should be included. Several contributing barriers to limited cover were identified, chiefly time constraints. These findings support previous surveys of medical students or teaching staff in Australia/New Zealand, South Africa, the US and UK through confirming low levels of content inclusion and extend these studies by finding, within New Zealand, that barriers to inclusion are more subtle than overt negative attitudes.

In the quantitative and qualitative findings, conveners reported positive attitudes towards the inclusion of LGBTQI content despite the limited coverage. This discrepancy between attitudes regarding inclusion and actual inclusion suggest that barriers other than negative attitudes towards LGBTQI healthcare are inhibiting conveners from incorporating this content into their teaching. The main barrier reported was space to include LGBTQI content. Given the considerable amount of content that is covered in the preclinical stages of the medical curriculum, it could be that conveners set aside LGBTQI content in favour of other content areas. This is a barrier that has been identified in research with teaching staff of other health professional training programmes.

Thematic analysis revealed another barrier; many conveners do not believe LGBTQI content to be relevant to their teaching. Preclinical medical training includes strong grounding in basic sciences;
LGBTQI content may arguably be less relevant to include within subjects with minimal applied focus such as biochemistry. However, it may be that educators lack awareness of LGBTQI issues and therefore fail to recognise relevant teaching opportunities within these subjects (e.g., biochemistry of hormone treatment). Further, a failure to recognise the relevance of LGBTQI content may represent an uncritical acceptance of heteronormativity and cisnormativity. For example, consideration of ‘physiological’ sex differences within basic sciences could be informed by consideration of the relevance of transgender hormone treatments. In addition, conveners noted that while not relevant to their module, other individuals did teach LGBTQI content. This viewpoint takes the responsibility off the individual convener to include LGBTQI content. The result is that a few individuals are the only people attempting to cover LGBTQI content.

A possible explanation for these barriers is the primary use of block teaching rather than integrating LGBTQI content into existing curriculum. The findings suggested that LGBTQI content is typically taught in discrete blocks with minimal interspersion throughout the curriculum. The Association of American Medical Colleges has recommended that faculty take an integrative approach to adding LGBTQI content to medical curricula; for instance, including LGBTQI patients in existing lectures, case studies and exam questions. A structured review of the degree of diversity that exists in the written teaching material and exploration of the implicit or ‘hidden’ curriculum in New Zealand medical schools would be a good way to supplement the findings of the current study in future research.

In a US-wide survey of medical school deans, one of the most successful strategies for increasing LGBTQI content in medical curriculum was having “faculty willing and able to teach LGBT-related curricular content”. The present findings suggest that New Zealand medical school staff are willing to teach LGBTQI content, but report that they are not able to, given the barrier of an already full curriculum. We hypothesise that another process may also be at work whereby heteronormativity and cisnormativity are uncritically accepted, therefore opportunities for the inclusion of LGBTQI content that do not involve additional teaching time are missed, for example including people who are LGBTQI in existing case studies. Although explicit attitudes towards LGBTQI health were positive in this survey, the task of challenging heteronormicity and ciscentricity remains.

Faculty development has been identified as a method for facilitating the inclusion of LGBTQI content in healthcare education. The results of the present study suggest that faculty development is either not being offered to staff or engagement is low. Either way, staff are provided with little experience or education regarding LGBTQI healthcare. Further, if staff are unaware of the disproportionate burden of health needs experienced by LGBTQI people, then decisions regarding teaching priorities may be inadequately informed.

There were limitations to this study. A moderate response rate constrained generalisability. In addition, the study is limited by surveying only the pool of preclinical module conveners rather than including all staff. Although conveners are most likely to have an overview of the content of their modules it is probable that there would have been variations in response from individual teaching staff reflecting more accurate estimates of content and greater diversity of attitudes. Further, it is likely that curriculum content has developed over time and is shaped by various institutional practices for curriculum development and may not reflect recent decisions about how much LGBTQI content to cover.

Despite the survey being anonymised, participants may have wanted to present a favourable picture of their coverage resulting in socially desirable responding. A high percentage of participants responded with the neutral response option provided. This option may have been used frequently as an uncontentious answer and makes the results difficult to interpret. The likelihood of responses being explicitly or implicitly shaped by social desirability may also have been affected by survey item wording. That is, participants were asked to indicate whether there was “good” coverage. “Good” may have a moral valence that influenced participant responding toward the positive throughout the survey. Further, participants were not asked how important they
considered LGBTQI teaching; while participants may consider that it would be “nice” to have greater time to teach a range of topics, they may be unaware of the value of including LGBTQI content. This is consistent with the finding that lack of time was a major barrier to teaching; this reflects that LGBTQI content is not considered to be a priority. It would be useful to understand teaching staff’s understanding of the importance and relative importance of LGBTQI content in order to provide appropriate education to teaching staff. The extent of LGBTQI coverage in the final years of New Zealand medical school remains unknown; it will be important for future research to capture the explicit content at later levels as well as the implicit knowledge passed on as students work alongside senior clinicians. Past research suggests there is less LGBTQI content later in the medical school curriculum, but participants in the current survey indicated that greater cover was provided in later years, establishing whether this is the case is important to ensure adequate coverage of LGBTQI content across New Zealand medical schools. Furthermore, studies assessing student learning are required to determine the impact of teaching about LGBTQI healthcare.

Conclusion
This study adds to international literature about barriers to the inclusion of content relating to sexuality and gender identity in medical training. Preclinical medical school module conveners have positive attitudes towards teaching LGBTQI healthcare in New Zealand; however, content is briefly included in blocks within content areas where it is considered relevant and most staff do not believe that changes need to occur. The discrepancy between positive attitudes about the content and the limited inclusion could be explained by curriculum constraints, the belief that the content should be covered elsewhere in the curriculum, lack of experience with LGBTQI healthcare needs, lack of awareness of the importance of LGBTQI content and slow adaptation of curriculum to societal changes. Leaders of medical school curriculum development could consider implementing training that addresses unconscious bias, increases motivation among medical school teaching staff to prioritise the delivery of LGBTQI content and explore integrative approaches to including LGBTQI content in medical school curricula.

Competing interests:
Nil.

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REFERENCES:


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Gynaecological cancers are a diverse group of cancers arising from the female reproductive system, including ovary, fallopian tube, uterus, cervix, vagina and vulva. In New Zealand, gynaecological cancers make up 10% of all cancer cases and contribute to 10% of all cancer deaths.\textsuperscript{1} Of these, endometrial cancer is the most common type of gynaecological cancer in New Zealand, however ovarian cancer is responsible for the most gynaecological cancer deaths.\textsuperscript{1}

The services for assessment and management of women with gynaecological cancers have developed regionally rather than being centrally organised, which raises an important question of whether there is consistent care across New Zealand. In an effort to ensure consistent care provision, the Ministry of Health has developed the ‘Faster Cancer Treatment’ (FCT) pathway, which aims to support district health boards (DHB) in achieving timely service provision for patients with suspected or confirmed malignancy.\textsuperscript{2}

The two key targets which have been identified from this initiative are:

\begin{itemize}
  \item Treatment should begin within 31 days of decision to treat with women with a confirmed diagnosis of gynaecological cancer
  \item Women referred with a high suspicion of gynaecological cancer receive their first cancer treatment within 62 days of the referral being made\textsuperscript{3}
\end{itemize}

The national baseline performance for all cancer patients receiving their first
treatment within 62 days was reported as 65% in 2014, with a target of >85% by July 2016 and >95% by July 2017. Standards of service provision have been developed in order to achieve these targets along with other good practice points, which have been developed using existing evidence-based standards, clinical guidelines, patient pathways and expert opinion to ensure all elements in cancer care are provided in an efficient and sustainable manner.1

In the context of Northland DHB, all suspected or confirmed gynaecological cancer cases are discussed with specialists at Auckland (a tertiary level gynaecological treatment centre) for a management plan at a weekly gynaecological oncology multi-disciplinary meeting. A large proportion of these patients then go on to have their treatment in Auckland, for example, patients requiring radiotherapy or surgery by gynaecology oncology specialists. While this current system promotes standard care across different DHBs, it has the potential to compromise the timeliness of care provision. It is therefore crucial that all elements of cancer care are provided within the timeframe outlined in the standards, in order to ensure all patients receive their treatment in a timely manner.

An audit evaluating Northland DHB’s performance against these national targets between June 2014 and June 2015 identified significant delays in assessment and treatment of gynaecological cancers. This study is a repeat clinical audit to review whether there has been an improvement in meeting the specific timeframes set out by the tumour standards and FCT targets.

Aims

The aims of this audit are as follows:

1. To obtain data from clinical records of patients with gynaecological cancers to investigate whether their cancer pathway timeline complies with the targets defined in the Standards of Service Provision for Gynaecological Cancers and Faster Cancer Treatment pathway

2. To review whether there has been an improvement in cancer care provision in Northland DHB following the changes that have been implemented since the previous audit.

Methods

The study population for this audit consisted of patients residing in the Northland DHB catchment areas who were discussed at the Auckland Gynaecology Oncology MDM between 1 January 2016 and 31 December 2016. These patients were identified by consulting the MDM patient list held by the Gynaecology and Colposcopy outpatients Clinical Nurse Specialist. A total of 76 patients were identified from this list, of which 30 were excluded from analysis due to the following reasons: non-malignant pathology on final histology; recurrence of previously treated cancer; cancer of non-gynaecological origin.

For the remaining 46 patients, information regarding their cancer treatment pathway was obtained from clinical notes and electronic patient record system (Concerto), by looking up their discharge summaries, clinic letters, operation notes, MDM reports, radiology and histology reports. Data collected from these sources were then collated on an Excel spreadsheet and statistical analysis performed to calculate the percentage of patients who met the standard for each datapoint, as well as the minimum, mean and maximum time for the datapoint to be achieved. These values were then compared directly with those from the previous audit for analysis.

The standards and the FCT targets set by the Ministry of Health remain the same as for the previous audit period (Table 1). Therefore, datapoints used for this current audit have been imported directly from the previous audit (Table 2), allowing direct comparison with the previous audit.
Table 1: Faster cancer targets, gynaecological tumour standards and good practice point.

<table>
<thead>
<tr>
<th>National faster cancer targets²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Treatment should begin within 31 days of a decision being made that they will have that treatment.</td>
</tr>
<tr>
<td>2. Patients receive their first cancer treatment within 62 days of the hospital receiving their referral. (When the doctor receiving the referral believes there is a high suspicion of cancer and that they should be seen within two weeks).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standards of service provision for gynaecological cancer patients¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 1: The following timeframes are met.</td>
</tr>
<tr>
<td>• Women referred urgently with a high suspicion of gynaecological cancer have their first specialist assessment (FSA) within 14 days.</td>
</tr>
<tr>
<td>• Women with a confirmed diagnosis of gynaecological cancer receive their first treatment within 31 days of the decision to treat.</td>
</tr>
<tr>
<td>• Women referred urgently with a high suspicion of gynaecological cancer receive their first cancer treatment within 62 days.</td>
</tr>
</tbody>
</table>

Pathology review good practice point 3.3:
• Provisional or final pathology reports are communicated with the lead clinician within 10 working days of the specimen being taken.

Standard 6:
• Women with a new diagnosis of gynaecological malignancy are offered an appointment for radiological investigations required for treatment planning that falls within two weeks of the date of receipt of that referral.

Standard 12:
• The MDM discussion takes place within 14 days of referral (provided referral criteria are met).

Table 2: Audit datapoints and target timeframe with respective original standards of service provision for gynaecological cancer patients.⁴

<table>
<thead>
<tr>
<th>Datapoints</th>
<th>Target (days)</th>
<th>Standards of service provision and FCT targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Time to first specialist appointment</td>
<td>≤14</td>
<td>S1a—Women referred urgently with a high suspicion of gynaecological cancer have their first specialist assessment within 14 days.</td>
</tr>
<tr>
<td>2a. USS wait time</td>
<td>≤14</td>
<td>S6—Women with a new diagnosis of gynaecological malignancy are offered an appointment for radiological investigations required for treatment planning that falls within two weeks of the date of receipt of that referral.</td>
</tr>
<tr>
<td>2b. CT wait time</td>
<td>≤14</td>
<td></td>
</tr>
<tr>
<td>2c. MRI wait time</td>
<td>≤14</td>
<td></td>
</tr>
<tr>
<td>3a. Decision to take histology – histology report</td>
<td>≤14</td>
<td>GP3.3—Provisional or final pathology reports are communicated with the lead clinician within 10 working days of the specimen being taken.</td>
</tr>
<tr>
<td>3b. Histology taken – histology report</td>
<td>≤10</td>
<td></td>
</tr>
<tr>
<td>4a. MDM referral to first MDM</td>
<td>≤14</td>
<td>S12—The MDM discussion takes place within 14 days of referral (provided referral criteria are met).</td>
</tr>
<tr>
<td>4b. MDM referral to treatment decision</td>
<td>≤14</td>
<td></td>
</tr>
<tr>
<td>5. Decision to treat—first treatment</td>
<td>≤31</td>
<td>S1b—Treatment should begin within 31 days of a decision being made that they will have that treatment.</td>
</tr>
<tr>
<td>6. GP referral—first treatment</td>
<td>≤62</td>
<td>S1c—Women referred urgently with a high suspicion of gynaecological cancer receive their first cancer treatment within 62 days.</td>
</tr>
</tbody>
</table>
Results

Demographics
There were 46 patients who were discussed at the Gynaecology Oncology MDM between January 2016 and December 2016 who had a new diagnosis of gynaecological cancer confirmed on their final histology. The average age of our patients was 60 years old, with the oldest patient being 83 and the youngest 25. Of the 46 patients, 27 were New Zealand European (58.7%), 13 New Zealand Māori (28.3%), four other European (8.7%) and two Pacific Islander (4.3%).

Cancer types
The most common type of cancer was endometrial cancer, closely followed by ovarian and cervical.

FCT targets
Datapoints 5 (first treatment within 31 days of decision to treat) and 6 (first treatment within 62 days of referral being made) relate directly to the national FCT targets.

Overall, datapoint 5 was met in 85% of cases with a mean time of 21 days (0–64 days) between decision to treat and first
This is a marked improvement from the previous audit, where the target was met in 73% of patients with a mean time of 28.5 days (0–161 days). When this was broken down to where first treatment took place, 71% of patients receiving their first treatment in Northland met the target, while 96% of patients receiving their first treatment in Auckland met the target. The average wait time was 23 days for Northland and 20 days for Auckland.

Datapoint 6 was only met in 45% of patients with an average wait time of 83.6 days from referral to first treatment (0–310 days). This again showed an improvement from the previous audit, where the target was met in 39% of patients with an average wait time of 98.5 days (5–525 days). Subgroup analysis showed that the target was met in 35% of patients receiving treatment in Northland and 52% of those receiving treatment in Auckland. The average wait time was 89.4 days and 79.2 days respectively.

Six patients were excluded from analysis as their cancer pathway did not reflect the DHB’s performance in meeting the target for the following reasons: two patients were seen and investigated by private specialists and referred to MDM for management; three patients had been followed up in colposcopy clinic for a number of years with high grade smears before they developed cancer; one patient had been seen and discharged from gynaecology clinic and re-referred self to clinic with recurrence of symptoms.

### Table 3: Percentage of patients who met datapoints 5–6 (correlating to FCT targets) and mean, minimum and maximum waiting times.

<table>
<thead>
<tr>
<th>Audit datapoint definition</th>
<th>Target met (%)</th>
<th>Total number</th>
<th>Mean (days)</th>
<th>Min–Max (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Treatment decision to first treatment &lt;31 days - Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northland</td>
<td>76</td>
<td>71</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Auckland</td>
<td>68</td>
<td>96</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>6 GP referral to first treatment &lt;62 days - Overall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northland</td>
<td>37</td>
<td>35</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>Auckland</td>
<td>43</td>
<td>52</td>
<td>21</td>
<td>23</td>
</tr>
</tbody>
</table>
Subgroup analysis by ethnicity showed Māori patients were less likely to meet FCT targets compared to their non-Māori counterparts.

Datapoint 5 was achieved in 76.9% of Māori patients compared with 87.9% in non-Māori. The average wait time was similar between the two groups.

Datapoint 6 was achieved in 27.3% of Māori patients compared with 51.7% in non-Māori. There was a significant discrepancy in wait time between referral and first treatment in Māori and non-Māori, with Māori on average waiting 38.5 days longer than non-Māori.

Other standards of cancer care service provision

The following results relate to the standards provided in the Standards of Provision for Gynaecological Cancer Patients in New Zealand.

Datapoint 1 required that patients have their first specialist appointment within 14 days of referral to gynaecology service from their general practitioner or other hospital specialty. This was achieved in 85% of patients with an average wait time of 12 days between referral and first specialist appointment, with the minimum being 0 days and maximum being 84 days. The previous audit had shown the target being met in only 65% of cases albeit a slightly shorter average time of 10.5 days (0–60 days).

Datapoint 2 necessitated that patients are offered radiological investigations within two weeks of request being made. This was analysed for each type of radiologic investigation, namely ultrasound (2a), CT (2b) and MRI (2c). For ultrasound, it took an average of 13.4 days for patients to have their scan, with the target of two weeks being met in 72% of patients. The range of wait times was 0–65 days. Datapoint 2a had been better achieved in the previous audit period, with the target being met in 81% of cases with an average wait time of 9.5 days (0–101 days). CT scans took on average 5.0 days, with the wait time ranging between 0 and 14 days. All of the patients needing CT had their scans within 14 days of request, which is

<table>
<thead>
<tr>
<th>Table 4: Māori and non-Māori patients having treatment within 31 days of decision to treat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datapoint</td>
</tr>
<tr>
<td>Target met (%)</td>
</tr>
<tr>
<td>Total number of patients</td>
</tr>
<tr>
<td>Mean (days)</td>
</tr>
<tr>
<td>Min–Max (days)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Māori and non-Māori patients having treatment within 62 days of GP referral.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datapoint</td>
</tr>
<tr>
<td>Target met (%)</td>
</tr>
<tr>
<td>Total number of patients</td>
</tr>
<tr>
<td>Mean (days)</td>
</tr>
<tr>
<td>Min–Max (days)</td>
</tr>
</tbody>
</table>
an improvement from 89% in the previous audit with the average wait time of 6.5 days (0–26 days). MRI scans were performed on average 11.2 days from the request date, with minimum wait time of three days and maximum of 20 days. The target was met in 75% of cases. This is comparable to the previous audit period, when the target was met in 73% cases with an average wait time of 10.6 days (0–23 days).

Figure 7: Percentage of patients meeting the criteria for datapoints 3a/3b/4a/4b.
Analysis for datapoint 3 was divided into two parts. Datapoint 3a required release of histology report confirming malignancy within two weeks of decision to biopsy for tissue diagnosis. Two patients were excluded from analysis as they were investigated in the private system and hence did not reflect DHB performance. Of the 44 patients included in the analysis, the target was achieved in 41% of our patients. On average this took 35.4 days with a minimum wait time of two days and maximum of 253 days. The target had been achieved in 35% of cases in the previous audit, with an average wait time of 31.5 days (0–140 days). As expected, the delay between decision for biopsy and actual biopsy taking place was most noticeable in patients who required an operative procedure for tissue diagnosis; in this group of patients, the target of 14 days was only met in 12% with an average wait time of 46.3 days, compared with 79% meeting the target with an average wait time of 22.5 days in patients who did not require an operative procedure for tissue diagnosis.

Datapoint 3b required provisional or final pathology reports to be communicated to the lead clinician within 10 working days of the specimen being taken, as set by the standards for service provision. This was achieved in 82% of patients with an average wait time of 8.1 days (2–22 days). This again shows an improvement from the previous audit where the target was met in 70% with an average wait time of 8.9 days (0–29 days).

Datapoint 4a related to the first MDM discussion taking place within 14 days of referral from Northland DHB. 84.4% of patients met the target with the average wait time of 9.8 days, ranging between 0–23 days. This standard had been better performed in the previous audit period, where 93% of patients met the target with an average wait time of 9.5 days (5–27 days).

Datapoint 4b required that treatment decision is made within 14 days of MDM referral being made. This was the worst performing area of this audit, with only 31.6% of patients meeting this target with an average wait time of 19.3 days (7–46 days). Again, this standard had been better achieved in the previous audit, with the target being met in 59% of patients with an average wait time of 22.3 days (5–162 days).

Table 6: Percentage of patients who met datapoints 1–4 and mean, minimum and maximum waiting times.

<table>
<thead>
<tr>
<th>Audit datapoint definition</th>
<th>Target met (%)</th>
<th>Total number</th>
<th>Mean (days)</th>
<th>Min-Max (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Time to FSA ≤14 days</td>
<td>65</td>
<td>51</td>
<td>10.5</td>
</tr>
<tr>
<td>2a</td>
<td>USS wait ≤14 days</td>
<td>81</td>
<td>21</td>
<td>9.5</td>
</tr>
<tr>
<td>2b</td>
<td>CT wait ≤14 days</td>
<td>89</td>
<td>37</td>
<td>6.5</td>
</tr>
<tr>
<td>2c</td>
<td>MR wait ≤14 days</td>
<td>73</td>
<td>22</td>
<td>10.6</td>
</tr>
<tr>
<td>3a</td>
<td>Decision for histology to report produced ≤14 days</td>
<td>35</td>
<td>54</td>
<td>31.5</td>
</tr>
<tr>
<td>3b</td>
<td>Histology taken to report produced ≤10 days</td>
<td>70</td>
<td>54</td>
<td>8.9</td>
</tr>
<tr>
<td>4a</td>
<td>MDM referral to first MDM ≤14 days</td>
<td>93</td>
<td>55</td>
<td>9.5</td>
</tr>
<tr>
<td>4b</td>
<td>MDM referral to treatment decision &lt;14 days</td>
<td>59</td>
<td>38</td>
<td>22.3</td>
</tr>
</tbody>
</table>
Discussion

Timely provision of cancer treatment requires every step in cancer care pathway to be carried out in a structured and coordinated manner, which necessitated the development of National Standards of Service Provision for Gynaecological Cancers. While this provides a useful framework and timeline for individual steps in cancer care, including referral to first specialist appointment, performance of various investigations, MDM discussion, treatment decision and commencement of treatment, it is evident that achieving the ultimate FCT target of 62 days from GP referral to first treatment remains a challenge in management of patients with gynaecological cancers, as reflected in our audit outcome of only 45% of patients achieving this target.

