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Haemochromatosis: evaluating the effectiveness of a novel patient self-management approach to venesection as blood donation

Sonam Mishra, Dalice Sim, Peter Flanagan

Regular venesection is an established form of therapy for patients with hereditary haemochromatosis. This study evaluated the effectiveness of a novel self-management approach to venesection as blood donation. Patients were discharged from the venesection clinic at the New Zealand Blood Service and educated to manage their own venesection by regular blood donation and an annual blood test by their general practitioner to check their ferritin level (a measure of iron stores). The self-management approach was successful for the majority of patients as they continued to donate blood and had their ferritin checked after discharge from the venesection clinic.

Audit of *Trichomonas vaginalis* test requesting by community referrers after a change from culture to molecular testing, including a cost analysis

Liselle Bissessor, Janet Wilson, Gary McAuliffe, Arlo Upton

Trichomonas vaginalis (TV) is an important sexually transmitted infection that affects women more than men. Both in New Zealand and internationally, it is more common among people with relative socio-economic deprivation. At Labtests we changed detection methods from culture to a molecular platform. While the molecular platform picks up more infection than culture, it is also a lot more expensive for each test. In order to make the change, we went from testing all vaginal swabs to only those where testing requested or where there were risk factors (age and gender, other sexually transmitted infections). This change has improved efficacy and resource allocation in the laboratory.

Rising levels of New Zealand medical student debt

Antonia Verstappen, Phillippa Poole

Concern has been expressed about the impact of student loan debt on the career choices of medical students, however, there is limited information available about what the student loan debt burden on New Zealand medical students is. This study sought to determine the pattern of New Zealand medical student debt over a decade, and explore the relationship between medical student loan debt and demographic factors. Over 92% of medical students in New Zealand have some form of student loan debt, and 28% of these have $90,000 or more in student loan debt. Medical students with larger student loan debts are more likely to rely on a larger number of financial sources to fund their studies, indicating that these students are managing a range of debts and employment as well as their medical study. Future study is needed to understand the relationship between medical student loan debt and future career choices.

Age at referral for undescended testes: has anything changed in a decade?

Mohit Bajaj, Vipul Upadhyay

Undescended testes can impact on fertility and also possess an increased chance of developing cancer in the future. Surgery to place the testis into the scrotum is now recommended to occur between 6–18 months of age. In our study, we have demonstrated that the median age at surgery was 12.6 months in patients treated at Starship hospital (2014–2016), a significant improvement compared to previously. This improvement is primarily due to earlier referrals to the surgical service from primary care doctors.

Adequate adherence to benzathine penicillin secondary prophylaxis following the diagnosis of rheumatic heart disease by echocardiographic screening

Nicola Culliford-Semmens, Elizabeth Tilton, Rachel Webb, Diana Lennon, Belinda Paku, John Malcolm, Sandi French, Nikki Blair, Nigel Wilson

We were concerned that patient adherence to treatment with penicillin recommended in an outpatient setting following the echocardiographic diagnosis of rheumatic heart disease, may not be as good as that following an episode of acute rheumatic fever when the child or young adult is unwell and admitted to hospital. This hospitalisation allows time for repeated family education about the need for penicillin treatment, which involves injections every four weeks for several years. The results are reassuring.

Clinical management and patient persistence with antibiotic course in suspected group A streptococcal pharyngitis for primary prevention of rheumatic fever: the perspective from a New Zealand emergency department

Jeremy J Mathan, Jozsef Ekart, Clair Mills, Anthony Houlding, Gary Payinda

This is the first study that assesses how well patients adhere to their course of prescribed antibiotics for possible strep throat. We found that most patients (over 70%) were compliant in completing their full course of antibiotics. Just over 80% of patients were prescribed the correct length of antibiotic treatment.

Mapping housing for the disabled in New Zealand

Jacqueline McIntosh, Adele Leah

The close relationship between housing and health has been well documented in New Zealand but is of particular concern for the disabled population. A 2013 survey identified that almost one-quarter (24%) of New Zealanders have a disability, and physical disabilities are projected to increase most dramatically as the population ages. Large numbers of the disabled population are living outside of the major urban centres, and a significant proportion are living in the most deprived areas residing in rental housing that is damp and difficult to keep warm. Poorer health outcomes are predicted for those who remain in their current unmodified homes. New Zealand is ill-prepared for the projected increase in demand for healthy rental housing; and the related consequences of poor health should not be underestimated.

Data sharing statements for clinical trials: a requirement of the International Committee of Medical Journal Editors

Darren B. Taichman, Peush Sahni, Anja Pinborg, Larry Peiperl, Christine Laine, Astrid James, Sung-Tae Hong, Abraham Haileamlak, Laragh Gollogly, Fiona Godlee, Frank A. Frizelle, Fernando Florenzano, Jeffrey M. Drazen, Howard Bauchner, Christopher Baethge, Joyce Backus

The International Committee of Medical Journal Editors (ICMJE) believes there is an ethical obligation to responsibly share data generated by interventional clinical trials because trial participants have put themselves at risk. In January 2016 we published a proposal aimed at helping to create an environment in which the sharing of deidentified individual participant data becomes the norm. In response to our request for feedback we received many comments from individuals and groups.[1] Some applauded the proposals while others expressed disappointment they did not more quickly create a commitment to data sharing. Many raised valid concerns regarding the feasibility of the proposed requirements, the necessary resources, the real or perceived risks to trial participants, and the need to protect the interests of patients and researchers.

It is encouraging that data sharing is already occurring in some settings. Over the past year, however, we have learned that the challenges are substantial and the requisite mechanisms are not in place to mandate universal data sharing at this time. Although many issues must be addressed for data sharing to become the norm, we remain committed to this goal.