As most patients do meet the other FCT target of receiving their first treatment within 31 days of decision to treat, it can be inferred that, for most patients, the delay occurs in the assessment and investigations leading up to decision to treat. The delay seems to be most marked in standard 3a—time from decision for histology to histology report being produced; less than half of our patients met the target of 14 days, but more importantly, the average wait time was 35 days, which is more than double the recommended timeframe. Unsurprisingly, the wait time was a lot longer in patients requiring an operative procedure for histology compared with those who did not. This reflects an inadequacy of our current healthcare system in providing theatre resources for management of our cancer patients in a timely manner, which is not limited to gynaecological cancers or to New Zealand healthcare setting; it has been identified in large studies that scarcity of access to surgery for management of cancer is a global phenomenon, with huge implications on disease burden globally.

Challenges in timely provision of operative procedures had already been identified in the previous audit, which led to the implementation of an extra elective gynaecology operating list per week, which allows up to four extra operations to be carried out per week. Our patients with high suspicion of cancer requiring an operative procedure for histological confirmation have priority to go on this list, which is likely to improve our outcome for datapoint 3a. One of the downsides of such implementation would be the inevitable lost theatre time for other departments, which may or may not have an impact on service provision for patients with non-gynaecological cancers. In addition to the extra surgical list, a number of elective surgical slots are now reserved for patients on the FCT pathway, while other non-FCT patients are on standby in case these slots are not filled by FCT patients. This allows further flexibility in prioritisation and timely provision of limited theatre time and resources for patients on the FCT pathway. Unfortunately, both of these changes have only been implemented since the end of our current audit period and our audit outcome does not reflect the effect of these changes.

One of the best performing areas of our audit was standard 2, which requires radiological investigations to be carried out within 14 days of request being made. This was consistently well performed in the previous and current audit periods, with the exception of ultrasound, which had been better performed in the previous audit. In an effort to improve this, a dedicated ultrasound assessment of endometrial thickness is now offered on the day of first specialist appointment for patients with post-menopausal bleeding, which is one of the symptoms of endometrial cancer. It is hoped that this will not only reduce the waiting time for ultrasound for these patients (standard 2a), but also allow improved distribution of limited theatre resources by excluding patients who do not require an operative procedure for histology.

Multidisciplinary meetings have now become the standard of care for various cancer types as they have been shown to improve patient outcome. Unfortunately, our audit shows that this may be one of the rate limiting steps in commencing treatment for our patients on the FCT pathway. The average wait time between MDM referral and first MDM discussion was 9.8 days, despite MDM discussion taking place on a weekly basis; for most patients, this was due to the initial referral being incomplete and lacking necessary radiological and histological investigations to facilitate MDM
discussion. Second part of this standard, requiring treatment decision to be made within 14 days of MDM referral, posed a greater challenge, as shown by less than a third of our patients meeting the target; most of our patients required multiple MDM discussions before treatment recommendation could be made, and this again was due to the inadequacy of investigations provided in the initial referral, which became available over multiple MDM’s. This shows that inability to perform investigations in a timely manner has major downstream effects in patients’ cancer journey with a potential to cause further delay in commencing treatment.

Inequities in health outcome between Māori and non-Māori have consistently been shown in the literature and this was also reflected in our audit outcomes. The difference was most marked in standard 3a (decision for histology–histology report <14 days), where it took on average 53.1 days for Māori patients to have their cancer diagnosis on histology from the decision to take histology, compared with 28.0 days for non-Māori. Further analysis revealed there were three outliers where the wait time was longer than 100 days; two of these were Māori patients, each taking 146 and 253 days for histological diagnosis of malignancy on repeat samples after initially non-malignant histology and one non-Māori patient, who had histological confirmation of malignancy 225 days after decision for histology, again due to initial samples showing non-malignant pathology. When these three outliers were eliminated, the average wait time was comparable between Māori and non-Māori, at 26.5 days and 22.2 days respectively.

It was disappointing to see such a marked discrepancy in percentage of patients achieving FCT targets depending on the location of treatment. Ideally, once treatment recommendation has been made by the MDM, patients should receive treatment in a timely fashion, regardless of where treatment takes place. Delay in starting first treatment in Northland likely reflects the current strain on resource availability for providing cancer treatment by Northland DHB. It is anticipated that the aforementioned extra operating list per week and flexibility in scheduling surgical lists will help reduce wait time for cancer operations, with subsequent improvement in meeting FCT targets.

This audit does have limitations which should be addressed prior to performance of subsequent audits. One of the main limitations of this audit was that there was a very short interval of six months between the end of primary audit period and the start of repeat audit period, allowing only a limited timeframe for the new implementations to take effect. Secondly, due to the small number of patients being included in our audit, cancer-specific analysis could not be performed. An audit with a bigger number of patients over a longer period of time may enable this to be done, which in turn may help identify specific areas for improvement for management of each cancer type.

Conclusion

This one-year follow-up audit has demonstrated an overall improvement in meeting FCT targets and Standards of Service Provision in Northland patients with gynaecological cancers compared with the previous audit period. However, it is evident that there is still a significant delay in patients’ cancer journey from referral to first treatment in Northland, as reflected by low rates of FCT targets being met. The biggest contributor to this delay appears to be a major shortage in theatre resources for both diagnosis and treatment of cancer, closely followed by limited availability of radiological investigations. A number of strategies have been implemented to address these areas in the FCT pathway where delay seems to be most pronounced, and a follow-up audit will be valuable in evaluating the effect of these new implementations.
Competing interests: Nil.

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REFERENCES:
Antimicrobial resistance among \textit{Shigella} in New Zealand

Helen Heffernan, Rosemary Woodhouse, Chris Hewison, Jillian Sherwood

\section*{ABSTRACT}

\textbf{AIM:} We undertook a national survey to provide current information on antimicrobial resistance among \textit{Shigella} isolated in New Zealand.

\textbf{METHODS:} Diagnostic laboratories are requested to refer all \textit{Shigella} isolates to the Institute of Environmental Science and Research (ESR) for epidemiological typing as part of the national surveillance of shigellosis. The antimicrobial susceptibility of 263 non-duplicate \textit{Shigella} isolates referred to ESR in 2015 and 2016 was tested.

\textbf{RESULTS:} The 263 \textit{Shigella} comprised 141 (53.6\%) \textit{S. sonnei}, 113 (43.0\%) \textit{S. flexneri}, 7 (2.7\%) \textit{S. boydii} and 2 (0.8\%) \textit{S. dysenteriae}. Among the 141 \textit{S. sonnei}, the majority were either biotype g (90) or biotype a (50). Rates of resistance to the two currently recommended first-line antibiotics, co-trimoxazole and fluoroquinolones, were relatively high at 56.7\% and 22.8\%, respectively. Azithromycin is considered a second-line treatment option, but 11.0\% of \textit{Shigella} were categorised as having a non-wildtype (NWT) azithromycin phenotype (ie, having some mechanism of azithromycin resistance although not necessarily clinically resistant). There were several significant differences in resistance between the two most prevalent \textit{S. sonnei} biotypes, with resistance being significantly more prevalent among biotype g isolates. \textit{Shigella} from patients who had not travelled overseas were significantly more likely to be azithromycin NWT than isolates from patients who had recently travelled (20.7 vs 5.6\%). Azithromycin NWT was more prevalent among \textit{Shigella} from males than females (13.9 vs 7.7\%).

\textbf{CONCLUSIONS:} These results suggest there is an immediate need to revise the currently recommended first-line treatment for shigellosis, especially when treatment is given on an empirical basis. Equally concerning is the fact that resistance to the second-line antibiotic for shigellosis, azithromycin, appears to be emerging in New Zealand. As diagnostic laboratories increase their use of culture-independent testing, it is recommended that they should continue to culture specimens from all shigellosis cases so that isolates are available for susceptibility testing and epidemiological typing.

\textit{Shigella} is a relatively uncommon cause of gastroenteritis in New Zealand with rates of notified shigellosis (3.7 per 100,000 population in 2016) considerably below rates of gastroenteritis due to other enteric pathogens such as \textit{Campylobacter}, \textit{Salmonella}, \textit{Yersinia}, and verotoxin- or Shiga toxin-producing \textit{Escherichia coli} (158.9, 23.2, 18.3 and 8.9 per 100,000, respectively, in 2016).\textsuperscript{1}

The majority (61.2\% in 2016) of people diagnosed with shigellosis in New Zealand have been overseas during the incubation period for the disease.\textsuperscript{1} \textit{Shigella} is easily passed from person to person as the infectious dose is low. While shigellosis is typically a self-limiting infection, appropriate antibiotic treatment can shorten the duration and severity of illness, and reduce the time \textit{Shigella} is excreted. Therefore, to reduce disease transmission, antibiotic treatment is usually recommended for cases of shigellosis in children <6 years of age, people who are institutionalised, men who have sex with men (MSM), people who are immunosuppressed, and food handlers. Antibiotic treatment is also recommended for patients with severe disease to shorten the duration of symptoms.\textsuperscript{2} In 2016, 30.2\% of shigellosis cases in New Zealand were admitted to hospital.\textsuperscript{1}
The Best Practice Advocacy Centre’s (BPAC) recommendations for the treatment of shigellosis, which were published in 2009, recommend either co-trimoxazole (first choice if the organism is susceptible) or alternatively a fluoroquinolone (ciprofloxacin or norfloxacin), with a further specific recommendation of ciprofloxacin when the patient is immunocompromised. The current 2014 Australian Therapeutic Guidelines recommend either a fluoroquinolone or co-trimoxazole when treatment of shigellosis is indicated. If an alternative is required due to resistance to these first-line antibiotics, azithromycin is recommended.

Shigella is somewhat notorious for developing antimicrobial resistance and has successively accumulated resistance to most of the antibiotics used for the treatment of infections. There are numerous reports from overseas of high rates of resistance to co-trimoxazole and fluoroquinolones, as well as emerging resistance to azithromycin.8

A national New Zealand survey in 1996 found that co-trimoxazole resistance was already prevalent among Shigella isolated in this country, but no ciprofloxacin resistance was identified and azithromycin susceptibility was not tested.7 Here we report the results of the first national antimicrobial susceptibility survey of Shigella that the Institute of Environmental Science and Research (ESR) has undertaken since the 1996 survey.

Methods

Diagnostic laboratories are requested to refer all Shigella isolates from cases of shigellosis to ESR for serotyping and biotyping as part of the national surveillance of this disease. The antimicrobial susceptibility of viable, non-duplicate Shigella isolates referred to ESR in 2015 and 2016 was tested.

Antimicrobial susceptibility was determined by agar dilution according to the methods of the Clinical and Laboratory Standards Institute (CLSI).8 Except for azithromycin and tetracycline, minimum inhibitory concentrations (MICs) were interpreted according to the European Committee for Antimicrobial Susceptibility Testing (EUCAST) clinical breakpoints.9 CLSI breakpoints were used to interpret tetracycline MICs.8 Currently there are no clinical breakpoints to interpret azithromycin MICs. However, for S. flexneri and S. sonnei, CLSI have defined ‘epidemiological cutoff values’ (ECVs) for azithromycin MICs.8 ECVs separate bacterial populations into those with acquired and/or mutational resistance mechanisms (referred to as non-wild type, NWT) and those without such mechanisms (referred to as wild type, WT).

Any isolates with a ceftriaxone or ceftazidime MIC ≥2 mg/L were tested for extended-spectrum beta-lactamase (ESBL) production using the combination disc test.8 To identify CTX-M type ESBLs, a multiplex polymerase chain reaction assay (PCR) that includes primers to detect the genes for the four CTX-M groups, 1, 2, 8 and 9, was used.10 Any isolates with a cefoxitin MIC ≥16 mg/L were tested by PCR for plasmid-mediated AmpC beta-lactamase genes.11 Overseas travel history for shigellosis cases was obtained from information reported in the EpiSurv notifiable disease database supplemented with any additional travel information received when the isolate from the case was referred to ESR. The chi-square test was used to determine the significance of any observed differences, with a p value of ≤0.05 being considered significant.

Results

The antimicrobial susceptibility of 263 Shigella isolates referred to ESR in 2015 and 2016 was tested. These 263 Shigella isolates accounted for 92.3% of the total 285 shigellosis cases notified during these two years. The 263 Shigella comprised 141 (53.6%) S. sonnei, 113 (43.0%) S. flexneri, 7 (2.7%) S. boydii and 2 (0.8%) S. dysenteriae. Among the 141 S. sonnei, the majority were either biotype g (90 isolates) or biotype a (50). There were a wide variety of serotypes among the 113 S. flexneri, with the commonest being serotype 2a (31), serotype 1b (20), serotype 2b (10), and serotype 6 biotype Boyd 88 (10).

Resistance to seven of the antimicrobials tested and multiple drug resistance is shown in Table 1. Resistance to the two first-line antibiotics was high, with 56.7% resistance to co-trimoxazole, 22.8% resistance to fluoroquinolones and 16.3% resistance to both co-trimoxazole and a fluoroquinolone. There was complete correlation between resistance to the two fluoroquinolones tested, ciprofloxacin and norfloxacin.
Table 1: Antimicrobial resistance among *Shigella* in New Zealand, 2015 and 2016.

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Percent resistant</th>
<th>S. sonnei n=141</th>
<th>S. flexneri n=113</th>
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<th>S. dysenteriae n=2</th>
<th>All species n=263</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>29.1</td>
<td>72.6</td>
<td>14.3</td>
<td>100</td>
<td>47.9</td>
<td></td>
</tr>
<tr>
<td>Azithromycin¹</td>
<td>12.1</td>
<td>9.7</td>
<td>-</td>
<td>-</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>Ceftiraxone</td>
<td>7.1</td>
<td>2.7</td>
<td>14.3</td>
<td>50.0</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacin²</td>
<td>25.5</td>
<td>20.4</td>
<td>14.3</td>
<td>0.0</td>
<td>22.8</td>
<td></td>
</tr>
<tr>
<td>Co-trimoxazole</td>
<td>63.8</td>
<td>49.6</td>
<td>14.3</td>
<td>100</td>
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<td></td>
</tr>
<tr>
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<td>14.3</td>
<td>0.0</td>
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<tr>
<td>Tetracycline</td>
<td>48.9</td>
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<td>100</td>
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<td></td>
</tr>
<tr>
<td>Ciprofloxacin + co-trimoxazole</td>
<td>18.4</td>
<td>14.2</td>
<td>14.3</td>
<td>0.0</td>
<td>16.3</td>
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<tr>
<td>Ciprofloxacin + co-trimoxazole + azithromycin¹</td>
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<td>0.0</td>
<td>0.0</td>
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1. The data given for azithromycin are the percentages that are categorised by the CLSI epidemiological cutoff values (ECVs) as non-wild type (ie, MICs ≥32 mg/L for *S. sonnei* and MICs ≥16 mg/L for *S. flexneri*). There are no azithromycin ECVs for *S. boydii* or *S. dysenteriae*.

2. The rates of ciprofloxacin resistance presented are based on the EUCAST MIC resistance breakpoint of ≥1 mg/L. However, a recent health advisory from the United States Centers for Disease Control and Prevention recommended that fluoroquinolones should not be prescribed for the treatment of shigellosis if the ciprofloxacin MIC is ≥0.12 mg/L (Reference 12). The percentage of isolates that had ciprofloxacin MICs ≥0.12 mg/L were: *S. sonnei* 37.6%, *S. flexneri* 29.2%, *S. boydii* 14.3%, *S. dysenteriae* 100% and all species 33.8%.

Twenty-eight (11.0%) of the *S. sonnei* and *S. flexneri* isolates were categorised as azithromycin NWT (Table 1). The azithromycin MICs of the *S. sonnei* and *S. flexneri* isolates are shown in Figure 1 and demonstrate a typical bimodal distribution. Among the 28 azithromycin NWT isolates, the majority (23) had MICs ≥128 mg/L. Three (2.1%) *S. sonnei* isolates were azithromycin NWT, co-trimoxazole resistant and ciprofloxacin resistant, that is, potentially resistant to all three antibiotic classes recommended for treatment (Table 1). Two of these three *S. sonnei* were biotype g and the remaining isolate was biotype f.

Figure 1: Distribution of azithromycin minimum inhibitory concentrations.

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**Table 1**: Antimicrobial resistance among *Shigella* in New Zealand, 2015 and 2016.

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<td>Ciprofloxacin + co-trimoxazole + azithromycin¹</td>
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<td>0.0</td>
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Fifteen isolates (5.7%) were ceftriaxone resistant and all 15 isolates had a CTX-M type ESBL: nine had a CTX-M group 1 ESBL, four had a CTX-M group 9 ESBL, one had a CTX-M group 8 ESBL and one had both CTX-M group 1 and group 9 ESBLs. No plasmid-mediated AmpC beta-lactamases were identified.

Comparison of resistance by *Shigella* species and *S. sonnei* biotype

There were some significant differences in resistance between *S. sonnei* and *S. flexneri*. *S. sonnei* were significantly more resistant to co-trimoxazole (*p* 0.022), whereas *S. flexneri* were significantly more resistant to ampicillin (*p* <0.001) (Table 1). There were also significant differences in resistance between the two prevalent *S. sonnei* biotypes. Compared with *S. sonnei* biotype a, *S. sonnei* biotype g isolates were significantly more likely to be azithromycin NWT (17.8 vs 0.0%, *p* 0.002); more resistant to ceftriaxone (10.0 vs 0.0%, *p* 0.021), ciprofloxacin (38.9 vs 0.0%, *p* <0.001), co-trimoxazole (73.3 vs 46.0%, *p* 0.001) and tetracycline (75.6 vs 2.0%, *p* <0.001); and more likely to be resistant to both co-trimoxazole and a fluoroquinolone (27.8 vs 0.0%, *p* <0.001). Notably, *S. sonnei* biotype g accounted for 57.1% (16/28) of all azithromycin-NWT isolates.

Comparison of resistance among *Shigella* according to whether the patient had recently travelled outside New Zealand

Among the patients from whom the 263 *Shigella* included in the survey were isolated, 63.1% (166) were reported to have recently travelled overseas. Azithromycin was the only antibiotic for which there was a significant difference in susceptibility depending on whether the patient had recently travelled, with *Shigella* from patients who had not travelled being more likely to be azithromycin NWT than isolates from patients who had recently travelled (20.7 vs 5.6%, *p* 0.001). Further analysis according to the *Shigella* species and biotype, showed that specifically *S. sonnei* biotype g and *S. flexneri* from patients who had not travelled were significantly more likely to be azithromycin NWT (36.7 vs 8.3%, *p* 0.001 and 17.8 vs 4.1%, *p* 0.019, respectively).

Comparison of resistance among *Shigella* by patient demographics

Except for tetracycline resistance being more common in *Shigella* isolated from males (55.7 vs 43.1%, *p* 0.041), there were no significant differences in the rates of resistance depending on the sex of the patient. However, the prevalence of azithromycin NWT among *Shigella* from males was nearly twice that among isolates from females (13.9 vs 7.7%, *p* 0.117). In a further breakdown by age (using age groups of <20, 20–39, 40–59 and ≥60 years), azithromycin NWT was more prevalent among isolates from males in all age groups except the youngest group, although the only age group in which the difference reached statistical significance was in the 40–59 years group. Twelve (63.2%) of the 19 azithromycin-NWT isolates from males were *S. sonnei* biotype g compared with four (44.4%) of the nine azithromycin-NWT isolates from females.

Discussion

Our results suggest there is an immediate need to revise the recommended treatment for shigellosis, especially when treatment is given on an empirical basis. The rates of resistance to the two currently recommended first-line antibiotics are relatively high: 56.7% co-trimoxazole resistance and 22.8% fluoroquinolone (ciprofloxacin or norfloxacin) resistance. Interestingly this rate of co-trimoxazole resistance is almost exactly the same as the rate of 57.0% reported in the last national survey conducted in 1996.7

In contrast, during the intervening 20 years between the surveys, fluoroquinolone resistance has emerged (from zero) and risen to a point where nearly a quarter of *Shigella* are resistant. Moreover, it should be noted that the potential for fluoroquinolone treatment failure could be somewhat higher than indicated by the rate of 22.8% resistance we have reported here. We used the EUCAST MIC clinical breakpoint of ≥1mg/L to categorise ciprofloxacin resistance. A recent health advisory from the United States Centers for Disease Control and Prevention (CDC) recommends that fluoroquinolones should not be prescribed for shigellosis if the ciprofloxacin MIC is ≥0.12mg/L, as it is likely *Shigella* with MICs as low as 0.12mg/L.
harbour at least one resistance gene known to confer reduced susceptibility to fluoroquinolones in enteric bacteria. However, while CDC is cautioning that fluoroquinolones should not be used to treat infections with *Shigella* with ciprofloxacin MICs as low as 0.12mg/L, it is not yet known if such treatment does actually result in a worse clinical outcome or increase the risk of transmission of the infection to contacts. A third (33.8%) of the *Shigella* in our survey had ciprofloxacin MICs ≥0.12mg/L (see footnote 2, Table 1).

Equally concerning is the fact that resistance to the second-line antibiotic for shigellosis, azithromycin, appears to be emerging in New Zealand. Twenty-eight (11.0%) *Shigella* were categorised as azithromycin NWT (non-wild type), as they had MICs above those of the wild-type population. While this NWT categorisation does not necessarily mean these isolates would be clinically resistant, 23 of the 28 isolates had relatively high azithromycin MICs of ≥128 mg/L and therefore are likely to be clinically resistant.

Ceftriaxone can be useful to treat severe and invasive shigellosis. Ceftriaxone resistance still appears to be relatively uncommon among *Shigella* isolated in this country, with just 5.7% resistance. However, all ceftriaxone resistance was mediated by CTX-M type extended-spectrum beta-lactamases. The genes for this type of ceftriaxone resistance are readily transmissible between different strains of enteric bacteria and are often transmitted along with genes conferring resistance to several other classes of antibiotics.

The rates of resistance among *Shigella* isolated in New Zealand in 2015–16 are similar to, or even higher than, rates reported elsewhere in the world. One of the most distinctive features of our results was that resistance was not more prevalent among *Shigella* apparently acquired overseas. This finding contrasts to the usual situation with antimicrobial resistance in New Zealand. A global review by the World Health Organization, published in 2014, reported that New Zealand had relatively low rates of antimicrobial resistance compared with most other countries and regions. ESR’s regular surveillance of resistance among another enteric pathogen, *Salmonella*, has consistently shown that infections acquired overseas are more resistant than those acquired in New Zealand.

However, many countries are reporting both recent increases in the incidence of shigellosis and increasing levels of resistance among *Shigella*. In particular, there are reports from several developed countries (including Australia, the US, Canada and England) of locally-acquired (i.e., non-travelled associated) shigellosis being associated in particular with MSM, and that resistance, especially to azithromycin, is prevalent among *Shigella* infections in MSM. It has been suggested that the use of azithromycin to treat sexually transmitted infections, specifically gonorrhoea and chlamydia, may be exerting selective pressure for the emergence and spread of azithromycin-resistant *Shigella* among MSM.

During the years covered by this survey, information on sexual practices was not routinely collected for shigellosis cases in New Zealand. However, as shigellosis among MSM is a recognised public health issue, in December 2017 the risk factor information collected for shigellosis notifications was extended to include a question on the sexual practices of male cases.

In the absence of any information on the sexual practices of the shigellosis cases included in this survey, we investigated if there were any significant differences in resistance according to the sex and age of the patient. While at the 95% probability level, the only difference was a higher rate of tetracycline resistance among isolates from males, *Shigella* from males were almost twice as likely to be azithromycin NWT as those from females but, due to the relatively small total number (28) of azithromycin-NWT isolates, this difference by the sex of the patient did not reach statistical significance. The higher rate of azithromycin NWT in males, which was particularly evident in the older age groups, coupled with the fact that azithromycin NWT was significantly more common among *Shigella* from people who had not travelled overseas, suggests azithromycin-NWT *Shigella* infections may also be associated with MSM in New Zealand.
Our results support the need for routine antimicrobial susceptibility testing of *Shigella* isolates from all cases to inform appropriate treatment options for individual patients and also to monitor changes in resistance patterns and guide empiric therapy. Diagnostic laboratories are increasingly introducing so-called ‘culture-independent diagnostic testing’, such as nucleic acid amplification tests (NAAT), to diagnose pathogens including enteric pathogens like *Shigella*. However, it is important that laboratories continue to also culture specimens from shigellosis cases, as a culture is required to perform susceptibility testing and also to undertake current subtyping methods (such as serotyping and biotyping) to provide epidemiological information.

In conclusion, while shigellosis is usually a self-limiting infection, antibiotic treatment is recommended for severe cases and also to reduce disease transmission among certain patient groups. However, our results show there are high rates of resistance to co-trimoxazole and fluoroquinolones, the antibiotics currently recommended for treatment, and also emerging resistance to the second-line treatment azithromycin, among *Shigella* in New Zealand. ESR plans to monitor trends in resistance among *Shigella* with more regular (three-yearly) national surveys.

**Competing interests:**
Nil.

**Acknowledgements:**
Staff of the ESR Antimicrobial Reference Laboratory for antimicrobial susceptibility testing and the ESR Enteric Reference Laboratory for *Shigella* identification and typing. This survey was funded by the Ministry of Health.

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**URL:**

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The futility of fertility research? Barriers to embryo research in New Zealand

Lucy Goodman, Lynsey Cree, Gareth Jones, Michael Legge, Andrew Shelling, Cindy Farquhar

ABSTRACT

AIMS: Successive New Zealand Health Ministers have failed to approve guidelines for research using viable human embryos, which effectively places a blanket ban on all research that “uses” viable human embryos in this country. This includes research that aims to improve currently available reproductive technologies, illustrated by a failed application to ministerial ethics committees for a clinical research project investigating the efficacy of in vitro fertilisation procedures. However, no data currently exists describing the degree to which these restrictions are inhibiting reproductive research in this country.

METHODS: We have conducted a qualitative survey of New Zealand researchers from 20 major academic, clinical and governmental institutes to qualify the impact these restrictions are having on New Zealand’s research outputs.

RESULTS: The results suggest dissatisfaction with the current guidelines, and the lack of guidance from the Ministry of Health and associated ethics committees regarding what constitutes embryo research and therefore what research can be performed.

CONCLUSIONS: The lack of current guidelines regarding the use of embryos for research is restricting improvements to established reproductive technologies, and any future research. We suggest that the Minister of Health instructs ministerial advisory and ethics committees to review the current guidelines and to define the term “use of embryos”.

As many as 20 percent of New Zealanders will experience infertility at some point in their lives and many couples will seek fertility treatment in the form of assisted reproduction. Since the first successful in vitro fertilisation (IVF) procedure in 1978, the range of available treatments has expanded to include intracytoplasmic sperm injection (ICSI) and preimplantation genetic testing (PGT), to name a few. However, the success of assisted reproduction is by no means guaranteed, with only 18.1% of all ART treatments initiated in Australia and New Zealand during 2015 resulting in a live birth. Regardless, many thousands of infertile couples go on to enjoy the benefits of these technologies annually, thanks to many years of extensive research and development programmes conducted using animal and human embryos in research and clinical laboratories. Currently, this human embryo research is performed overseas and not in New Zealand.

In New Zealand, the use of human embryos for assisted reproduction or for human reproductive research is governed by the HART Act 2004. This policy framework was developed to secure the benefits of assisted reproduction for individuals and society while maintaining the health and wellbeing of children born as a result of this technology. While ART treatment facilities are widely available, and treatments are performed routinely throughout New Zealand, the stance on the use of embryos for research purposes is restrictive. While the HART Act itself is permissive for research using human embryos (section 19), research
applications must be referred to the ministerial ethics committee known as the Ethics Committee on Assisted Reproductive Technology (ECART). ECART, in turn, must base their decisions using guidelines published by the Minister of Health's Advisory Committee on Assisted Reproductive Technology (ACART). As the current guidelines developed in 2005 only allow for non-viable human embryos to be used in research, ECART is unable to grant ethics approval for research that uses viable human embryos. This includes research projects using identical procedures to those already approved by ACART for clinical use, as the following case study illustrates.

In September 2013 one of the authors [CF] made a preliminary enquiry to ECART about a clinical research project titled “The Day of Embryo Transfer (DOT) Study”, which aimed to improve pregnancy rates for women undergoing IVF. During an IVF procedure, the embryo is transferred into the woman’s uterus either during the cleavage stage (three days after fertilisation), or the blastocyst stage (when the culture time is extended and the embryo has reached five to six days after fertilisation). Both cleavage stage and blastocyst embryo transfer procedures have been approved by ACART as established procedures, and are performed routinely in fertility clinics throughout New Zealand. The fertility clinics’ decision on whether to perform a Day 3 or Day 5 transfer on each individual woman is usually governed by the number of viable embryos present on Day 3 (among other things), and does not require ACART approval.

Blastocyst culture is thought to improve pregnancy rates above cleavage stage transfer by better synchronising the embryo with the receptive state of the endometrium at the time of transfer. However, extending the culture from Day 3 to Day 5 or 6 can reduce the number of embryos available for transfer (or cryopreservation). Statistically, this may improve pregnancy rates (when measured as a proportion of transferred embryos), without individual women themselves necessarily experiencing a benefit. To examine whether blastocyst transfer can achieve superior pregnancy rates without the confounding influence of embryo availability, the DOT study proposed to randomise couples with four or more embryos to either transfer day, without altering any aspect of these routine, ACART-approved procedures. The trial also aimed to include neonatal outcome data as there have been concerns about the epigenetic changes in embryos with prolonged culture.

After gaining legal advice from the Crown Law Office, ECART refused the application due to its use of viable embryos. While the HART Act does not specifically prohibit embryo research using viable embryos, ECART is unable to give approval for this research unless the activity is consistent with relevant guidelines or advice issued by the ACART. However, because the current guidelines by ACART will only permit the use of non-viable human embryos for reproductive research, ECART advised that it cannot currently approve the DOT study. The Ministry of Health’s two legal opinions that supported their decision were made publicly available only after [CF] made a complaint to the Office of the Ombudsman that this information was in the public’s best interest. However, no progress has been made by ACART and the Ministry of Health to define the term “use of embryos” for human reproductive research.

As this case illustrates, New Zealand’s ‘restrictive by default’ stance on the “use” of embryos for reproductive research effectively allows fertility clinics to provide reproductive treatments, while preventing all potential research projects that could improve these existing treatments. While seeking to respect human embryos, these restrictive policies militate against best practice in healthcare with possible negative repercussions for women and their offspring.

Against this background, we have conducted a qualitative survey to understand the extent to which the HART Act, as interpreted by the Ministry of Health and respective Ministers of Health since 2005, is inhibiting reproductive research in New Zealand. Our aim was to understand the types of embryo research currently being conducted in this country, the major barriers to such research faced by reproductive researchers, and the potential research opportunities restricted by existing policies and attitudes.
Methods

A survey was administered by Survey Monkey and distributed to 20 major academic, clinical and governmental institutes in New Zealand, via email between August and December 2017. The survey consisted of 22 closed or open-ended questions regarding respondents’ research experience, field of expertise and experiences obtaining ethical approval from New Zealand ethics committees. Responses were transcribed and qualitatively described. Frequencies are described as a percentage of total survey participants. The project was approved by The University of Auckland Human Ethics Committee (reference number 019608).

Results

Research demographics

Invitations were sent to 88 email addresses from 20 institutions. Twenty-eight researchers (35%) responded. Of these, 10 were experienced researchers with more than 20 years’ research experience, six cited 10–20 years, eight had 5–9 years, with four having had less than five years’ research experience (Table 1). Participants were employed in universities (14), clinics or hospitals (4) or non-university research institutes (1), with an additional nine participants being employed across multiple institutions.

Table 1: Research demographics of survey participants.

<table>
<thead>
<tr>
<th>Research experience</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>4</td>
</tr>
<tr>
<td>5–9 years</td>
<td>8</td>
</tr>
<tr>
<td>10–20 years</td>
<td>6</td>
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<tr>
<td>More than 20 years</td>
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<table>
<thead>
<tr>
<th>Place/s of work</th>
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</thead>
<tbody>
<tr>
<td>University</td>
<td>14</td>
</tr>
<tr>
<td>Clinic or hospital</td>
<td>4</td>
</tr>
<tr>
<td>University and clinic or hospital</td>
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</tr>
<tr>
<td>Multiple clinics or universities</td>
<td>4</td>
</tr>
<tr>
<td>Research institute (non-university)</td>
<td>1</td>
</tr>
<tr>
<td>Total respondents</td>
<td>28</td>
</tr>
</tbody>
</table>

Current or previous embryo research in New Zealand

Fifteen researchers had previously and/or were currently conducting research involving embryos in some way. The majority of respondents classified their research as ‘basic science research’ (12), ‘embryology’ (6) and/or clinical research (4), with six respondents conducting research projects across multiple disciplines (Figure 1).

Figure 1: Types of embryo research currently or previously conducted in New Zealand.

A subset of seven respondents provided further details describing their previous or current embryo research. In brief, the four research projects with direct use of human embryos referred to the use of non-viable embryos (2), analysis of embryo culture media (2), embryo development in vitro (1) and/or human embryo research conducted overseas (1). Other research projects not directly working with human embryos described the use of animal embryos (3) or research into the psychology and perceptions of reproduction (1).

Perceived barriers to embryo research in New Zealand

Fifteen survey respondents identified one or multiple barriers to their own or their institution’s embryo research. The majority (9) perceived the HART legislation (or part thereof) as a barrier to their field of research, followed by ministerial guidance to avoid research that “uses or creates” embryos (8), and the lack of suitable ACART guidelines about the use of human embryos for research purposes (6) (Table 2). The lack of specific funding for research was a perceived barrier for only four researchers, and five researchers specified that they are not facing any current barriers.
Three-quarters (15) of respondents agreed or strongly agreed that the term “use or creation of embryos” as indicated in Section 5 of the HART Act 2004 is a barrier to progressing scientific research in New Zealand (Figure 2). Similarly, 85% of respondents (17) agreed or strongly agreed with the suggestion that New Zealand needs better guidance about the term “use of embryos” for reproductive research as described in the HART act, feel disadvantaged by the lack of specific guidance on this issue and feel that the Minister of Health should direct their ministerial ethics committees to develop guidelines about the use of embryos for research purposes.

Table 2: Barriers to embryo research perceived by embryo researchers in New Zealand.

<table>
<thead>
<tr>
<th>Barriers to embryo research</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>One or more barriers to embryo research identified:</td>
<td>15</td>
</tr>
<tr>
<td>HART legislation (part of)</td>
<td>9</td>
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<tr>
<td>Ministerial guidance to avoid research that “uses or creates” embryos</td>
<td>8</td>
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<tr>
<td>No ACART guidelines about the “use” of embryos</td>
<td>6</td>
</tr>
<tr>
<td>Lack of specific funding</td>
<td>4</td>
</tr>
<tr>
<td>Other barriers</td>
<td>3</td>
</tr>
<tr>
<td>No specific barriers to embryo research identified</td>
<td>5</td>
</tr>
<tr>
<td>No response</td>
<td>8</td>
</tr>
<tr>
<td>Total respondents</td>
<td>20</td>
</tr>
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</table>

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Figure 2: Perceived influence of New Zealand legislation on embryo research as reported by researchers in the field (n=20 survey respondents).
Embryo research currently restricted in New Zealand

Eleven respondents had previously applied for ethics approval for human or animal embryo research in New Zealand from one or more ethics committees. Six of these respondents gained approval from ECART, with the remainder gaining ethical approval from University human or animal committees (6), or the Human Fertilisation and Embryology Authority (1). The only research project declined ethics approval by ECART was the “Day of Embryo Transfer” study described in the case study above.

Eleven researchers responded that they have potential research projects that they would consider undertaking in the future but are not permitted under the current ACART regulations. Five respondents described their potential research projects in further detail, namely, they would use surplus embryos in vitro to improve fertility success rates and/or increase understanding of embryo biology (4). The single clinical research study cited above (The “Day of Embryo Transfer” study) would use embryos in patient populations to improve fertility success rates.

Discussion

The early restrictions on embryo research in New Zealand reflected a concern for human life and the rights of an unborn child. The HART Act of 2004 defines human reproductive research as “research that uses or creates a human gamete, a human embryo or a hybrid embryo”, and while research using embryos is not openly restricted, researchers must gain ethical approval from the ministerial ethics committee (ECART), who base their decision on guidelines published by their advisory committee (ACART). In turn, ACART can only issue guidelines for reproductive technologies that have undergone a complete and thorough review process, involving public consultation. Although ACART undertook a public consultation process in 2007 and advised the then Minister of Health that research on human embryos should be allowed (with approval via ECART), this was never enacted, and no guidelines currently exist on the use of viable human embryos for research purposes. Without existing guidelines on which to base their decision, ECART is unable to approve any applications for research using viable human embryos. This effectively places a blanket ban on all such research in this country, including research that is identical in practice to already established ART clinical procedures. For example, while New Zealand fertility clinics offer fertility treatments that routinely transfer embryos and thus “use” embryos, research projects such as the “Day of Embryo Transfer” study, which could improve the efficacy of these procedures has effectively been prevented.

The purpose of this survey was to highlight the inconsistencies of the current impasse to the newly appointed Minister of Health. We consider that the current policy on human embryo research fails to protect either the rights of the embryo or the couples who seek treatment for infertility. As the ethical and moral implications of New Zealand’s restrictions on embryo research are described in detail elsewhere, here we have sought to quantify the impact these restrictions are having on New Zealand’s research outputs and therefore our contribution to improved healthcare. The surveyed opinions of a proportion of New Zealand’s embryologists, clinicians, biologist and social scientists suggest dissatisfaction with the current indecisive guidelines provided by ACART in 2005, and the lack of guidance from the Ministry of Health and associated ethics committees regarding what constitutes embryo research and therefore what research can be performed. Other than the proposed DOT study, our survey did not identify any other research applications that have been rejected by ECART. However, far from supporting the current procedures, this is probably a reflection that most researchers are aware of the restrictions on embryo research in New Zealand and do not seek ethics approval or even grant funding to conduct research in this area, particularly those working in embryology and basic science research. The DOT study presents a potentially unique case, highlighting that these restrictions extend to all clinical research, a situation that may not be obvious to clinical researchers who routinely conduct these same procedures on patients.
In 2005, ACART published guidelines about the use of gamete and non-viable embryos for research purposes, however the basis for restricting research to non-viable human embryos is unknown. These guidelines are far too restrictive to support research programmes that could benefit women and children in New Zealand. We were able to identify only two researchers using non-viable embryos for research purposes, presumably due to the difficulties in obtaining these tissues and to the inherent limitations of research using non-viable embryos.

While our survey could not detect the full extent of reproductive research that is being inhibited in New Zealand by the current guidelines, more than a third of respondents identified potential research projects using human embryos that are not currently allowed in New Zealand. A small number of researchers described these research projects in more detail, which included basic science, embryology and clinical research almost exclusively aimed at improving the reproductive potential of infertile women. Although we received a relatively small number of survey responses (28), we suggest that this is representative of the small number of New Zealand researchers working in this field and who are likely to hold an opinion on this topic. Strong support for improved guidelines was apparent, despite the fact that many (15) of the respondents did not have any future research ideas that are currently impermissible, and some (5) did not appear to be facing any barriers to their current research. This suggests that researchers are not committing themselves to research projects using human embryos, since they are aware that they will not be able to undertake them in New Zealand’s present legislative climate. This in turn suggests that researcher support for improved guidelines on viable embryo research is unlikely to be restricted solely to researchers currently in this field and who responded to our survey.

Looking beyond our survey at research conducted overseas, it is apparent that New Zealand is missing out on opportunities in reproductive science and medicine with this current legislation in place. For example, in addition to clinical research that could improve existing fertility treatments, stem cells from excess embryos have the potential to treat human disease, and recent advances in genome editing may allow scientists to remove genetic diseases from developing embryos. These recent developments are only possible in countries including Australia and the UK, which allow research using donated viable human embryos up to 14 days post-fertilisation. In addition, the HART Act requires that New Zealand fertility clinics discard viable embryos after 10 years if an extension for storage is not requested by the owners of the embryos, thereby wasting a valuable opportunity for reproductive research in this country.

As New Zealand will likely reap the benefits of any future treatment options that arise from embryo research in other countries, the current policies on embryo research pass the burden to researchers overseas by preventing scientists in New Zealand from contributing to our future healthcare. We concede that the ethical and moral issues surrounding the use of embryos for research purposes are polarising and require extensive debate by politicians, researchers and the New Zealand public. In no way are we suggesting that New Zealand opens the door to all possible types of embryo research, but we seek to develop policies to set new boundaries on what is allowed and what should be restricted. We suggest that the Minister instructs ACART to review the current guidelines and to define the term “the use of embryos” and consider allowing research on viable embryos that are being discarded, and where consent for research is received, up to 14 days of gestation.
Competing interests:
CF is the principle investigator for the “Day of Embryo Transfer” study described in the introduction. Authors CF, AS, LC, and ML participated in this survey.

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Keeping track of antimicrobial resistance for \textit{Neisseria gonorrhoeae} in Auckland, New Zealand: past, present and future considerations

Gary N McAuliffe, Marian Smith, Mike Brokenshire, Rose Forster, Murray Reid, Sally A Roberts

\textbf{ABSTRACT}

\textbf{AIMS:} \textit{Neisseria gonorrhoeae} (NG) has developed resistance to a wide range of antimicrobials. Population level data is essential to determine empiric treatment regimes. We sought to identify antimicrobial resistance patterns for NG in the Auckland region from 2008–2016, and review the utility of current methods of antimicrobial resistance testing.

\textbf{METHODS:} Antimicrobial susceptibilities and demographic data from NG isolates derived from patients attending the Auckland Regional Sexual Health Service and Auckland City Hospital were analysed to determine resistance rates and trends over time. Antimicrobial susceptibility testing was performed by agar dilution using Clinical and Laboratory Standards Institute (CLSI) interpretation criteria.

\textbf{RESULTS:} Results for 2,302 isolates from 1,941 patients were analysed. While ciprofloxacin resistance increased between 2008 and 2011, resistance rates for all antibiotics declined from 2013–2016. In 2016, 22\% (53) of isolates were resistant to ciprofloxacin, 7\% (17) to penicillin, 31\% (76) to tetracycline and 0.8\% (2) exhibited decreased susceptibility to ceftriaxone.

\textbf{CONCLUSION:} Ceftriaxone is still suitable as a component of gonorrhoea treatment in our region but resistance to other agents prohibits their use for empiric treatment regimens. Current methods of detecting antimicrobial resistance for NG needed to be updated so that they are fit for purpose.

Since the beginning of the antibiotic era, strains of \textit{Neisseria gonorrhoeae} (NG) have developed resistance to a wide range of antimicrobials, including sulphonamides, tetracycline, penicillin, ciprofloxacin, ceftriaxone and azithromycin.\textsuperscript{1}

However, widespread use of molecular detection for NG and other sexually transmitted infections has led to a reduction in samples submitted for NG culture, and has meant that patient level individual isolate susceptibility information is rarely available to guide definitive antibiotic therapy. Therefore, population level data, such as that provided from active surveillance programmes, is essential to determine empiric treatment regimes. Many countries, including New Zealand, participate in national or supranational surveillance programmes.\textsuperscript{2-4} Although the New Zealand national public health laboratory (Institute of Environmental Science and Research, ESR) periodically reports gonococcal resistance data, there have not been any longitudinal studies documenting NG antimicrobial resistance for New Zealand in recent years.\textsuperscript{5}
Our laboratory submits gonococcal antimicrobial susceptibility data annually to the World Health Organization (WHO) Western Pacific region Gonococcal Antimicrobial Surveillance Programme (GASP). These data are derived from patients attending the Auckland Regional Sexual Health Service, as well as inpatients and outpatients from Auckland City Hospital. A continuous database of susceptibility results for these antibiotics has been maintained since 2008.