Therefore, ICMJE will require the following as conditions of consideration for publication of a clinical trial report in our member journals:

1. As of July 1, 2018 manuscripts submitted to ICMJE journals that report the results of clinical trials must contain a data sharing statement as described below.
2. Clinical trials that begin enrolling participants on or after January 1, 2019 must include a data sharing plan in the trial's registration. The ICMJE's policy regarding trial registration is explained at *www.icmje.org/recommendations/browse/publishing-and-editorial-issues/clinical-trial-registration.html*. If the data sharing plan changes after registration this should be reflected in the statement submitted and published with the manuscript, and updated in the registry record.

Data sharing statements must indicate the following: whether individual deidentified participant data (including data dictionaries) will be shared; what data in particular will be shared; whether additional, related documents will be available (e.g., study protocol, statistical analysis plan, etc.); when the data will become available and for how long; by what access criteria data will be shared (including with whom, for what types of analyses and by what mechanism). Illustrative examples of data sharing statements that would meet these requirements are in the Table.

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Table 1: Examples of data sharing statements that fulfill these ICMJE requirements.*

	Example 1	Example 2	Example 3	Example 4
Will individual participant data be available (including data dictionaries)?	Yes	Yes	Yes	No
What data in particular will be shared?	All of the individual participant data collected during the trial, after deidentification.	Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures, and appendices).	Individual participant data that underlie the results reported in this article, after deidentification (text, tables, figures and appendices).	Not available
What other documents will be available?	Study Protocol, Statistical Analysis Plan, Informed Consent Form, Clinical Study Report, Analytic Code	Study Protocol, Statistical Analysis Plan, Analytic Code	Study Protocol	Not available
When will data be available (start and end dates)?	Immediately following publication. No end date.	Beginning 3 months and ending 5 years following article publication.	Beginning 9 months and ending 36 months following article publication.	Not applicable
With whom?	Anyone who wishes to access the data.	Researchers who provide a methodologically sound proposal.	Investigators whose proposed use of the data has been approved by an independent review committee ("learned intermediary") identified for this purpose.	Not applicable
For what types of analyses?	Any purpose.	To achieve aims in the approved proposal.	For individual participant data meta-analysis.	Not applicable
By what mechanism will data be made available?	Data are available indefinitely at (Link to be included).	Proposals should be directed to xxx@yyy. To gain access, data requestors will need to sign a data access agreement. Data are available for 5 years at a third party website (Link to be included).	Proposals may be submitted up to 36 months following article publication. After 36 months the data will be available in our University's data warehouse but without investigator support other than deposited metadata. Information regarding submitting proposals and accessing data may be found at (Link to be provided).	Not applicable

*These examples are meant to illustrate a range of, but not all, data sharing options.

These initial requirements do not yet mandate data sharing, but investigators should be aware that editors may take into consideration data sharing statements when making editorial decisions. These minimum requirements are intended to move the research enterprise closer to fulfilling our ethical obligation to participants. Some ICMJE member journals already maintain, or may choose to adopt, more stringent requirements for data sharing.

Sharing clinical trial data is one step in the process articulated by the World Health Organization (WHO) and other professional organisations as best practice for clinical trials: universal prospective registration; public disclosure of results from all clinical trials (including through journal publication); and data sharing. Although universal compliance with the requirement to prospectively register clinical trials has not yet been achieved and requires continued emphasis, we must work toward fulfilling the other steps of best practice as well—including data sharing.

As we move forward into this new norm where data are shared, greater understanding and collaboration among funders, ethics committees, journals, trialists, data analysts, participants, and others will be required. We are currently working with members of the research community to facilitate practical solutions to enable data sharing. The United States Office for Human Research Protections has indicated that provided the appropriate conditions are met by those receiving them, the sharing of deidentified individual participant data from clinical trials does not require separate consent from trial participants.[2] Specific elements to enable data sharing statements that meet these requirements have been adopted at ClinicalTrials.gov (https://prsinfo.clinicaltrials.gov/definitions.html#shareData). The WHO also supports the addition of such elements at the primary registries of the International Clinical Trials Registry Platform. Unresolved issues remain, including appropriate scholarly credit to those who share data, and the resources needed for data access, the transparent processing of data requests, and data archiving. We welcome creative solutions to these problems at www.icmje.org.

We envision a global research community in which sharing deidentified data becomes the norm. Working toward this vision will help maximize the knowledge gained from the efforts and sacrifices of clinical trial participants.

Note: This article is being published simultaneously in *Annals of Internal Medicine, BMJ (British Medical Journal), Bulletin of the World Health Organization, Deutsches Ärzteblatt (German Medical Journal), Ethiopian Journal of Health Sciences, JAMA (Journal of the American Medical Association), Journal of Korean Medical Science, New England Journal of Medicine, New Zealand Medical Journal, PLOS Medicine, The Lancet, Revista Médica de Chile (Medical Journal of Chile),* and *Ugeskrift for Laeger (Danish Medical Journal)*.

Disclaimer: Dr. Sahni's affiliation as representative and past president of the World Association of Medical Editors (WAME) does not imply endorsement by WAME member journals that are not part of the ICMJE.

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Dr. Gollogly reports being employed by the World Health Organization. Dr. Haileamlak is an employee of Jimma University in Ethiopia and the Editor of EJHS. Dr. Laine reports that she is employed as an editor by the Annals of Internal Medicine and the American College of Physicians. Dr. Peiperl reports other from Public Library of Science, non-financial support from World Health Organization, non-financial support from Association of Healthcare Journalists, outside the submitted work. Dr. Taichman reports that he is employed as an editor by the Annals of Internal Medicine and the