The aim of this study was to identify antimicrobial resistance (AMR) patterns for NG in the Auckland region over the period 2008–2016, to review the current approach to AMR surveillance, and use this knowledge to focus our AMR surveillance strategy to support both local and national decision-making for empiric treatment guidance.

**Methods**

Antimicrobial susceptibility results for non-duplicate isolates of NG, derived from patients attending the Auckland Regional Sexual Health Service and Auckland City Hospital between January 2008 and December 2016 were included. Referred samples from external laboratories were excluded. Samples from patients attending general practices are processed elsewhere.

**Antimicrobial susceptibility testing and breakpoints**

Antimicrobial susceptibility testing was performed using an agar dilution method (breakpoint technique) for penicillin, tetracycline, ciprofloxacin and ceftriaxone (Clinical and Laboratory Standards Institute, CLSI). Our laboratory participates in the WHO Western Pacific region GASP annual external quality assessment programme.

During the study period, antimicrobial susceptibility testing results were interpreted, and reported using CLSI criteria. Accordingly, penicillin resistance was categorised by production of penicillinase as determined by nitrocefinase disc testing (BD, Becton Dickinson, Melbourne, Australia) or in its absence, as chromosomal mediated resistance. High-level tetracycline resistance was defined as minimum inhibitory concentration (MIC) MIC ≥16mg/L. In addition, for ceftriaxone, decreased susceptibility was defined as isolates in the MIC range 0.06–0.12mg/L, in accordance with the Australian Gonococcal Surveillance Programme (AGSP) criteria. The MIC required to inhibit 50% and 90% of isolates were calculated for each antibiotic.

For comparative purposes, European Committee on Antimicrobial Susceptibility Testing (EUCAST) criteria are also presented in Table 1.

**Statistical methods**

Cochran-Armitage trend tests were used to assess trends over time; otherwise Chi square was used to compare proportions. Patient level information was analysed by sex and anatomical site.

Ethical review was not required for this audit-related activity.

**Results**

Over the study period, 2,302 isolates were tested for antimicrobial susceptibility, from 1,941 patients. Most (1,704, 74%) isolates were from men. The number of isolates varied between 158 and 315 per year.

Among men, the isolates were cultured from urethral samples (1,255, 74%), from rectal samples (302, 18%) and from throats (91, 5%), as well as from other sites or unspecified sites (56, 3%). Among females isolates were cultured from urogenital sites (urethra, vagina, cervix, 502, 88%), from rectal samples (17, 3%) and from throats (22, 4%), as well as from other sites or unspecified sites (56, 9%).

In 2016, 22% (53/245) of isolates were resistant to ciprofloxacin, 7% (17/245) to penicillin, 0.8% (2/245) exhibited decreased susceptibility to ceftriaxone, and 31% (76/245) were resistant to tetracycline. Overall susceptibility over the study period is presented in Table 1. Trends in susceptibility are shown in (Figure 1).
Penicillin resistance

The vast majority of isolates (n=2,256, 98%) were non-susceptible to penicillin. This was mostly attributable to reduced susceptibility (78%, n=1,793) by chromosomal mediated changes to penicillin binding proteins, in which strains have mutations which increase the risk of further mutations conferring outright resistance, with less, 20% of isolates (n=463) exhibiting resistance according to CLSI breakpoints. Resistance was chromosomally mediated in 12% (n=286), and by the production of penicillinase in 8% (n=177) of isolates. The resistance rates significantly decreased from 26% in 2008 to 7% in 2016 (p =0.004), with a corresponding increase in the proportion of isolates falling into the reduced susceptibility category (70% in 2008 to 92% in 2016, p<0.001). The proportion of susceptible isolates was low, and reduced further over the study period (4% in 2008 to 0.8% in 2016, p<0.002). Higher rates of resistance were seen in males (22%, 378/1,704 isolates) compared with females (15%, 87/597 isolates, p<0.001), and in extra-genital (31%, 135/432 isolates) compared with urogenital (18%, 363/1,763, p<0.001) isolates.

Figure 1: Trends in antibiotic resistance for Neisseria gonorrhoeae isolates, LabPlus 2008–2016.

![Figure 1](image-url)
Ceftriaxone decreased susceptibility
Overall, 4.6% (n=109) of isolates exhibited decreased susceptibility to ceftriaxone during the study period. Variation in this proportion was seen with time, with rates highest in 2009, 2010 and 2012, with a trend towards increasing susceptibility over the study period (p<0.001). No isolates resistant to ceftriaxone were detected through breakpoint testing over the study period.

The proportion of samples with decreased ceftriaxone susceptibility was higher (13%, 54/432) from extra-genital, compared with urogenital sites (3%, 52/1763 isolates, p<0.001), and for men (6%, 101/1,704 isolates) compared with women (1.4%, 8/568 isolates p<0.001). Accordingly, the MIC 90 of isolates from males (0.03mg/L) was higher than that for isolates from females (0.016mg/L), and the MIC 90 for extra-genital (rectal/throat) isolates (MIC 0.06mg/L) was higher than urogenital isolates (0.03mg/L).

Ciprofloxacin resistance
Overall, 34% (n=787) of isolates were resistant to ciprofloxacin, with two trends evident: resistance rates increased from 24% in 2008 to a peak of 45% in 2011 (p<0.001) and then declined to 22% in 2016 (p=0.002). Isolates from men were more likely to be resistant (35%, 598/1,704), compared with those from females (32%, 189/597, p=0.006) as were those from extra-genital (42%, 182/432 isolates) compared with urogenital sites (32%, 566/1,763, p<0.001).

Tetracycline resistance
Overall, 48% (n=1,113) of isolates were resistant to tetracycline, with 24% (n=547) exhibiting high-level resistance. Resistance rates were highest in the period 2008–2012 (48–66%), and declined to 31% in 2016 (p<0.001).

No difference in resistance rates were seen between isolates from males and females, but extra-genital isolates were more likely to be resistant (57%, 246/432 isolates) compared with urogenital isolates (47%, 832/1,763 isolates, p<0.001).

Discussion
Consistent with other countries, we report high levels of resistance to multiple antimicrobials among local NG isolates in a predominantly STI clinic-based population. Resistance rates to ciprofloxacin (22%), penicillin (21%), and tetracycline (42%), from 2008–2016 remained well above the WHO-recommended 5% threshold for the use of these agents as empiric therapy for gonorrhoea infections.10

There has been temporal changes in susceptibility patterns, reflecting worldwide trends.2,4,8 In the early study period (2008–2011), rates of ciprofloxacin resistance were increasing, and around 5% of isolates had decreased susceptibility to ceftriaxone. However, from 2013–2016, resistance rates for penicillin, ciprofloxacin and tetracycline declined, and rates of decreased ceftriaxone susceptibility reduced to less than 5%. These trends probably represent fluctuations in circulating clones.8 However, the number of strains of NG harbouring resistance with the capacity to spread is likely to be increasing, as evident by the increasing number of reports of clones associated with treatment failure, placing significant pressure on our limited antibiotic options for this organism.8

We found that isolates from men, and those from extragenital sites, were overall more likely to be resistant than those from urogenital sites. Though we do not have behavioural information to confirm this, as reported elsewhere, this finding likely reflects the fact that these sites are more likely to be sampled in men who have sex with men (MSM), a group known to have increased rates of NG resistance compared with the general population.12

In New Zealand, ciprofloxacin resistance was uncommon before the turn of the century. Rates increased exponentially from <5% to 40% between 2000 and 2011, due to the introduction of resistant gonococcal strains from overseas and their subsequent dissemination via sexual networks.5,13 This increase in resistance necessitated changes...
to local treatment guidelines, including the recommendation of ceftriaxone as the standard empirical treatment for gonococcal infections,13,14 more recently given in combination with azithromycin.15 Consequently, resistance rates for ciprofloxacin declined after 2012, but remain well above thresholds recommended for use as empiric therapy. The role of this drug is currently limited to a minority of patients, where susceptibility results for their isolate are available at the time of clinical review. In these situations, it is recommended that it be administered with azithromycin,15 because resistance still occurs when this drug is used as monotherapy below the breakpoint for resistance.16

Although resistance to penicillin is relatively uncommon, most strains in our region have reduced susceptibility to penicillin, again with the potential to accumulate further mutations, and become fully resistant,8 so this antibiotic is not appropriate for use. Tetracyclines have never been recommended for the treatment of NG, because of high resistance rates and the requirement for multiple-dose therapy,16 but this could change in the future, as other options are lost, if susceptibility results were available to guide treatment.

Decreased susceptibility to ceftriaxone remains low in our setting, and this agent is still suitable as a component of empiric treatment. However, worldwide there are increasing reports of ceftriaxone treatment failure.17,18 This is due to an increasing number of circulating clones of ceftriaxone susceptible gonorrhoea that are harbouring mosaic PBP mutations, which increase the likelihood of de-novo generation of resistance.8 Though no patients in New Zealand have had ceftriaxone resistant NG to date, we know that non-adherence to recommended treatment among healthcare providers is common in our region, and there are concerns that monotherapy with ceftriaxone or azithromycin may contribute to increasing resistance in our population.19

As has been demonstrated with ciprofloxacin, importation of resistant strains can rapidly lead to dissemination, and ongoing vigilance is required.

Azithromycin resistance appears to be an emerging issue in our population, likely through both de-novo resistance and spread of already resistant strains,20 but until now monitoring of azithromycin susceptibility has not been part of local surveillance activities.21 Resistance is of concern because the current empiric regime relies on azithromycin to protect ceftriaxone activity,22 and high rates of resistance to this agent could hasten development of ceftriaxone resistance. Additionally, for patients unable to receive ceftriaxone, some current international guidelines allow the administration of azithromycin as monotherapy;23 this regime appears to be in jeopardy.24

In line with current therapeutic options and our antimicrobial resistance patterns, we have changed our approach to NG AMR testing to support both individual and population-based treatment guidance. We now perform real-time susceptibility testing of NG isolates so that patients infected with resistance strains can be identified earlier, and test-of-cure performed where clinically warranted. This involves determining the MIC for ceftriaxone and azithromycin using a gradient diffusion method, along with susceptibility to ciprofloxacin by disc diffusion for all NG isolates. We started performing azithromycin susceptibility testing in mid-2017, and to date the results have shown that azithromycin resistance is present in 21% of NG isolates in the Auckland region (32/153 isolates tested, unpublished data).

Whole genome sequencing has recently been applied to local gonococcal isolates and offers a powerful surveillance tool for both genotypic resistance and epidemiological surveillance.20 In the clinical setting, the availability of rapid, sensitive, gonorrhoea detection and genotypic resistance point of care tests would allow definitive, tailored therapy at the time high-risk patient presents for review.25,26 However, this technology is not yet widely available, and is currently limited to detection of a narrow range of mutations. In addition, in order to detect newer resistance mechanisms there would be an ongoing requirement for phenotypic testing to be performed on a proportion of isolates.27,28

With increasing reports of treatment failure worldwide, it is essential that clinicians in New Zealand do not become complacent about the risks and consequences of widespread resistance to the
current antibiotic options for NG, which include increasing rates of pelvic inflammatory disease, tubal infertility and neonatal eye disease. Given the high azithromycin rates that we have noted, it is also essential that antimicrobial stewardship interventions occur in the community to address potential sources of inappropriate azithromycin administration, such as encouraging the use of multiple dose doxycycline regimes for symptomatic chlamydia infections, as recommended in recent updates to national guidelines, rather than the use of single-dose azithromycin.

In summary, changes in susceptibility patterns of N. gonorrhoeae have occurred in our region over the last eight years, consistent with those reported worldwide. Though ceftriaxone remains a suitable component of empiric therapy in our region, rates of resistance for other antimicrobials remain high. We have tailored our AMS for NG to reflect clinical and surveillance needs by provision of real-time results, and the introduction of susceptibility testing for azithromycin. In the future, developments in point of care testing may allow rapid, individualised therapy for patients in STI clinics.

Competing interests:
Nil.

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The impact of multimorbidity on people’s lives: a cross-sectional survey

Jeannine Stairmand, Jason Gurney, James Stanley, Elinor Millar, Cheryl Davies, Kelly Semper, Anthony Dowell, Dee Mangin, Ross Lawrenson, Diana Sarfati

ABSTRACT

AIMS: To describe the experiences of people living with multimorbidity in New Zealand.

METHODS: We conducted a cross-sectional survey of adults with multimorbidity enrolled in two primary health organisations in New Zealand. Potential participants with multimorbidity were identified using retrospective hospital discharge data coded for long-term conditions. Sampling was stratified by ethnicity (Māori, Pacific and non-Māori/non-Pacific). Analysis was descriptive, with some responses compared to the general population estimates from the New Zealand Health Survey.

RESULTS: A total of 234 participants completed the survey (mean age 65.2). Self-reported physical health was poor among the cohort: forty-one percent of participants reported only ‘fair’ or ‘poor’ general health, compared to 13.5% in the general population (age and sex standardised), with similar results for both self-reported mental health and physical health. Self-reported health was poorer for Māori and Pacific participants. The majority (70%) of those who were working reported their health had affected their productivity, while nearly 20% of participants reported financial difficulty in taking care of their health needs.

CONCLUSIONS: These results emphasise the serious impact multimorbidity has on patients’ health status compared to the general population. This research supports the development of holistic patient-centred care models designed to improve patient outcomes.

Multimorbidity is the presence of two or more long-term conditions that collectively influence a person’s health status, often requiring complex care and management. Multimorbidity is more common among older people, although a study of two million people registered in primary care practices found the absolute number of people with multimorbidity was higher for those under 65 than those over 65. While there is little published evidence on multimorbidity prevalence in New Zealand, one study of 1,326 hospitalised patients found that a third had comorbid disease (defined as disease occurring in addition to their primary reason for admission), and this was associated with poorer outcomes. The burden of multimorbidity is generally higher in those in lower socioeconomic groups and other underserved populations such as indigenous and ethnic minority groups, and the onset tends to be at a younger age.

The impact of multimorbidity on those affected is far reaching: it often involves taking multiple medications, may adversely affect employment and can involve frequent but fragmented healthcare. These patients are at high risk of poor outcomes such as disability, functional decline and poor quality of life. Multimorbidity also comes at a cost for both individuals and the healthcare system, with healthcare utilisation and costs increasing with each additional condition. Two recent qualitative New Zealand studies found that multimorbidity often has a substantial negative impact on people’s lives, including considerable difficulty with managing medications and difficulties accessing and navigating appropriate healthcare.
the impact of multimorbidity may be greatest for Māori, who have higher rates of many long-term conditions, poorer access to primary care, are more likely to experience discrimination and experience a lower socio-economic status than non-Māori.16–18

This study aimed to assess the frequency, pattern and impact of physical and mental health, and issues regarding support, employment and finance for people with multimorbidity across different ethnic groups in New Zealand.

Methods
Survey population and eligibility criteria
The study population was adults aged 18+ with multimorbidity, enrolled with one of three primary health organisations (PHOs) in New Zealand.

Multimorbidity was defined using retrospective hospital discharge data (via ICD-10 coded diagnosis codes). All recorded diagnoses from hospital discharge records were coded for 61 long-term conditions drawn from the M3 multimorbidity index.19 To be eligible for this study, participants needed to have two or more identified conditions in the five years prior to the data extract date (1 January 2016), with at least one being a physical health condition.

Other sampling eligibility criteria were enrolment in one of the study Primary Health Organisation’s (PHO) at time of data extraction, and recorded as alive at time of data extraction. Data were provided by the Ministry of Health, drawing from the National Health Index (NHI) master table and the National Minimum Dataset (NMDS),20 linked by NHI number (unique identifier for individuals engaged with healthcare system in New Zealand).

Sampling process
Sampling was stratified by respondent ethnicity (Māori, Pacific and Non-Māori/Non-Pacific, based on ethnicity recorded in the NHI master record). The target sample size was set at 200 participants per stratum to achieve a margin of error (half-width of 95% confidence interval) of +/- 7% for stratified estimates. We assumed a 40% response rate, and selected a list of 1,500 patients to invite in order to achieve a final sample size of 600 participants.

Following a pilot study of the survey recruitment methods, which identified a need for additional resources for recruitment, a decision was made to focus on two of the original PHOs: a new sample of patients was drawn for one PHO (Compass Health) where in-depth recruitment processes could be used (n=999, stratified by ethnicity), and the original sampling list was retained for the second PHO (Pegasus Health) (n=472).

Invitation lists were reviewed by each PHO to check patients were alive and still enrolled with the PHO. The resulting practice-level lists were subsequently reviewed by the participating general practices who removed patients deemed inappropriate to invite (due to acute poor health or impairment from conditions like dementia; see Supplementary Table 1).

Recruitment
Strategies for gaining the support of primary healthcare practices and recruiting individual patients within those practices were developed in conjunction with an advisory group of research-active GPs, PHOs and a Māori health provider.

Once a primary care practice agreed to participate, participant packs were prepared for all eligible patients (including invitation letters addressed from the patient’s practice, information sheet, paper copy of the survey and post-paid return envelope). Participants were able to complete the paper survey or had the option of completing the survey online or over the telephone.

A research company (Research New Zealand) was contracted to coordinate data collection, including design of the web-based version of the survey, data entry for returned paper surveys and conduct of telephone interviews using a Computer Assisted Telephone Interview (CATI) system.

Measures
The survey combined original questions alongside items from existing questionnaires including: New Zealand Health Survey,21 Work Productivity and Impairment Questionnaire (adapted),22 Bayliss23 and Social Provisions Scale (three questions only).24 The survey included five key topics: social support, financial implications, access to healthcare, health literacy, and coordination and continuity of care. These areas were
chosen based on a literature review which identified key themes around patients' experiences of living with multimorbidity, and themes emerging from our earlier qualitative study on multimorbidity. The survey also included demographic questions. A draft survey was piloted with 11 patients with multimorbidity, with subsequent amendments made and reviewed by the research and clinical advisory teams before the survey was finalised.

Data analysis
To account for the stratified sampling design, we calculated inverse sampling weights for each participant (by ethnicity and PHO) so that total estimates for the sample were weighted back to represent the eligible population (ie, people with multimorbidity in the two participating PHOs). These inverse sampling weights were used in all analyses: for categorical outcomes, we have reported unweighted frequencies (actual number of respondents in each category) alongside weighted percentages and their 95% confidence intervals.

Crude descriptive analyses for each survey question include frequencies and weighted proportions, both for the total cohort and stratified by ethnicity, calculated using Proc Surveyfreq in SAS v9.3. Mean scores on the SF-12 Mental and Physical health scales were calculated using Proc Surveymeans.

General population figures for questions drawn from the 2015/16 New Zealand Health Survey (NZHS) were based on analysis NZHS data that was then directly standardised to the age- and sex-profile of our survey respondents. Socioeconomic deprivation (NZDep) was measured using NZDep2013, a small-area based index calculated using aggregated census data on residents' socioeconomic characteristics. For the sake of brevity, we have only presented ethnicity-stratified results where there was notable variation.

Data management and analysis was performed in SAS v9.3 and Microsoft Excel. Ethical approval for the study was granted by the Southern Region Ethics Committee (16/STH/16); the study was also considered by the University of Otago Ngāi Tahu Research Consultation Committee.

Results
Patients were drawn from 75 primary care practices (Supplementary Table 2). Of 1,471 potential participants, 758 (51.5%) were deemed eligible and sent study information packs by the practices. Of these, 234 participants completed the survey (response rate: 31%), with 167 respondents from PHO 1 (37% response rate) and 67 from PHO 2 (22% response rate) (Supplementary Table 1). Of the 234 returned surveys, 219 were self-completed by paper survey, seven were completed online and eight by telephone.

Study participants characteristics
Participant characteristics are presented in Table 1. Over half of the participants (52%) were 65 years or older (mean age = 65.2, SD=13.9) with equal numbers of male and female participants (n=117 for both). Although we aimed to recruit similar numbers in each ethnic group, 25% of participants were Māori, 19% Pacific and the majority (56%) were Non-Māori/non-Pacific (NMNP). Most participants (74%) reported living with other people (partner, children, family, flatmates/non-family), 25% were living alone and only three participants were living in a home/care facility. Only 12% of participants were from NZ Dep Quintile 5 (most deprived) neighbourhoods. Half of the participants (50%) had a secondary school or similar level qualification, while a small proportion (15%) held a bachelor's degree or higher and the remainder (29%) reported having no qualifications. While the majority (57.9%, 95% CI 48.7–67.1) were retired, homemakers or volunteers) a sizable minority were working in paid employment (38%, 95% CI 28.8–47.2).

More than half of all participants had been diagnosed with three or more long-term conditions, with nearly 10% having five or more (9.2%, 95% CI 4.8–13.6). When stratifying comorbid conditions by ethnicity, we observed that Māori and Pacific participants appeared to have marginally greater numbers of comorbid conditions (Supplementary Table 3). Cardiovascular conditions were among the most common (cardiac arrhythmia: 5.5%, cardiac disease other: 5.4%, uncomplicated hypertension 4.3%, myocardial infarction 4.0%, angina 3.6%, cerebrovascular disease 3.6%; Table 2).
Table 1: Sociodemographic characteristics of survey participants.

<table>
<thead>
<tr>
<th>Total cohort</th>
<th>N (total=234)</th>
<th>Unweighted proportion %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–24</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>25–49</td>
<td>30</td>
<td>13%</td>
</tr>
<tr>
<td>50–64</td>
<td>76</td>
<td>32%</td>
</tr>
<tr>
<td>65–74</td>
<td>64</td>
<td>27%</td>
</tr>
<tr>
<td>75+</td>
<td>59</td>
<td>25%</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>65.2 (13.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>117</td>
<td>50%</td>
</tr>
<tr>
<td>Male</td>
<td>117</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>58</td>
<td>25%</td>
</tr>
<tr>
<td>Pacific</td>
<td>45</td>
<td>19%</td>
</tr>
<tr>
<td>Non-Māori/Non-Pacific</td>
<td>131</td>
<td>56%</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary school qualification</td>
<td>59</td>
<td>25%</td>
</tr>
<tr>
<td>Polytechnic qualification or Trade Certificate</td>
<td>59</td>
<td>25%</td>
</tr>
<tr>
<td>Bachelor’s degree or higher</td>
<td>36</td>
<td>15%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>No qualifications</td>
<td>69</td>
<td>29%</td>
</tr>
<tr>
<td><strong>Living situation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>58</td>
<td>25%</td>
</tr>
<tr>
<td>Living with partner/family</td>
<td>158</td>
<td>68%</td>
</tr>
<tr>
<td>Living with flatmates/non-family</td>
<td>17</td>
<td>7%</td>
</tr>
<tr>
<td>Living in a home/care facility</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td><strong>NZDep (Quintile)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (least deprived)</td>
<td>55</td>
<td>24%</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>23%</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>18%</td>
</tr>
<tr>
<td>4</td>
<td>54</td>
<td>23%</td>
</tr>
<tr>
<td>5 (most deprived)</td>
<td>27</td>
<td>12%</td>
</tr>
</tbody>
</table>

1Missing data for nine participants.
2Participants could choose more than one option.
3Missing data for four participants.
Table 2: Prevalence of multiple long-term conditions within the cohort.

<table>
<thead>
<tr>
<th>Number of long-term conditions:</th>
<th>N (total=234)</th>
<th>Weighted proportion (%), 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>105</td>
<td>48.1 (40.3, 55.9)</td>
</tr>
<tr>
<td>3</td>
<td>68</td>
<td>26.4 (19.6, 33.2)</td>
</tr>
<tr>
<td>4+</td>
<td>33</td>
<td>16.3 (10.4, 22.1)</td>
</tr>
<tr>
<td>median [IQR]</td>
<td>3 [2–4]</td>
<td></td>
</tr>
</tbody>
</table>

Individual condition prevalence¹

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
<th>Weighted proportion (%), 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac arrhythmia</td>
<td>62</td>
<td>5.5 (2.0, 9.0)</td>
</tr>
<tr>
<td>Cardiac disease other²</td>
<td>53</td>
<td>5.4 (1.9, 8.9)</td>
</tr>
<tr>
<td>Diabetes with complications</td>
<td>62</td>
<td>5.4 (1.8, 8.9)</td>
</tr>
<tr>
<td>Metabolic disorder</td>
<td>47</td>
<td>4.9 (1.6, 8.2)</td>
</tr>
<tr>
<td>Hypertension (uncomplicated)</td>
<td>36</td>
<td>4.3 (1.3, 7.4)</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>23</td>
<td>4.0 (1.0, 7.0)</td>
</tr>
<tr>
<td>Coagulopathy/other blood disorder</td>
<td>29</td>
<td>4.0 (0.9, 7.0)</td>
</tr>
<tr>
<td>Angina</td>
<td>25</td>
<td>3.6 (0.8, 6.4)</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>24</td>
<td>3.6 (0.6, 6.6)</td>
</tr>
<tr>
<td>Obesity</td>
<td>32</td>
<td>3.2 (0.5, 5.9)</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>26</td>
<td>3.0 (0.3, 5.6)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>24</td>
<td>2.9 (0.2, 5.6)</td>
</tr>
<tr>
<td>Inflammatory bowel disease</td>
<td>19</td>
<td>2.7 (0.6, 4.8)</td>
</tr>
<tr>
<td>Anaemia deficiency</td>
<td>20</td>
<td>2.7 (0.3, 5.0)</td>
</tr>
<tr>
<td>Chronic renal disorder</td>
<td>18</td>
<td>2.5 (0.1, 4.9)</td>
</tr>
<tr>
<td>Sleep disorder</td>
<td>18</td>
<td>2.5 (0.1, 4.8)</td>
</tr>
<tr>
<td>Eye problem (long term)</td>
<td>14</td>
<td>2.4 (0.1, 4.8)</td>
</tr>
<tr>
<td>Diabetes (uncomplicated)</td>
<td>15</td>
<td>2.4 (0.0, 4.7)</td>
</tr>
<tr>
<td>Pulmonary circulation disorder</td>
<td>13</td>
<td>2.3 (0.0, 4.6)</td>
</tr>
<tr>
<td>Paralysis</td>
<td>13</td>
<td>2.1 (0.0, 4.5)</td>
</tr>
<tr>
<td>Metastatic cancer</td>
<td>11</td>
<td>2.1 (0.0, 4.4)</td>
</tr>
<tr>
<td>Cardiac valve</td>
<td>14</td>
<td>2.0 (0.0, 4.3)</td>
</tr>
</tbody>
</table>

¹Only conditions with a weighted proportion of 2% or greater are reported.
²Residual category of cardiac conditions not counted under other specified cardiac categories.

Table 3: General self-rated health.

<table>
<thead>
<tr>
<th></th>
<th>Total cohort (N=234)</th>
<th>Māori</th>
<th>Pacific</th>
<th>NMNP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Weighted proportion %</td>
<td>95% CI</td>
<td>n</td>
</tr>
<tr>
<td>Excellent</td>
<td>6</td>
<td>4.2</td>
<td>(0–8.6)</td>
<td>0</td>
</tr>
<tr>
<td>Very good</td>
<td>41</td>
<td>21.5</td>
<td>(13.5–29.4)</td>
<td>7</td>
</tr>
<tr>
<td>Good</td>
<td>85</td>
<td>33.1</td>
<td>(24.6–41.6)</td>
<td>26</td>
</tr>
<tr>
<td>Fair</td>
<td>82</td>
<td>35.8</td>
<td>(26.7–44.8)</td>
<td>18</td>
</tr>
<tr>
<td>Poor</td>
<td>17</td>
<td>5.4</td>
<td>(1.4–9.4)</td>
<td>7</td>
</tr>
</tbody>
</table>

¹Missing data for three participants.
²Missing data for one participant.
³Missing data for two participants.
Hauora: Physical, mental and social wellbeing

When asked to rate their general health, many participants reported only ‘fair’ or ‘poor’ health (41.2%) (Table 3). Māori (47.7%) and Pacific (53.2%) respondents were more likely to report having only fair or poor health compared with NMNP living with multimorbidity (40.2%). These figures were much higher than general population estimates from the NZHS, where only 13.5% rated their health as fair or poor (95% CI 10.6–16.4; age- and sex-standardised from the 2015/16 NZHS to match our sample).

The mean aggregate SF-12 Physical Health Score was 38.5 (95% CI 37.0–40.1) for survey participants, which was substantially lower than the general population mean score (mean=46.5, 95% CI 45.4–47.5, age- and sex-standardised from 2015/16 NZHS;). Health was reported by many participants (72.4%) to limit their ability to climb several flights of stairs (Supplementary Table 3).

The mean aggregate SF-12 Mental Health score for survey participants was 48.8 (95% CI 47.1–50.4), again lower than for the general population (mean=53.0, 95% CI 54.4–55.7; age- and sex-standardised from 2015/16 NZHS; Supplementary Table 4). Nearly half (48%) of participants reported accomplishing less than they would have liked as a result of their emotional problems (eg, feeling depressed or anxious) over the previous four weeks.

The majority (97.3%) of survey participants reported having participated in different social interactions in the two weeks prior to completing the survey (Table 4). Access to help was readily available with the majority (85.8%, 95% CI 79.1–92.4) of participants having people in their lives who they could depend on for help. However, half of participants (50.3%, 95% CI 40.5–60.1) also reported having other people who depended on them for help (Table 4).

Table 4: Socialisation and support.

<table>
<thead>
<tr>
<th>Activities in the past two weeks:1</th>
<th>Total cohort</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met with friends or relatives</td>
<td>204</td>
<td>86.4 (79.7–93.1)</td>
</tr>
<tr>
<td>Talked on phone or online with friends/relatives</td>
<td>208</td>
<td>91 (85.7–96.3)</td>
</tr>
<tr>
<td>Gone to church</td>
<td>62</td>
<td>17.4 (11.1–23.7)</td>
</tr>
<tr>
<td>Gone to a show/movie</td>
<td>103</td>
<td>45 (35.7–54.3)</td>
</tr>
<tr>
<td>Eaten out at a restaurant</td>
<td>115</td>
<td>50.6 (41.3–59.9)</td>
</tr>
<tr>
<td>None of the above</td>
<td>7</td>
<td>2.7 (0–5.5)</td>
</tr>
</tbody>
</table>

I have people I can rely on2

| True                  | 190   | 85.8 (79.1–92.4) |
| Neutral               | 21    | 7 (2.2–11.8) |
| False                 | 14    | 7.3 (2.3–12.2) |

I have people who depend on me3

| True                  | 113   | 50.3 (40.5–60.1) |
| Neutral               | 61    | 28.1 (19.2–36.9) |
| False                 | 43    | 21.6 (13.5–29.7) |

1Participants could select more than one option.
2Missing data for nine participants.
3Missing data for 17 participants.
Employment, work and financial impacts

Of the 119 participants who had been employed in the past five years, many had made changes to their working conditions as a result of their health, including decreasing working hours (31.3%, 95% CI 18.4–44.2), taking lighter duties (17%, 95% CI 6.6–27.4) or changing job (11.8%, 95% CI 2.5–21.1), while some had stopped working altogether (8.3%, 95% CI 2–14.7) (Table 5). A majority (70%, 95% CI 56.8–83.3) of these participants reported their health had affected their productivity over the previous seven days. Pain was reported as interfering with work over the previous four weeks for most of these participants (75.7%, 95% CI 67.8–83.7), while more than a quarter (26.1%, 95% CI 13.6–38.5) had taken time off work due to problems associated with their health (eg, to attend doctor’s appointments, sick days, left work early).

Nearly one in five participants (18%, 95% CI 10.7–25.0) reported financial difficulty taking care of all their healthcare needs including prescriptions (Table 6). Māori (37%, 95% CI 19.3–53.7) and Pacific people (29%, 95% CI 12.8–44.9) were more likely to report financial healthcare difficulties than non-Māori/non-Pacific (16%, 95% CI 8.0–23.7). Nearly a quarter of participants (24%, 95% CI 16.4–32.2) reported difficulties covering other basic living costs (eg, rent/mortgage, food, power) in addition to healthcare costs, and more than a quarter cut down on other purchases (eg, clothing) because of their healthcare expenses (26%, 95% CI 17.4–34).

Table 5: Health impact on work.

<table>
<thead>
<tr>
<th>Current work situation</th>
<th>n</th>
<th>%</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working in paid employment</td>
<td>85</td>
<td>38</td>
<td>(28.8–47.2)</td>
</tr>
<tr>
<td>Not in paid employment but looking for a job</td>
<td>10</td>
<td>1.7</td>
<td>(0.4–2.9)</td>
</tr>
<tr>
<td>Not in paid employment, and not looking for a job (eg, retired, homemaker, volunteer)</td>
<td>123</td>
<td>57.9</td>
<td>(48.7–67.1)</td>
</tr>
<tr>
<td>Not in paid employment, due to sickness</td>
<td>9</td>
<td>2</td>
<td>(0.5–3.5)</td>
</tr>
<tr>
<td>Not in paid employment, currently a student</td>
<td>2</td>
<td>0.4</td>
<td>(0–1.2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If not currently employed, were you employed in the last five years?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact on work productivity¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work changes due to health¹,²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease your working hours</td>
</tr>
<tr>
<td>Do light duties</td>
</tr>
<tr>
<td>Change jobs</td>
</tr>
<tr>
<td>Stop work altogether</td>
</tr>
<tr>
<td>Has not affected work at all</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pain interference with work¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>A little bit</td>
</tr>
<tr>
<td>Moderately</td>
</tr>
<tr>
<td>Quite a bit</td>
</tr>
<tr>
<td>Extremely</td>
</tr>
</tbody>
</table>

¹Among those who had been in paid employment in the past five years (n=119).
²Participants could select more than one option.
³Among the total cohort (n=234).
**Discussion**

This study describes the self-reported health status and experiences of people living with multiple long-term conditions in New Zealand. Participants with multimorbidity experienced poorer self-reported general health, physical health and mental health than the general population; their conditions also impacted adversely on their employment and financial wellbeing. Māori and Pacific participants reported poorer health and financial healthcare difficulties than Non-Māori/non-Pacific (NMNP).

Our observation that patients with multimorbidity report poorer health than a similar cohort of the general New Zealand population is unsurprising. Over half of our study cohort were living with three or more long-term conditions, and health-related quality of life scores have been found to decrease as the number of concurrent conditions increases.²⁷

However, this study also suggests that Māori and Pacific people with multimorbidity may experience greater impact on their health than NMNP people with multimorbidity. There are a number of potential reasons for this difference. When stratifying comorbid condition by ethnicity, we observed that Māori and Pacific people appeared to have a marginally greater number of comorbid conditions, which may at least partially explain why Māori and Pacific people tend to report poorer overall health. Māori are also more likely to have poorer health arising from the breach of indigenous rights, manifesting in differential access to the determinants of health, differential access to healthcare and differences in the quality of care received.²⁸ Māori are also more likely to have experienced racism (interpersonal and institutional), which is associated with poor health.¹⁷ In addition, and likely partially as a result of these factors, Māori and Pacific people experience higher rates of, and have been found to have, worse outcomes for a number of long-term conditions.²⁸

These results are in line with previous studies where people living with multimorbidity experienced poorer mental health compared with a similar cohort of the general population.²⁹ Multimorbidity places a substantial psychological burden on those who live with it, and so these people are at higher risk of poor mental health compared with those without multimorbidity.²³ As an additional burden for those with multimorbidity, poor mental health can make self-management difficult.³¹ Other studies have suggested that depression in conjunction with other long-term conditions results in greater decrements in health.³²

We observed a high degree of socialisation and support among respondents, which can influence the mental health of those with multimorbidity.¹⁴,³³–³⁵

| Table 6: Experiences of financial difficulty among patients with multimorbidity. |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                                  | **Total cohort**                | **Māori**                       | **Pacific**                     | **NMNP**                        |
| **n**                            | **Weighted proportion %**       | **95% CI**                      | **n**                           | **Weighted proportion %**       | **95% CI**                      | **n**                           | **Weighted proportion %**       | **95% CI**                      |
| I can financially address my healthcare and prescription needs | | | | | | | | |
| Definitely true                  | 128                             | 61.8 (52.6–71.1)                | 26                              | 44.9 (27.5–62.3)                | 20                              | 44.1 (26.4–61.8)                | 82                              | 63.9 (53.6–74.2)                |
| Neutral                          | 45                              | 20.4 (12.6–28.2)                | 11                              | 18.6 (5.3–31.9)                 | 10                              | 27.1 (10.4–43.7)                | 24                              | 20.2 (11.6–28.9)                |
| Definitely false                 | 50                              | 17.8 (10.7–25)                  | 18                              | 36.5 (19.3–53.7)                | 13                              | 28.8 (12.8–44.9)                | 19                              | 19.9 (8–23.7)                   |
| I find it hard to cover basic living costs in addition to my healthcare expenses | | | | | | | | |
| Definitely true                  | 71                              | 24.3 (16.4–32.2)                | 25                              | 47.9 (30.1–65.6)                | 17                              | 37.3 (20.9–53.7)                | 29                              | 21.9 (13.2–30.6)                |
| Neutral                          | 49                              | 20.9 (13.1–28.7)                | 13                              | 17.4 (6.4–28.4)                 | 9                               | 25.4 (6.5–42.3)                 | 27                              | 21 (12.4–29.7)                  |
| Definitely false                 | 96                              | 54.8 (45.3–64.4)                | 16                              | 34.7 (17.5–52)                  | 15                              | 37.2 (19.2–55.3)                | 65                              | 57.1 (46.5–67.6)                |
| I have cut down on purchases because of healthcare expenses | | | | | | | | |
| Definitely true                  | 68                              | 25.7 (17.4–34)                  | 21                              | 38.3 (21.2–55.4)                | 18                              | 40.8 (23.1–58.4)                | 29                              | 24.1 (14.8–33.3)                |
| Neutral                          | 55                              | 28.1 (19.3–36.8)                | 14                              | 24.4 (9.5–39.3)                 | 7                               | 24 (7.8–40.1)                   | 34                              | 28.5 (18.8–38.3)                |
| Definitely false                 | 96                              | 46.3 (36.6–55.9)                | 20                              | 37.3 (20.2–54.3)                | 17                              | 35.3 (19.7–50.8)                | 59                              | 47.4 (36.7–58.2)                |
support networks are important for practical reasons, emotional wellbeing and are key in supporting people to self-manage their health.\textsuperscript{14,36,37} High levels of social support are also associated with perceived improved quality of life for those living with multimorbidity.\textsuperscript{36}

Employment issues were identified as a problem, with participants reporting having to make changes to their employment as a result of poor health. Our findings are consistent with those from other studies, which show multimorbidity adversely affects employment by acting as a barrier to employment and resulting in time off work due to illness or injury.\textsuperscript{19} Employment limitations and financial treatment burdens associated with multimorbidity also make self-management challenging.\textsuperscript{13,38}

To maintain workplace productivity and employee wellness, it is necessary for workplaces to take a proactive approach to the health of their workers. Our observation that nearly 20% of participants experienced financial difficulties taking care of their healthcare needs (including prescriptions in addition to basic living costs) was unexpected given the small proportion (12%) of respondents living in quintile 5 (most deprived). This impact was greater for Māori and Pacific participants, with nearly half of Māori participants reporting that they find it hard to cover basic living costs in addition to their healthcare expenses. The financial impact of long-term conditions is important and under-researched. The relationship between financial hardship and higher levels of multimorbidity is consistent both with the hypothesis that those with lower incomes are at higher risk of multimorbidity, and that multimorbidity may result in loss of income. Both are likely to be operating, and the association is important regardless of the direction of causality.

Another financial element is the likelihood that patients require multiple different prescriptions, although we do note that many participants accessed one of two government subsidy schemes which should reduce the cost of multiple prescriptions. When patients cannot afford to collect some or all of their prescribed medications they may be forced to prioritise which medications are most essential, or ration the medication they can afford, resulting in unnecessary suffering, deterioration in health and increased costs to the patient and healthcare system.\textsuperscript{15,39,40} This research supports previous suggestions for the need to reconsider prescription costs to better enable optimal self-management to maintain health among people with multimorbidity.\textsuperscript{41}

This population-based study is among the first to report on the impact of multimorbidity on patients from New Zealand primary care. The survey questionnaire was developed using a rigorous process, using validated or existing questions wherever possible, which allowed for broader comparison with the general population. Unfortunately the overall response rate was lower than anticipated, which limits the statistical precision of our estimates (ie, confidence intervals are wide) and raises the potential of selection bias. Since our sample only included those who had been hospitalised in the last five years, the included participants may have been less well than the broader population of people with multimorbidity. Poor recruitment of Māori and Pacific peoples meant we were unable to generate substantial evidence for these populations. Future studies in this setting may benefit from identifying alternative and complementary recruitment strategies, and factoring in a greater allowance for the screening out of unsuitable patients by PHOs and GPs.

Conclusions

The results of this study provide a picture of the substantial impact that multimorbidity has on individuals in terms of their physical, mental and social wellbeing, their employment, and financial wellbeing. Furthermore, these impacts appear to be greater for Māori and Pacific people. Taken together, these results support a partnership approach to improving the lives of people with multimorbidity, including supporting patients to self-manage their conditions; society level support involving support people and employers; and healthcare providers taking person-centred approaches using holistic care models.\textsuperscript{15,42–45} Finally, future research should concentrate on the investigation of potential explanations and interventions for ethnic disparities in New Zealand.
## Appendix

**Supplementary Table 1:** Participant sample and participation

<table>
<thead>
<tr>
<th></th>
<th>PHO1</th>
<th>Combined</th>
<th>PHO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>999</td>
<td>1,471</td>
<td>472</td>
</tr>
<tr>
<td>Removed</td>
<td>547</td>
<td>713</td>
<td>166</td>
</tr>
<tr>
<td>Sent</td>
<td>452</td>
<td>758</td>
<td>306*</td>
</tr>
<tr>
<td>Returned</td>
<td>167 (37%)</td>
<td>234 (31%)</td>
<td>67 (22%)</td>
</tr>
</tbody>
</table>

*Not all practices in PHO 2 returned information about the number of patients invited into the study so the figure is the maximum possible.

**Supplementary Table 2:** Practice sample and participation.

<table>
<thead>
<tr>
<th></th>
<th>PHO1</th>
<th>Combined</th>
<th>PHO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invited</td>
<td>48</td>
<td>134</td>
<td>86</td>
</tr>
<tr>
<td>Opted out</td>
<td>14</td>
<td>40</td>
<td>26</td>
</tr>
<tr>
<td>Sub-total</td>
<td>34</td>
<td>94</td>
<td>60</td>
</tr>
<tr>
<td>No response</td>
<td>5</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>Participated</td>
<td>29</td>
<td>75</td>
<td>46</td>
</tr>
</tbody>
</table>

**Supplementary Table 3:**

### Percentage of respondents (95% CI) with n conditions

<table>
<thead>
<tr>
<th>Prioritised ethnicity</th>
<th>Māori (n=58)</th>
<th>Pacific (n=45)</th>
<th>NZ European (n=131)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>41.8 (27.2, 56.3)</td>
<td>24.0 (10.6, 37.4)</td>
<td>49.6 (41.0, 58.3)</td>
</tr>
<tr>
<td>3</td>
<td>34.2 (20.5, 47.8)</td>
<td>39.7 (19.8, 59.5)</td>
<td>25.2 (17.7, 32.7)</td>
</tr>
<tr>
<td>4</td>
<td>10.1 (0.6, 19.6)</td>
<td>16.4 (0.6, 32.1)</td>
<td>16.8 (10.3, 23.3)</td>
</tr>
<tr>
<td>5+</td>
<td>13.9 (3.7, 24.2)</td>
<td>20.0 (3.8, 36.2)</td>
<td>8.4 (3.6, 13.2)</td>
</tr>
</tbody>
</table>

**Supplementary Table 4:** Impact of health on ability to climb several flights of stairs.

<table>
<thead>
<tr>
<th>Total cohort</th>
<th>N</th>
<th>Weighted proportion %</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes limited a lot</td>
<td>63</td>
<td>30.4</td>
<td>(21.5–39.2)</td>
</tr>
<tr>
<td>Yes, limited a little</td>
<td>100</td>
<td>42</td>
<td>(32.6–51.5)</td>
</tr>
<tr>
<td>No, not limited at all</td>
<td>59</td>
<td>27.6</td>
<td>(19–36.2)</td>
</tr>
<tr>
<td>Total</td>
<td>222</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Competing interests:
Professor Lawrenson is both an employee of the University of Waikato and Waikato District Health Board; Dr Sarfati and Dr Millar reports grants from the Health Research Council during the conduct of the study.

Acknowledgements:
The authors would like to acknowledge the generosity of the participants and thank them for sharing their experiences with us so we might help others. We would also like to thank our clinical and community advisors and the Primary Care Organisations and Primary Care Practices for their time and support.

We would like to thank Statistics New Zealand and the Ministry of Health for access to the New Zealand Health Survey data. Access to the NZHS data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The opinions presented are those of the authors and do not necessarily represent an official view of Statistics New Zealand or the Ministry of Health. This project was funded by the New Zealand Health Research Council (HRC 14/173). The project design was initiated by the authors, and the funding body has had no involvement into the conduct or reporting of the study. Ethical approval for the study was granted by the Southern Region Ethics Committee (16/STH/16); the study was also considered by the University of Otago Ngāi Tahu Research Consultation Committee.

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Supplementary Table 5: Accomplished less than would have liked due to emotional problems, such as feeling depressed or anxious in the past four weeks.

<table>
<thead>
<tr>
<th>Q3c</th>
<th>Total cohort</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of the time</td>
<td>7</td>
<td>(0.4 - 3.7)</td>
</tr>
<tr>
<td>Most of the time</td>
<td>22</td>
<td>(5.3 - 18.8)</td>
</tr>
<tr>
<td>Some of the time</td>
<td>56</td>
<td>(14.9 - 31.1)</td>
</tr>
<tr>
<td>A little of the time</td>
<td>38</td>
<td>(6.1 - 15.7)</td>
</tr>
<tr>
<td>None of the time</td>
<td>103</td>
<td>(42.5 - 61.5)</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>100</td>
</tr>
</tbody>
</table>
REFERENCES:


22. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a work productivity and activity impairment instrument.


Audit to investigate junior doctors’ knowledge of how to administer and score the Montreal Cognitive Assessment (MoCA)

Chani Tromop-van Dalen, Katie Thorne, Krystina Common, Garrick Edge, Lisa Woods

ABSTRACT

AIM: To investigate junior doctors’ knowledge of how to conduct the Montreal Cognitive Assessment (MoCA).

METHODS: A two-part questionnaire was administered to junior doctors at teaching sessions across three New Zealand district health boards. Part 1 investigated prior experience and knowledge of the MoCA. Part 2 tested junior doctors’ ability to identify errors in administration and how to score the test. Several weeks later a brief MoCA teaching session was given followed immediately by a repeat questionnaire.

RESULTS: Seventy-one individuals completed the initial audit and 46 did the follow-up audit. The majority of junior doctors carried out the MoCA on a monthly basis. Prior to our teaching session, only 23% of participants had received formal teaching on how to administer and score the MoCA. The majority (89%) of participants thought that the teaching session had improved their ability to conduct the MoCA. Statistically significant changes were seen in participants’ ability to administer the trail-making question and to score the example questions of clock faces, naming animals, serial seven subtractions, verbal fluency testing, abstraction and the awareness about the effect of years of education on the MoCA score.

CONCLUSION: Junior doctors administer and score the MoCA but many have not received formal teaching on how to do so. A short teaching session improved their ability to conduct the MoCA and identify errors in administration and scoring.
in 46 languages and dialects. There is also a blind version and more recently an application (app) for smart devices.

Anecdotally, we noted that completing the MoCA test was often a task given to the most junior members of inpatient medical teams. Knowledge on how to administer and score the MoCA seemed to be variable among junior doctors. This led to concerns that there could be errors in administration and scoring, which could impact on patient clinical outcomes.

No studies assessing accuracy of MoCA administration and scoring were identified through a literature search. We therefore designed an audit with the aim of investigating junior doctors’ knowledge of how to complete the MoCA. We hypothesised that formal teaching would improve the results on a follow-up audit.

Methods

This audit was completed between April and June 2017 at Canterbury, Capital and Coast and Hutt Valley District Health Boards (DHBs) in New Zealand. Participants included first-year doctors (also known as house officers) and final-year medical students (trainee interns) attending protected training time sessions.

Participants completed an anonymous two-part written questionnaire (Appendix 1). Part 1 comprised of participant demographics and information regarding the frequency of MoCA administration, prior knowledge about the test and experience of formal teaching. Part 2 consisted of examples of completed questions from the MoCA designed to test participants’ ability to identify errors in administration and score the test. They were given a copy of a blank MoCA test sheet but not the official administration or marking schedule. Results were assessed using a marking scheme and verified by two separate study investigators (Appendix 2).

Several weeks after the initial questionnaire a 15-minute teaching session was given followed immediately by a repeat of the questionnaire. The teaching covered all questions in the MoCA and the formal administration and scoring guidelines corresponding to each question (available at www.mocatest.org).

Part 1 of the repeat questionnaire was the same as the initial audit with the addition of two questions; whether participants had completed the initial questionnaire and whether they felt teaching was beneficial or not (Appendix 3). Part 2 of the questionnaire remained unchanged.

Statistical analysis was completed using IBM SPSS Statistics version 23 for Windows and Fisher’s exact test to determine statistical significance for discrete variables. The Holm-Bonferroni method was applied to the Part 2 results adjusted for multiple comparisons. Unanswered questions were marked as being incorrect.

The audit was deemed to be outside the scope of review by the Health and Disability Ethics Committee, New Zealand. It was registered at the research offices for all three DHBs.

Results

Part 1

Seventy-one individuals completed the questionnaire for the initial audit and 46 in the follow-up audit (Table 1).

Table 1: Distribution of participants among the three DHBs.

<table>
<thead>
<tr>
<th>DHB</th>
<th>Initial audit</th>
<th>Follow-up audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital and Coast</td>
<td>29</td>
<td>17</td>
</tr>
<tr>
<td>Hutt Valley</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>Canterbury</td>
<td>23</td>
<td>13</td>
</tr>
</tbody>
</table>

The majority of study participants in both the initial and follow-up audits were house officers, 62 (87%) and 43 (93%); with the remainder being trainee interns and other students (Table 2). There was no significant difference between the pre- and post-teaching groups. Twenty-six (57%) of participants involved in the follow-up audit had also completed the initial questionnaire.
The majority of junior doctors carried out the MoCA on a monthly basis (37% in the initial audit and 43% in the follow-up audit), however frequency of performance varied with some having never carried out the test in the last 12 months. Prior to the teaching session provided, 23% of participants had received formal teaching on how to administer and score the MoCA. There was no statistically significant difference in the frequency of MoCA testing, or the number of participants who understood the reason for the MoCA being tested between the initial and re-audit groups.

Table 2: Results of Part 1 of audit questionnaire.

<table>
<thead>
<tr>
<th>Question</th>
<th>Initial audit (71)</th>
<th>Re-audit (46)</th>
<th>p-value from Fisher’s Exact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of junior doctor?</td>
<td>Trainee intern</td>
<td>7 (10%)</td>
<td>3 (7%)</td>
</tr>
<tr>
<td></td>
<td>House officer</td>
<td>62 (87%)</td>
<td>43 (93%)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>First questionnaire completed?</td>
<td>Yes</td>
<td>---</td>
<td>26 (57%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>---</td>
<td>20 (43%)</td>
</tr>
<tr>
<td>How often MoCA completed in last 12 months?</td>
<td>Never</td>
<td>12 (17%)</td>
<td>4 (9%)</td>
</tr>
<tr>
<td></td>
<td>Weekly</td>
<td>18 (25%)</td>
<td>8 (17%)</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
<td>26 (37%)</td>
<td>20 (43%)</td>
</tr>
<tr>
<td></td>
<td>Once a year</td>
<td>15 (21%)</td>
<td>14 (30%)</td>
</tr>
<tr>
<td>Reason for completing MoCA?</td>
<td>Always</td>
<td>45 (63%)</td>
<td>25 (54%)</td>
</tr>
<tr>
<td></td>
<td>Often</td>
<td>22 (31%)</td>
<td>17 (37%)</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>4 (6%)</td>
<td>3 (7%)</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Not answered</td>
<td>1 (2%)</td>
<td></td>
</tr>
<tr>
<td>Aware of formal instructions?</td>
<td>Yes</td>
<td>67 (94%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>4 (6%)</td>
<td>0</td>
</tr>
<tr>
<td>Read formal instructions?</td>
<td>Yes</td>
<td>55 (77%)</td>
<td>43 (93%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>16 (23%)</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>How long to perform MoCA?</td>
<td>&lt;10 min</td>
<td>7 (10%)</td>
<td>4 (9%)</td>
</tr>
<tr>
<td></td>
<td>11–20 min</td>
<td>48 (68%)</td>
<td>35 (76%)</td>
</tr>
<tr>
<td></td>
<td>&gt;20 min</td>
<td>15 (21%)</td>
<td>7 (15%)</td>
</tr>
<tr>
<td></td>
<td>unknown</td>
<td>1 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>Aware of more than one version?</td>
<td>Yes</td>
<td>56 (79%)</td>
<td>31 (67%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>15 (21%)</td>
<td>15 (33%)</td>
</tr>
<tr>
<td>Prior formal training?</td>
<td>Yes</td>
<td>16 (23%)</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>55 (77%)</td>
<td>---</td>
</tr>
<tr>
<td>Did teaching improve ability to perform MoCA?</td>
<td>Yes</td>
<td>---</td>
<td>41 (89%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>---</td>
<td>2 (4%)</td>
</tr>
<tr>
<td></td>
<td>Maybe</td>
<td>---</td>
<td>2 (4%)</td>
</tr>
<tr>
<td></td>
<td>Not answered</td>
<td>0</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>
Although there was no statistically significant difference in the number of participants who were aware of the formal guidelines for how to complete the MoCA, there was a statistically significant difference with more participants having read the guidelines in the follow-up audit (77% and 93% respectively). 41 participants (89%) thought that the teaching session had improved their ability to complete MoCA testing.

### Part 2

Statistically significant improvements were seen in participants’ ability to administer the trail-making question and to score the example questions of clock faces, naming animals, serial seven subtractions, verbal fluency testing, abstraction and the question about the effect of years of education on the MoCA score.

<table>
<thead>
<tr>
<th>MoCA question</th>
<th>Score for each question</th>
<th>Initial audit (71)</th>
<th>Re-audit (46)</th>
<th>% change</th>
<th>p-value from Fisher’s Exact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trail-maker</td>
<td>correct</td>
<td>28 (39%)</td>
<td>32 (70%)</td>
<td>31</td>
<td>(p=0.002)</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>43 (61%)</td>
<td>14 (30%)</td>
<td>-31</td>
<td></td>
</tr>
<tr>
<td>Cube</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>(p=0.064)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1 (1%)</td>
<td>1 (2%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6 (8%)</td>
<td>0</td>
<td>-8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>64 (90%)</td>
<td>44 (96%)</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Clock</td>
<td>0</td>
<td>4 (6%)</td>
<td>2 (4%)</td>
<td>-2</td>
<td>(p&lt;0.0005)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>15 (21%)</td>
<td>5 (11%)</td>
<td>-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>42 (59%)</td>
<td>16 (35%)</td>
<td>-24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10 (14%)</td>
<td>23 (50%)</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Naming animals</td>
<td>0</td>
<td>3 (4%)</td>
<td>1 (2%)</td>
<td>-2</td>
<td>(p&lt;0.0005)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8 (11%)</td>
<td>0</td>
<td>-11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>20 (28%)</td>
<td>1 (2%)</td>
<td>-26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>40 (56%)</td>
<td>44 (96%)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td>correct</td>
<td>65 (92%)</td>
<td>43 (93%)</td>
<td>1</td>
<td>(p&gt;0.9995)</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>6 (8%)</td>
<td>3 (7%)</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>Serial 7 subtraction</td>
<td>0</td>
<td>18 (25%)</td>
<td>3 (7%)</td>
<td>-18</td>
<td>(p=0.028)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>18 (25%)</td>
<td>15 (33%)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>35 (49%)</td>
<td>28 (61%)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Sentence repetitions</td>
<td>correct</td>
<td>33 (46%)</td>
<td>30 (65%)</td>
<td>19</td>
<td>(p=0.058)</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>38 (54%)</td>
<td>16 (35%)</td>
<td>-19</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3: Results of Part 2 of the initial and re-audits demonstrating the number (and %) of participants giving correct answers for each question in the MoCA questionnaire.
Discussion

The MoCA is a standardised test with formal marking guidelines, so the goal should be 100% accuracy in administering and scoring the test. A single error in administration or scoring could change the score for a patient, leading to an incorrect diagnosis. Nasreddine et al identified a MoCA score of <26/30 to indicate MCI with sensitivity of 90%. Other studies have, however, suggested lower scoring cutoffs may have superior predictive rates, particularly in populations where the baseline probability of cognitive impairment is higher.

Although we could not identify any studies that specifically looked at the accuracy of administering and scoring the MoCA, we did identify studies that demonstrated errors in administration and scoring of other neuropsychological tests. Schafer et al found that 80.6% of raters of the ADAS-cog test made errors in administration and scoring leading to concerns that errors may affect clinical trial outcomes. Ramos et al identified examiner errors during the administration and scoring of the Woodcock Johnson III test of Cognitive Abilities carried out by graduate students. The number of errors reduced after three test administrations, suggesting that the students may benefit from more focus and practice on correct administration and scoring.

<table>
<thead>
<tr>
<th>Words beginning with F</th>
<th>0</th>
<th>9 (13%)</th>
<th>3 (7%)</th>
<th>-6</th>
<th>p=0.004</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7 (10%)</td>
<td>0</td>
<td>-10</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 (11%)</td>
<td>2 (4%)</td>
<td>-7</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4 (6%)</td>
<td>2 (4%)</td>
<td>-2</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>21 (30%)</td>
<td>7 (15%)</td>
<td>-15</td>
<td>-5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9 (13%)</td>
<td>6 (13%)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5 (7%)</td>
<td>10 (22%)</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4 (6%)</td>
<td>7 (15%)</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4 (6%)</td>
<td>9 (20%)</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abstraction</td>
<td>0</td>
<td>23 (32%)</td>
<td>6 (13%)</td>
<td>-19</td>
<td>p=0.001</td>
</tr>
<tr>
<td>1</td>
<td>7 (10%)</td>
<td>0</td>
<td>-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>41 (58%)</td>
<td>40 (87%)</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed recall 1</td>
<td>correct</td>
<td>67 (94%)</td>
<td>43 (93%)</td>
<td>-1</td>
<td>p&gt;0.9995</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>4 (6%)</td>
<td>3 (7%)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Delayed recall 2</td>
<td>correct</td>
<td>64 (90%)</td>
<td>43 (93%)</td>
<td>3</td>
<td>p=0.738</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>7 (10%)</td>
<td>3 (7%)</td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>Education &lt;= 11 yrs</td>
<td>correct</td>
<td>47 (66%)</td>
<td>43 (93%)</td>
<td>27</td>
<td>p=0.001</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td>24 (34%)</td>
<td>3 (7%)</td>
<td>-27</td>
<td></td>
</tr>
<tr>
<td>Reason for change to score for education</td>
<td>correct</td>
<td>39 (55%)</td>
<td>31 (67%)</td>
<td>12</td>
<td>p=0.259</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>16 (23%)</td>
<td>10 (22%)</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A*</td>
<td>16 (23%)</td>
<td>5 (11%)</td>
<td>-12</td>
<td></td>
</tr>
</tbody>
</table>

*N/A: if participants did not know that there was a change to the MoCA score with <11 years of education then they did not answer the final question.
Only 23% of participants in this audit had been given any formal teaching on how to conduct the test prior to our teaching session. Standardised training and feedback given to inexperienced administrators has been shown to result in a decline in errors of instruction, administration and recording of neuropsychological tests. Following the brief teaching session we found improvements in participants’ ability to administer the trail-making question. There were improvements in their ability to identify errors and to score the example questions of clock faces, naming animals, serial seven subtractions, verbal fluency testing, abstraction and the question about the effect of years of education on the MoCA score. There was also subjective improvement with 89% of participants responding that the teaching session had improved their ability to carry out the MoCA.

There was no statistically significant improvement in the questions for marking the cube, attention, sentence repetition or delayed recall. Knowledge of these questions was good in the initial audit (correct answers mostly above 90%), leaving little room for improvement. Conversely, although there was a statistically significant improvement in marking the clock face examples in the follow-up audit, only 50% of participants scored all three examples correctly. Price et al demonstrated scoring variability for the clock-drawing component between clinicians of one to three points when using the MoCA guidelines, highlighting concerns that error could potentially alter the overall score by 10%. Improvement was found with repeated training and use of a more detailed scoring system (Consentino criteria), however this also took raters longer to score. They recommended training and practice to improve the reliability of scoring.

Our audit has several limitations; the number of participants was small and there were fewer participants in the follow-up audit sessions. Although protected training time is considered compulsory, other work commitments and leave can mean that not all junior doctors attend every session. Our initial audit at Capital and Coast DHB was carried out following a teaching session given by one of the house officer supervising consultants, which may have resulted in higher attendance to this session (29 participants compared to 17 in the follow-up audit session). Carrying out the questionnaires at more than one teaching session at each DHB would likely have improved our response rates.

Only 57% of participants completed both the initial and follow-up audit. There was no statistically significant difference between the demographic statistics, suggesting that both groups were similar and therefore reasonably comparable. We felt it was important to keep the questionnaire anonymous to encourage honest answers and were therefore unable to identify individuals who participated in both audits. Further research could be improved by using the same group of participants for initial and follow-up audits.

Our audit was carried out between April and June 2017, when junior doctors had been working for 4 to 7 months (house officers in New Zealand begin work in November). Our results showed that some junior doctors had never carried out the MoCA (17% in the initial audit and 9% in the follow-up) and many had only performed the test once in the last 12 months (21% in the initial audit and 30% in the follow-up). Our results may have differed had we carried out the audit later in the year when junior doctors had received more exposure to the MoCA in their clinical practice.

The majority of participants took over 10 minutes to complete the test (89% in the initial audit and 91% in the follow-up), which may be a reflection of limited experience. The MoCA is also carried out by occupational therapists who have more experience than junior doctors, however, tend to use it as part of more complete cognitive and functional assessment rather than as a screening test. Other brief cognitive tests have been shown to compare well with the MoCA and MMSE and could be considered as simpler alternatives, which may be easier for junior doctors with limited experience to administer. A short-form MoCA comprising three statistically selected components; orientation, word recall and serial subtraction, has been shown to be effective at classifying MCI and Alzheimer’s disease when compared to the MoCA and MMSE. The Mini-Cog compares well with the MMSE for the detection of dementia but...
is much briefer, being made up of only the three-item recall and clock drawing components. This test may not be as suitable due to the aforementioned problems with marking of the clock drawing component.

As well as house officers there were a small number of trainee interns and other students involved in the audit. Students probably have less clinical experience and this may have led to lower scores of the questionnaire. The proportion of trainee interns and students involved in both audits was similar so unlikely to have made an impact on the improvements noted in the follow-up audit. Trainee interns are both full-time students and apprentice house officers, taking responsibility for patient care decisions under supervision. Our real-world experience is that students do carry out the MoCA and so including this group in our study was deemed important.

Conclusions
Our audit shows that the MoCA is a test performed by junior doctors on a variable basis. Prior to our teaching session the majority of junior doctors had not received any formal teaching on how to complete the MoCA test. A short teaching session improves junior doctors' ability to administer and score the MoCA.

We recommend that the formal administration and scoring instructions are used each time the MoCA is performed. The newly released app for smart devices may make this easier to achieve and more appealing to today's junior doctors. Annual teaching on how to administer and score the MoCA will be provided to the house officers in the hospitals involved in this study. We also recommend that the same training is incorporated into the medical school curriculum as trainee interns and medical students are also involved in administering the test.

Deficits in knowledge around the MoCA may lead to inaccurate administration and scoring and incorrect MoCA scores may have consequences in terms of clinical outcomes for patients. This study does not actually assess this and further research could be of value.
Appendix

Montreal Cognitive Assessment Audit

We are carrying out an audit about the knowledge of medical staff around the Montreal Cognitive Assessment (MoCA). We understand that the education around how to carry out, and mark the MoCA test can be variable.

Please answer this questionnaire honestly. It will be kept anonymous and any information will be used to improve understanding around this important tool.

Part One: General Questions
Please circle your answer

1. Please tell us what level you are at:
   - Trainee Intern
   - House Surgeon
   - Other________

2. How often have you completed a MoCA in the last 12 months?
   - Never
   - Weekly
   - Monthly
   - One a year

3. Do you know the reason for completing the MoCA on your patients?
   - Always
   - Often
   - Sometimes
   - Never

4. Are you aware that there are formal Administration and Scoring instructions on how to carry out and mark the MoCA?
   - Yes
   - No

5. Have you ever read the formal Administration and Scoring instructions?
   - Yes
   - No

6. How long would you estimate it takes you to carry out the MoCA?
   - < 10 min
   - 11-20 min
   - > 20 min

7. Have you ever received any formal training in how to complete a MOCA?
   - Yes
   - No

8. Are you aware there is more than one version of the MOCA?
   - Yes
   - No
Part Two: Questions Specific to the MoCA test and marking

Please use the attached copy of the MoCA to remind yourself of the questions

**Visualspatial/Executive**
- In your own words, describe how you would explain to a patient how to complete the trail making question?

```
```

```
```

* Please mark these examples of a copied cube:

/1 /1 /1

* Please mark these clock face examples:

/3 /3 /3

**Naming**
Which of these answers would you mark as correct for the names of the animals? Please circle your correct answers, you may circle more than one answer (MoCA version1)

<table>
<thead>
<tr>
<th>Image 1</th>
<th>Image 2</th>
<th>Image 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion</td>
<td>Rhino</td>
<td>Camel</td>
</tr>
<tr>
<td>Cat</td>
<td>Hippopotamus</td>
<td>Horse</td>
</tr>
<tr>
<td>Tiger</td>
<td>Rhinoceros</td>
<td>Dromedary</td>
</tr>
</tbody>
</table>
**Attention**

- When asked to tap their hand on the letter "A", a patient also taps their hand twice on the letter "J", they do not tap their hand once for the letter "A".

Do they score a point for this question?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

- For serial 7 subtraction, how many points would you give the following examples?

<table>
<thead>
<tr>
<th>100</th>
<th>92</th>
<th>85</th>
<th>78</th>
<th>71</th>
<th>64</th>
<th>points allocated: ___</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>94</td>
<td>86</td>
<td>79</td>
<td>72</td>
<td>67</td>
<td>points allocated: ___</td>
</tr>
</tbody>
</table>

**Language**

- Which of these repeated sentences would be given a point? Tick the option(s)

  - I only know that John is the one I’ll help today
  - John is the one who helped today
  - I only know that John is the one to help today

  → The cats always hid under the couch when the dog is in the room
  → The cat always hides under the couch when the dogs were in the room
  → The cat hid under the couch when the dogs were in the room

- Please circle the words that do not score a point when the patients is asked to give “words beginning with F”

<table>
<thead>
<tr>
<th>France</th>
<th>Foxes</th>
<th>Frustration</th>
<th>Frangipane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fox</td>
<td>Four</td>
<td>Face</td>
<td>Froth</td>
</tr>
<tr>
<td>Forrest</td>
<td>Festive</td>
<td>Frustrating</td>
<td>Fossil</td>
</tr>
<tr>
<td>Fantail</td>
<td>Frances</td>
<td>Fantastic</td>
<td>Fun</td>
</tr>
<tr>
<td>Fax</td>
<td>Fourteen</td>
<td>Fred</td>
<td>Finland</td>
</tr>
</tbody>
</table>
Abstraction

• Which of the following are correct answer(s) for the “similarity between question” (please tick – you may select more than one option)

Train – bicycle

They both have wheels
I am interested in both trains and bicycles
They are modes of transport

Ruler – watch

They are tools for measurement
They have numbers
I own both of these items

Delayed Recall

• If a patient gives all 5 words correct but in a different order, does this affect their score?

Yes No

• If a patient recalls the words with a clue, do they score a point?

Yes No

• Your patient finished high school at year 11. Does this affect the score of the MoCA test? If so, how?

Thank you for completing our questionnaire
Appendix 2

MoCA Audit: Questionnaire Marking Schedule
Use the official MoCA Administration and scoring guidelines alongside this marking schedule
For questions that are Yes/No answers, the correct answer is in bold type

Q1: Visuospatial/Executive (Trailmaker)
In your own words, describe how you would explain to a patient how to complete the trail making question?

ANSWER: The phrase must include a description or imply a trail between alternating letters and numbers and ascending order at a minimum to be considered correct (not necessarily in these exact words).
this question should be validated between two investigators as it is somewhat open to interpretation as to whether it fits this description

Q2: Cube drawing
Please mark these examples of a copied cube:

/1  /1  /1

ANSWER:
0/1  1/1  0/1

Mark as 0 or 1,2,3 out of 3 (correct marks allocated to the cube)

Q3: Clockface
Please mark these clock face examples:

/3  /3  /3

ANSWER:
2/3  1/3  2/3

Mark as 0 or 1,2,3 out of 3 (correct marks allocated to the clockface)

Q4: Naming animals
Which of these answers would you mark as correct for the names of the animals? Please circle your correct answers; you may circle more than one answer (MoCA version1)

<table>
<thead>
<tr>
<th>Image 1</th>
<th>Image 2</th>
<th>Image 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion</td>
<td>Rhino</td>
<td>Camel</td>
</tr>
<tr>
<td>Cat</td>
<td>Hippopotamus</td>
<td>Horse</td>
</tr>
<tr>
<td>Tiger</td>
<td>Rhinoceros</td>
<td>Dromedary</td>
</tr>
</tbody>
</table>
ANSWER: Both Rhino and Rhinoceros and Camel and Dromedary should be selected as both are correct. If only one of these two are selected then mark as incorrect.

• Mark as 0 or 1,2,3 out of 3 (ie, if all highlighted words are circled then score 3, if rhino but not rhinoceros is circled but all others are circled then score two)

Memory (no question here)

Q5: Attention
• When asked to tap their hand on the letter “A”, a patient also taps their hand twice on the letter “J”, they do not tap their hand once for the letter “A”

Do they score a point for this question?

Yes  No

Q6: Serial 7 subtraction
• For serial 7 subtraction, how many points would you give the following examples?

100  92  85  78  71  64  points allocated:

ANSWER: 3 points (4 correct subtractions)

100  94  86  79  72  67  points allocated:

ANSWER: 2 points (2 correct subtractions)

• score 0 or 1, 2 out of 2 (ie, if both have the correct points allocated then score 2, if only one has correct points allocated then score 1)

Q7: Sentence Repetition
• Which of these repeated sentences would be given a point? Tick the option(s)

• I only know that John is the one I’ll help today

• John is the one who helped today

• I only know that John is the one to help today – correct ANSWER only

→ The cats always hid under the couch when the dog is in the room

→ The cat always hides under the couch when the dogs were in the room

→ The cat hid under the couch when the dogs were in the room
ANSWER: none of the above options are exactly correct. A correct answer is if none of the options are circled.

Score as correct if the both answers are correct. If only one is correct, score as incorrect.

Q8: Words beginning with F
Please circle the words that do not score a point when the patients is asked to give “words beginning with F”

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>Foxes*</th>
<th>Frust**</th>
<th>Frangipane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*</td>
<td>Four (number)</td>
<td>Face</td>
<td>Froth</td>
</tr>
<tr>
<td></td>
<td>Forrest</td>
<td>Festive</td>
<td>Frustrating*</td>
<td>Fossil</td>
</tr>
<tr>
<td></td>
<td>Fantail</td>
<td>Frances (PN)</td>
<td>Fantastic</td>
<td>Fun</td>
</tr>
<tr>
<td></td>
<td>Fax</td>
<td>Fourteen (number)</td>
<td>Fred (PN)</td>
<td>Finland (PN)</td>
</tr>
</tbody>
</table>

ANSWER: All of the following words must be circled as being words that do not score in order to mark this question correct:

- France, Frances, Fred, Finland (proper nouns)
- Four, Fourteen (numbers)

Words that begin with the same sound but different suffix
- Of Fox and Foxes, one must be marked as incorrect
- Of Frustration and Frustrating, one must be marked as incorrect

• Mark out of 8 – there are 8 answers that cannot score points (taking into account that only one of Fox or foxes and frustration and frustrating) can be scored.

Q9: Abstraction
Which of the following are correct answer(s) for the “similarity between question” (please tick – you may select more than one option)

Train – bicycle
- They both have wheels
- I am interested in both trains and bicycles
- They are modes of transport

Ruler – watch
- They are tools for measurement
- They have numbers
- I own both of these items

ANSWER: only the answers are in bold are correct

• mark 0,1,2, out of 2 (ie, if both answers are correct then score 2)
Q10: Delayed Recall 1  
• If a patient gives all 5 words correct but in a different order, does this affect their score?  

Yes  No

Q11: Delayed Recall 2  
• If a patient recalls the words with a clue, do they score a point?  

Yes  No

Q12: Education  
• Your patient finished high school at year 11. Does this affect the score of the MoCA test? If so, how?  

ANSWER: Yes

Q13: Reason for change to score for education  

ANSWER: A point is added for <12 years of formal education  

• correct or incorrect. If the answer to Q12 was “No", which is incorrect, then Q13 should be left blank as the participant cannot know the reason that the score would change
Appendix 3
Montreal Cognitive Assessment Re-Audit
We are carrying out an audit about the knowledge of medical staff around the Montreal Cognitive Assessment (MoCA). We understand that the education around how to carry out, and mark the MoCA test can be variable.
Please answer this questionnaire honestly. It will be kept anonymous and any information will be used to improve understanding around this important tool.

Part One: General Questions
Please circle your answer

1. Please tell us what level you are at:
   - Trainee
   - Intern
   - House Surgeon
   - Other__________

2. Did you complete the first audit questionnaire?
   - Yes
   - No

3. How often have you completed a MoCA in the last 12 months?
   - Never
   - Weekly
   - Monthly
   - One a year

4. Do you know the reason for completing the MoCA on your patients?
   - Always
   - Often
   - Sometimes
   - Never

5. Were you aware before today, that there are formal Administration and Scoring instructions on how to carry out and mark the MoCA?
   - Yes
   - No

6. Have you ever read the formal Administration and Scoring instructions?
   - Yes
   - No

7. How long would you estimate it takes you to carry out the MoCA?
   - <10 min
   - 11–20 min
   - >20min

8. Are you aware there is more than one version of the MOCA?
   - Yes
   - No

9. Do you feel the teaching today has improved your ability to perform and mark the MoCA?
   - Yes
   - No
Competing interests:
Dr Thorne reports affiliation with FLights to Auckland outside the submitted work.

Acknowledgements:
The authors wish to acknowledge Dr Joanne Williams, Hutt Valley District Health Board for her assistance in supervising the project.

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New Zealand’s health workforce planning should embrace complexity and uncertainty

Gareth H Rees, Peter Crampton, Robin Gauld, Stephen MacDonell

ABSTRACT

Concerns over New Zealand’s health workforce sufficiency, distribution and sustainability continue. Proposed solutions tend to focus on supplying medical professionals to meet predicted numbers or to resolve distributional problems. This is despite quantitative forecasts being known to have poor reliability. A recent study on New Zealand’s health workforce planning, which focused less on medical workforce numbers and more on the system’s organisation and constituent interrelations, highlights the use of complementary methods to define the problems and design a range of policy responses. Core to deciding on suitable interventions is the use of analysis tools, such as judgement-based approaches, which are commensurate with the actual levels of uncertainty being experienced, and which complement quantitative predictive forecasting.

Recently, concerns have been raised over the sufficiency, distribution and sustainability of New Zealand’s medical workforce, with competing views being offered on the responses that should be taken.1,2 The arguments presented for and against proposed solutions tend to be medically orientated and supported by evidence and the analysis of trends that are framed by the present health system’s organisation. This has the outcome of further embedding the present’s infrastructures and service delivery methods, which limit alternative consideration of how future services could be provided and peopled.3 In the main, suggested solutions seek to address New Zealand’s medical workforce imbalances by reducing reliance on international medical graduates (IMGs), to increase the numbers and placements of locally trained doctors through medical school roll increases, and by continuing or improving a range of incentives and informational programmes as a means to promote and attract trainees for hard-to-staff vocational specialities.4–6 Yet despite numerous similar policy interventions over past decades, the issues of persistent shortages and misdistributions continue.2 This is in part due to a traditional medically focused and a by-profession approach to health workforce policy and planning, as well as a reliance on quantitative forecasts made under conditions of uncertainty.7 In New Zealand, these forecasts, made available by academics and professional organisations,8,9 with regularly collected workforce survey data are also used as an aid to project the future numbers of particular professions.10,11 However, this approach tends to neglect the fact that health workforce planning involves a range of constituents, some of whom exhibit various states of rivalry and tension. These conflicts, which can impede health workforce plans,12 are found across the health sector between constituents such as politicians, managers and clinicians and within institutions, and may be expressed as contradictions in authority and accountability between management and professionals, and as tensions between continuing busi-
ness-as-usual and introducing innovation.\textsuperscript{13} As such, health workforce planning struggles to achieve ‘right or optimal’ solutions, while the needs of its multiple constituencies may or may not be met by the policy or policies that are chosen.\textsuperscript{14}

Hence, in this article, we offer some insights provided by a recent study of health workforce planning in New Zealand.\textsuperscript{15} We begin by discussing the limitations of traditional health workforce planning. We then move on to introduce types of approaches considered to be more appropriate for studying the future under conditions of increasing uncertainty. We conclude with an overview and suggest a rethinking of the practices and policy frames used to plan for future health workforces.

The planning of health workforces

The aim of health workforce planning is to determine the balance between workforce demand and supply that ensures the availability of sufficient appropriately qualified personnel.\textsuperscript{16} Due to considerable differences between health systems’ designs and operations, a range of models and methods are applied to achieve this task.\textsuperscript{16,17} In the main, these models quantitatively estimate expected service demand. These estimates are then used to approximate future workforce supply and adequate numbers of professionals or specialist roles, to determine workforce numbers sufficient to meet future health needs or to realise benchmarked population-provider ratios.\textsuperscript{18} There is a range of limitations to these health workforce forecasting approaches.\textsuperscript{19}

Predictive approaches to forecasting tend to be best suited for situations that are able to be expansively mapped, measured and modelled.\textsuperscript{20} As such, they tend to perform well enough in situations where there are few surprises, for example short-run economic or financial decisions.\textsuperscript{20, 21} Over longer time frames their accuracy diminishes.\textsuperscript{18} Predicting outcomes in social systems is more difficult due to these systems’ variable relationships, discontinuities and interactions along with the effects of time.\textsuperscript{21} In social system situations, predictive forecasts are not failing due to poor execution, but rather because they are trying to do the impossible, dealing as they are with the system’s complexity and contradictory interdependencies, and through minimising the effects of human agency by assuming that behavioural variables remain constant.\textsuperscript{20} In response, there has been a range of efforts to reduce workforce forecast inaccuracy by improving the models, by taking more systematic approaches\textsuperscript{22} and by rethinking.\textsuperscript{2} The latter seeks to look past the numbers and use clinically-led visions of future services to build an understanding of how to achieve the desired outcome of meeting future demand with an appropriate and financially viable workforce.\textsuperscript{7,22}

Rethinking also requires that the problem to be addressed is understood.\textsuperscript{23} Some problems are relatively easy to define and describe, and therefore straightforward to solve. Others suffer from lack of information that would enable a solution to be easily found, while yet others, such as wicked problems, express irreducible complexity.\textsuperscript{21} Popularised by Rittel and Weber,\textsuperscript{24} a wicked problem cannot be described as objectively correct or false and nor does it have a definitive solution. It is also exacerbated by poor forecasting conceptualisation, insufficient data or intelligence and a plurality of constituent objectives, resulting in contradictions where a solution for one constituent generates a problem for another.\textsuperscript{24} Health workforce planning, like a number of other health management issues, exhibits the wicked problem’s features of having no ‘right or optimal’ solution, poor forecasting outcomes and constituent diversity.\textsuperscript{25,26}

This is problematic as, comparable to other areas of public policy, health workforce planning is also dominated by a culture of predictive data and evidence-based decision-making.\textsuperscript{27} When this culture is coupled with an institutional intolerance of uncertainty, it leads to the overuse and over-reliance on forecasts leading to projections being treated as facts or what Veenman\textsuperscript{28} termed certainification, or a strengthening of the illusion of prediction reliability.\textsuperscript{29} Faced with poor results, policymakers are likely to refine and improve on these techniques, further embedding error and forecast inaccuracies.\textsuperscript{30} In addition, policymakers tend to be under political pressure to produce more accurate predictions, to use better models and, in particular, to avoid mistakes.\textsuperscript{31} This in turn reinforces policymakers’ propensity to dismiss assistance from non-numeric forecasting.\textsuperscript{27}
Forecasting under conditions of uncertainty

The range of forecasting’s non-statistical techniques are termed judgemental and can be characterised by those that predict one’s own future behaviour or the future behaviours of others determined by experts. Judgemental methods may also integrate aspects of statistical methods to quantify proposed relationships, producing semi-quantitative forecasts by providing probabilities or weights to opinions.

Judgemental forecasting shares a number of methods with another discipline of futures studies termed ‘foresight’ (see Figure 1). While forecasts produce logical results as predictions or projections based on the past, foresight copes better with conditions of uncertainty and expresses the future as a range of possibilities (see Figure 2). Thus, for longer-term views of the future, techniques shared by forecasting and foresight such as scenarios, Delphi and intentions, elucidated through stakeholder or actor surveys or interviews, are able to provide judgmental narrative and semi-quantitative data that can be used as part of describing the problem or to design more representative short-run models or simulations.

A potential benefit of using judgement-based techniques in the context of health workforce planning is that foresight’s strength rests with its ability to account for the “difficult-to-quantify, dynamic properties of any given set of complex circumstances, particularly where social systems and markets are concerned”. Scenarios, particularly those developed with stakeholder input, have been found to be useful for addressing wicked problems, enabling the causes of future outcomes to be understood and to allow the problem’s dimensions to be examined more fully. The use of scenarios has also been shown to alter people’s expectations of future events, which is particularly useful should the constituents be rivals, as scenarios allow constituents to project themselves into future situations or to ask them to explain the depicted outcomes, particularly should the scenario storylines be inconsistent with a constituent’s preconceived biases.

Figure 1: Intersection between forecasting and foresight methods.

Figure 2: Forecasting, foresight and futures studies.
Where are we in New Zealand?

New Zealand produces scenario-based data as part of its workforce planning processes, through Health Workforce New Zealand's Work Service Reviews (WSRs). Described as sets of possible future clinical scenarios for service aggregates and generated by clinical subject matter experts and opinion leaders, the WSRs are planning analyses that, along with cross-sectional analyses of by-profession or role-based workforce forecasts, aim to provide robust planning intelligence.

In the health workforce study referred to earlier in this article, WSR data and clinical-derived service preferences were aggregated by health sub-sector and re-analysed. This re-analysis revealed that many of the solutions and policies being offered by present health workforce interventions are aimed at fixing worker stocks and flows, or maintaining numbers. However, these interventions are at odds with the approach that Meadows considers to be effective for leveraging system change, which involves a focus on system goals and its organisation, rather than managing numbers. The numbers-based policy interventions that we found here in New Zealand tended to be representative of and promoted the present's health workforce organisation and were mostly reactive to immediate presenting issues. More encouraging, though, is the finding that New Zealand's workforce constituents seem to be in general agreement that a system's funding structures and models of care are most important in terms of determining future workforces. Exploring these fundamental levels of a system's organisation, rules and goals is, as Meadows points out, more effective in terms of leveraging system change.

By taking the aggregated WSR themes, a number of scenario storylines were able to be constructed, providing a normative or common vision of how the future ought to be, along with a few relevant alternatives. Opinions of these scenarios' desirability and likelihood were collected using two expert sector panels, which provided detailed insight using the managed polling technique of policy Delphi. Here the aim was to gather the widest range of opinions, rather than seeking agreement or consensus, as a means to identify the areas of enablement and those policy areas that may lead to conflict. These panels revealed that the organisation of the health sector and the mechanisms through which services are delivered present as much of a barrier for workforce sufficiency, as does the present reliance on parameter-level interventions to produce, retain and maintain the workforce. This observation starts to point to why many of New Zealand's health workforce problems persist, and also provides some insight into why the range of corrective approaches and pilot projects have not diffused further across the health system. For instance, the panels indicated that the current models of care, funding parameters and sector organisation patterns in primary care disincentivise the introduction of new roles, care options and, in particular, the involvement of patients to be part of the design and introduction of new service configurations. Importantly, the panels saw that services should be collectively led with a strong clinical presence, though pointed out that current service delivery models may also be a contributor to the shortages of some roles. A health service's business model as well as its model of care are two factors that are identified as impediments to the advancement of role innovation and skill-mix adoption or for a diffusion of workforce roles that would be useful for future integrated care formats. Thus a consideration of future workforces, their roles, numbers and avenues of training is required when considering service configurations, models of care and funding decisions at national, regional and local levels. Further, business models that permit the use of specialised community-based roles and enable access to further training and qualifications will act to incentivise and motivate current staff to upskill and take on these more specialised care and treatment tasks. These business models have implications for planning and ensuring a fit for purpose future workforce, particularly when New Zealand's vision is of a more integrated and patient-centred system of health delivery.
Conclusion

This article has underscored the importance of better understanding the problem of planning for future health workforces and the selection of analysis methods to enable this task. We introduce the notion that a wider range of forecasting methods to support health workforce planning should be considered. As the literature points out, a principal practice of public policy organisations is to argue policy and propose plans in terms of numbers, which acts to reinforce a prediction orientation. However, taking into account the fact that the health workforce is a social system, that we are looking at timeframes longer than the immediate future, and that the problem is wicked in nature, this orientation inevitably produces estimates that are only valid for a short time.

It would be beneficial if these quantitative models were to be complemented by methods that are more attuned to the social dynamics of healthcare and the wickedness of the health planning problem. Our suggestion is that health workforce forecasting needs not only to focus on predicting the numbers of people that will be working in our future health system, but on employing approaches that act as uncertainty reduction mechanisms by describing possible future situations. With these approaches, policy makers are able to consider actions and eventualities as propositions to model future workforce situations, thereby discerning the numbers, roles and skills required. Scenarios are a means to this end and are already being used as part of New Zealand's health workforce planning system, although there are few observable effects thus far from their development and use. In part to address the core issue cited here, we propose that cultures of certainification in health workforce planning be acknowledged, that we become open to improving problem definitions and that we begin to consider policy identification mechanisms that are more in line with the levels of uncertainty being encountered.

Competing interests:
Dr Rees reports grants from Health Workforce New Zealand, University of Otago and Freemasons New Zealand during the conduct of the study. Dr MacDonell reports grants from Ministry of Health outside the submitted work.

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Black Flu 1918; The story of New Zealand’s worst public health disaster

Frank Frizelle

This is the account of the 1918 influenza pandemic. The author has written and published extensively on the topic, including having published a number of articles in the NZMJ. The story is tragic, with over 8,000 people dying (at least 6,400 Pakeha and 2,500 Māori). This is about half the number that died in the First World War, with most of the deaths in short 3–4-month period at the end of 1918.

The author is an expert on this topic; he had previously interviewed about 150 people who survived the epidemic. The history book account comes alive with tales of the individual experience of the period. This is enhanced by the photos, figures and tables. The illustrations are both black and white and colour.

There are seven chapters, and at the end of the book are a list of references and suggested further reading and websites, as well as an index for cross referencing content.

The book covers not only the factual history of what happened, such as how most of those who died actually died of secondary pneumonia, but also reviews the disaster management and comments on research and lessons learned.

Any person interested in the history of New Zealand from a medical/health point of view would find this book an interesting read, and may want to hang onto it as a reference with its excellent photos and figures.

Competing interests:
Nil.
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The Older Traveller: A guide for the health professional

Frank Frizelle

When I found this book was returned from the initial reviewer without a review from the person who had “volunteered” to review it, I thought that I might well learn something to help myself as a frequent traveller, being not as young as I once was. I was disappointed to find that I actually made the criteria for the older traveller, and even more disappointed to read that according to the Erik Erikson eight stages of life span, I am on the final stage!

The book points out that more and more people are traveling, especially older people. People travel for all sorts of reasons, and a lot of older people are traveling for pleasure and to see family, as they have the time, the health and the money in retirement.

The book itself is written for doctors advising people about travel preparations, not for people who are traveling themselves. As such it may well be useful for GPs and doctors who have such an interest in travel medicine. It essentially covers a range of
issues that might affect travellers such as acute respiratory and diarrheal illness, impact of traveling with early dementia, as well as the issues of stress and anxiety while traveling. It briefly also covers issues with musculoskeletal arches and pains and DVT prophylaxis. A large part focuses on the risk versus benefits in the older patients of immunisation for travel.

It is easy to read with its plain language and expands into the issues of aging physiology, which is interesting enough.

It is a multiauthor book (15 authors) with the authors being predominately from South Africa, but some from Australia, US, UK and Europe. As with most multi-authors books there is some repetition and overlap between chapters, however at least the overlap is consistent.

It is a book that one might read once and not keep for reference, and as such it is an easy and informative read—almost enjoyable.

Competing interests:
Nil.

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Is New Zealand immigration policy a barrier to TB elimination?

Emmanuel Badu, Charles Mpofu, Panteá Farvid

In many high-income countries including Aotearoa/New Zealand, the search for a 'magic bullet' to eliminate TB has intensified following the introduction of the WHO's post-2015 TB strategy, "Towards TB elimination". The new strategy requires low-incidence countries, defined as countries reporting less than 100 cases per 1,000,000 population to achieve pre-elimination (defined as less than 10 TB cases, all forms, per 1,000,000 population) by 2035 and subsequent elimination (defined as less than 1 TB case, all forms, per 1,000,000 population) by 2050. While these targets are bold, New Zealand remains far from achieving them. For instance, it has been estimated that an annual rate of decline of about 11% is required to achieve elimination by 2050, which is over three times the rate of decline (3.8%) observed between 2000 to 2012.

TB rates have declined to such low levels, 6.7 per 100,000 in New Zealand, that most people are less likely to experience a case of TB in their lifetime. Whereas this is a positive public health outcome, it has contributed to the general societal misconception that TB does not exist and has died out. History has shown that global TB control efforts only intensify when there are periods of a sudden rise in TB incidence, and dwindle when the rates decline. This phenomenon, where TB programmes and funding decline with the downward trend of incidence to create a favourable condition for resurgence, has famously been referred to as "the U-shaped curve of concern".

Even today, with improvements in diagnostics and several decades after the introduction of the BCG vaccine and anti-TB drugs (perceived as the panacea to the disease), TB continues to affect the lives of many people in the world. In 2015 alone, an estimated 10.4 million people were affected and 1.8 million died from TB, and yet about four million more people were living with undiagnosed or unnotified TB globally.

Like other low-incidence countries, migration remains the enduring threat to the TB elimination agenda. Foreign-born persons living in these countries contribute the highest proportion of all notified TB cases. For instance, the foreign-born population in New Zealand constitute about a quarter (25.2%; 1,001,787 people) of the population, yet they report the highest proportion (77.6%) of TB cases. With migration projected to rise, more deliberate policies to improve migrant wellbeing, and early diagnosis and treatment are warranted.

Thus, the aim of this letter is to add to the knowledge about TB service delivery challenges for the most vulnerable in our society and to increase pressure on policy makers by sharing our findings around a key structural barrier to TB control efforts from a small qualitative study that sought to understand the factors that drive the TB epidemiology in New Zealand. We purposively sampled and interviewed nine key informants (four community leaders, four health professionals and one charitable organisation staff) in Auckland. The methods for this study have been described elsewhere. Our findings suggest New Zealand immigration policies may be preventing some migrants from accessing and completing TB treatment. Health professionals interviewed in this study were concerned about the lack of clarity and consistency in the implementation of the immigration policy rules as to who gets to stay or leave because of TB. They reported that many of their clients with multi-drug resistance TB have had their applications to stay in New Zealand declined. This lack of
clarity in how immigration works inhibited health professionals’ abilities to offer reliable advice to their clients, which makes some people reluctant to be diagnosed or treated for TB. In many instances, according to the participants, migrants on short-term visas were anxious about their immigration status and less worried about their own health. Participants explained that people who are unfortunate to be diagnosed with TB while they are in New Zealand are often very fearful about what will happen to their immigration status, particularly if they are a visitor or on a short-term permit. Such individuals are often very worried about what will happen if they have to declare to immigration that they have had treatment for TB.

Within the communities, the results suggest a lack of information about healthcare eligibility and free TB services for new migrants. Also, community leaders reported some mistrust for health professionals due to what they perceived as the unknown link or interaction between healthcare providers and immigration New Zealand, which sometimes inhibit some migrants from seeking help.

The study demonstrated that while individual knowledge about symptoms of TB could positively influence health decisions, concerns about one’s immigration status has the potential to prevent actual help-seeking behaviour. We note that the prevailing silence and lack of advocacy may reflect the general societal and political disposition towards TB. Unfortunately, this curable disease may remain a silent killer, as the many people affected are the vulnerable and voiceless who have no influence over the agenda setting process.

We recommend: a clear guide for consistent implementation of the immigration New Zealand policy, which should be widely disseminated within migrant communities to diffuse the fear of getting diagnosed with TB; a national TB elimination strategy with specified goals, targets and ring-fenced funding to accelerate the public health action on eliminating TB; and more engagements with the media to influence the national discourse on TB from one of stigma or blame on immigration to that which interrogates how system factors such as the immigration policy may influence TB among migrants.

Competing interests:
Nil.

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The Smokefree 2025 goal: an opportunity for the new government

Martin Witt, Richard Edwards, Janet Hoek, George Thomson

Mike Daube’s editorial1 challenges us all to see the Smokefree 2025 goal realised. Reducing smoking prevalence to fall below five percent among all population groups is undoubtedly bold, but needs to be if we are to overcome the smoking epidemic. Currently, smoking is estimated to cause around 5,000 deaths2 each year, and around 550,000 New Zealanders remain addicted to nicotine.3 We need the audacity to plan a future in which the tobacco industry and its lethal products no longer have a pernicious hold on our population’s health.

We agree with Daube’s observation that progress since the goal was adopted in 2011 has been slow. This is despite the legacy of the Māori Affairs Select Committee, whose members first recommended setting a Smokefree 2025 goal.4 The previous Government introduced some important policies, such as getting rid of point-of-sale tobacco displays, but focused mainly on increasing individual cessation help, with quit attempts largely stimulated by higher taxation. There has been no overall plan, insufficient new population level policies and inadequate resources allocated to tobacco control.

With a new Government, we now have an opportunity to introduce a coordinated, evidence-based strategy. Already there are some signs of progress. The Minister of Health quickly recognised that a clear path was required to achieve the 2025 goal,5 and now Associate Minister Salesa has committed to creating a plan.6

The multi-level strategy Achieving Smokefree Aotearoa by 2025 (ASAP), launched last August, provides a clear roadmap for achieving the goal.7 ASAP 2025 drew on expertise from throughout the smokefree sector to create a plan that would reduce the incidence of smoking and create the first smokefree generation. Benefiting from wide consultation, particularly within the Māori and Pacific tobacco control sector, ASAP 2025 offers policymakers evidence-based options to accelerate progress.

To realise this progress, we need that extra push that can only be provided by Government itself. In the same way that the Australian government won accolades for their stance on introducing standardised packages,8 the New Zealand Government needs to demonstrate that sovereign rights to health should always take priority over the tobacco industry. Adopting the principles of the ASAP plan and resourcing the work would build on the work done throughout the tobacco control sector.

Now is the time for the Government to start breaking new ground. To date, addressing the issue of tobacco has largely focused on reducing demand for the product. We must intensify these efforts, but also address the availability of tobacco and start to regulate the product itself, so it is less appealing and less addictive.9–11 US Federal Drugs Administration has recently announced its intention to introduce policy measures in these areas.12

Rather than sell a lethal product through thousands of outlets, we should limit distribution and sell tobacco from outlets with secure storage and trained adult staff.13,14 Selling tobacco only from outlets open only to those over 18 would remove the product from its current everyday place in the retail environment.

Using community wisdom to inform the delivery of cessation services to high prevalence communities, and increasing funding for these services by drawing on tobacco
excise tax, could enhance their reach and effectiveness, as well as reduce criticism directed at higher tobacco taxation as an effective measure, including the disproportionate effects on lower income groups.\textsuperscript{15} Greatly increased use of mass and social media to encourage quitting and discourage uptake should also be implemented.

The editorial gives pause for thought. Should we give up on the 2025 goal? Emphatically no! Doing so would betray the vast majority of smokers who want to quit.\textsuperscript{16–20} More particularly, abandoning the goal would be to betray Māori, who have suffered disproportionately from the impacts of tobacco. Abandoning the goal would also betray the vision of the Māori Affairs Select Committee, whose members conceived the 2025 goal.

So, we need the Government to step up quickly with action. Please Minister Salesa, we are waiting and there is no time to lose.

**Competing interests:**
Nil.

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Professor Derek Nigel John John Hart
25 May 1952–13 December 2017

Professor Derek Hart sadly passed away in Sydney 13 December 2017, having been diagnosed with inoperable bowel cancer over a year beforehand.

Derek was born in Christchurch 25 May 1952 to Joe and Monica Hart, and grew up on a five-acre farm on Ham Road. He attended Christ's College where he regularly won academic prizes over the years, was noted for his abilities working with ceramics and was a school prefect. He found time to follow his love of sport, being a rugged hooker for the 1st XV for two years, and in the summer weekends would join his father and two brothers, Rick and Phil, racing on the family yacht. With Frank Dickson on board, they managed to win the Wellington to Akaroa race on their first and only attempt!

Having made the most of his time at school, which he always credited for giving him a flying start to his subsequent career, Derek easily gained entry to the Otago Medical School and after two years in Dunedin was in the first class to start at the new Christchurch Clinical School in his fourth year. He graduated top of his class with distinction in 1975 and became a house surgeon at Christchurch Hospital. During his four years in Christchurch, Derek continued playing top class rugby, being selected for various Canterbury representative teams.

At the beginning of his house surgeon year, Derek applied for, and was one of two New Zealanders to be granted, a Rhodes Scholarship to Oxford England. The other New Zealand recipient that year was Sir John Hood who became a lifelong friend.

In Oxford Derek was at Brasenose College and worked at the Nuffield Department of Surgery under the guidance of another
antipodean Sir Peter Morris. A requirement to join the Nuffield Department of Surgery included to undertake surgical training and he completed his initial surgical training in the UK before realising his talents lay in the field of haematology and immunology. He submitted his Doctor of Philosophy thesis on transplantation antigens in 1981. Oxford was a pivotal place for Derek. He learned how to make monoclonal antibodies from Caesar Milstein who later won the Nobel Prize for this work. Derek used this technology to make some of the first monoclonal antibodies to histocompatibility antigens which enabled him to discover interstitial dendritic cells. His subsequent research related to the importance of dendritic cells in many aspects of immune medicine and their modification for immunotherapy. In one of his early seminal papers published in 1981, he predicted that monoclonal antibodies would be useful for controlling immune responses in transplantation and cancer therapy. His most recent work included therapies for decreasing graft-host rejection as well as for cancer treatment.

Derek returned to Christchurch in 1983 where he set up a very productive research laboratory, toured the South Island fundraising to build Ranui House and subsequently took up a post as a consultant haematologist. This included five years as the director of the South Island Bone Marrow Transplantation Unit. His patients universally spoke of his total dedication to their care, as well as his empathy and caring manner. During this time he joined with his fellow haematologist Mike Beard, in publishing what was to become known as “the little blue book”—an indispensable guide for junior doctors in the initial treatment of most medical problems. Although obviously extensively modified it is still a valued guide for house surgeons at Christchurch Hospital today.

In 1998 Derek left Christchurch to take on the role as the Inaugural Director of the Mater Medical Research Institute in Queensland. He left his mark on Queensland: the Mater Medical Research Institute became internationally renowned within its first decade, sat on the Premier's smart state committee, was recognised as one of Queensland’s “50 best and brightest” and initiated the building of the Translational Research Institute. After a decade in Queensland he moved to the ANZAC Research Institute at the University of Sydney. Here he established the Dendritic Cell Research group focused on true translational research working tirelessly to build the academic, clinical and commercial collaborations to enable the translation of one of the group's monoclonal antibodies into clinical trial to treat patients who develop graft versus host disease as a result of a bone marrow transplant.

Derek had a prolific and internationally recognised research career. He published 264 peer reviewed papers, 29 book chapters and gave numerous national and international presentations. The quality of this work was underlined with over 1,200 citations with his definitive 1997 review on dendritic cells being cited over 1,000 times.

He was a valued member of various editorial boards, committees for scientific societies including the International Society for Cell Therapy, scientific advisory boards, and journal and grant review panels chairing the Ramaciotti Foundation until shortly before his death.

In 2006 he was made a Royal College of Pathologists Distinguished Fellow for significant and ground-breaking research, he was awarded a Paul Harris Fellowship from The Rotary Foundation and in 2016 won The Leo Dintenfass Memorial award for Excellence in research.

One of Derek's many great attributes was his enthusiasm to share the credit for his successful career. As noted above, he credited his school and parents for giving him a great start. His time in Oxford certainly launched his research career, along with amazing lifelong friendships, and he remained a strong supporter of the Rhodes community sitting on the selection committee while in Queensland. In regards to his time in Christchurch he always acknowledged the great research team he had there, and the funding he received from the Medical Research Councils as well as funding from a senior doctor's private family trust, which enabled him to return to Oxford for a sabbatical. He certainly repaid their faith in him.

It was while on sabbatical that Derek courted and finally won over his wife.
Georgina Clark. Georgina, now an Associate Professor at Sydney University, became the lynchpin of both his research and family teams! There is no doubt that he could not have achieved what he did without her enormous contribution. Georgina, a world-renowned researcher in her own right, continues his enormous research legacy.

As much as Derek loved his work, his greatest love was always his family. Derek was a devoted husband and father, and was rightly very proud of his two children Olivia and James. Derek's favourite times were always his family holidays—usually to the snow in winter, where he tried to follow the very accomplished Georgina down the slopes without great success, and somewhere by the sea in summer. Having grown up around boats, Derek had a great love of the water. He always had some sort of water craft and his ultimate happy place was on a boat with his family.

Derek had a great love of place and always wanted to live by water. He always lived by the water and together with Georgina built two waterfront homes enticing his children to often comment that it would be nice to live in a finished house before they left home. Despite living in Australia, Derek retained a nine-acre property in Wainui on the Banks Peninsula, which contained two old gun emplacements with resultant magnificent views over Akaroa Harbour. This was the venue for Derek's annual “Woodstock Wainui” gatherings involving a small tent city, some music, wine and lots of friends. Derek very much valued his friendships and, despite generally living in places far from many, made a great effort to retain them.

As per his wishes, Derek passed away peacefully in his amazing Sydney Harbour home, looking out over the water, surrounded by his wonderful family. Derek leaves behind an extraordinary legacy; a huge volume of ground-breaking research which, with the help of Georgina, he made sure will carry on without him.

Derek was an extraordinary man, a true visionary, who lived an extraordinary life—driven by that wonderful goal—to cure cancer, sadly not quite in time for himself.
Primary care-led weight management for remission of type 2 diabetes

Type 2 diabetes is a chronic disorder that requires lifelong treatment. The investigators in this report aimed to assess whether intensive weight management within routine primary care would achieve remission of type 2 diabetes.

Patients aged 20–65 years, diagnosed within the past six years who were not taking insulin were involved. Two hundred and ninety-eight such patients were recruited from 49 primary care practices in Scotland and England. One hundred and forty-nine were allocated to receive a weight management programme delivered by practice dietitians or trained nurses. The other 149 received standard best practice care. At 12 months 24% of the intervention group had lost 15kg or more versus none in the control group. Diabetes remission, defined as glycated haemoglobin of less than 48mmol/mol, occurred in 46% of the patients in intervention group and in 4% of the control group.

The investigators concluded that their findings show that, at 12 months, almost half of participants achieved remission to a non-diabetic state and off antidiabetic drugs. Remission of type 2 diabetes is a practical target for primary care.

Lancet 2018; 391:541–51

Continuous glucose monitoring (CGM)

Interstitial glucose levels, which are closely related to blood glucose levels, can be measured by a sensor inserted subcutaneously. The sensor is linked to a handheld receiver. This enables the subject to deal with episodes of hypo- or hyperglycaemia.

This issue is comprehensively reviewed in this paper. Historically there has been concern about the accuracy of these devices. However, the currently available CGM devices have an accuracy approaching 10% when the CGM result is compared with a simultaneous capillary blood glucose treatment.

The authors of the review conclude that CGM in type 1 diabetes improves HbA1C and hypoglycaemia. However, the evidence is less robust for type 2 diabetes. It is noted that the Australian Government has recently agreed to fund CGM for type 1 diabetes in patients under the age of 21 years.

Internal Medicine Journal. 2018; 48:499–508

A role for hydrocortisone therapy in septic shock?

Two studies and an accompanying editorial in a recent NEJM review this important topic.

In one, 3,658 patients were randomised to receive hydrocortisone or placebo in addition to standard ICU care. The researchers noted a significant reduction in the need for mechanical ventilation. However, 90-day mortality was not reduced in the steroid cohort.

In the second study 1,241 patients were randomised to receive hydrocortisone plus fludrocortisone or placebo. The number of ventilation-free days was similar in the two groups. The 90-day mortality was significantly less in the steroid-treated group.

An editorial reviewer noted the different outcomes and speculated that these might be accounted for by differences in the severity of illness between the two studies.


URL:
A Case of Congenital Hypertrophic Stenosis of the Pylorus

By J. P. S. Jamieson, Nelson Hospital

Such cases are perhaps sufficiently uncommon to warrant record.

On 8th December, 1917, an infant 24 days old was admitted to Nelson Hospital with diagnosis of that condition. The history was quite typical:—A boy, at birth vigorous and weighing ten pounds. For the first few days nothing unusual was noticed, excepting food regurgitation, deemed to be normal. Vomiting became troublesome in the second week. During the third week everything taken was vomited, and there was rapid wasting and obstinate constipation. When first seen by Dr. Warneford at 22 days old peristalsis was obvious.

When admitted to hospital weight was 6 pounds 6 ounces, one-third of the birth weight having been lost. Every drink was vomited, usually after an interval of half an hour, and vomiting was projectile, quite according to the text-book. Strong gastric peristalsis could be seen, and the pyloric mass stood up prominently under the thin abdominal wall. Movement of the bowels was limited to a little bile-stained mucus. The infant was so weak after a seventy-mile journey that he was voiceless.

It was alleged that when less than a week old he had been given a full tablespoonful dose of castor oil, and that he had a teaspoonful of neat brandy frequently when crying at nights.

At first, efforts were made to get some fluid absorbed per rectum; but the large intestine proved quite as intolerant as the stomach, and at no time, with the greatest care and patience, did we succeed in getting anything retained by the bowel.
The only route available was no subcutaneous injection, so he was given saline by that method, containing 5 per cent. glucose. Meanwhile the stomach was washed out and tempted with small sips of albumen water, beef juice, and whey; but everything came back. Nevertheless, the subcutaneous nourishment improved him so that next day he was able to cry.

For a week every endeavour was made to get nourishment in by natural channels, but nothing was retained. Frequently there was no vomiting for eight hours or so, but the longer interval only meant a larger emesis. The stomach was washed out and he was given sterile saline with glucose subcutaneously twice a day. This was really the only nutriment he had. Every day he was weighed, and there was a debate as to operation or further waiting. At the end of a week, there being a further loss of an ounce or two, it was determined to risk all and operate.

Operation was done on 15th December, Dr. Lucas having the unbelievable task of anaesthetist, and Dr. Bett assisting. On the table the infant looked more like a skinned rabbit than one of the human species. The hypertrophied pylorus formed a firm, fusiform mass almost as bulky as a golf ball. Posterior gastro-enterostomy was done without clamps. The operation was not so greatly more difficult than in the adult subject as might be expected, the main difficulty being the location of the duodeno-jejunal flexure. This wasted a few minutes, so that the time occupied to the completion of anastomosis was half an hour. Nevertheless, there were no anaesthetic alarms, and very little shock.

For the first two days there was some regurgitation of bile, but that yielded to stomach washing. Until it ceased the subcutaneous alimentation was continued. Thereafter convalescence was uneventful. Feeding passed through stages of albumen water, whey, and diluted peptonised milk on to humanised milk. There was no more vomiting, and bowels became normal. Weight increased by an average of half a pound per week, but it took eight weeks to regain birth weight. Reports since he returned home state that he is thriving well and is a fine baby.

URL: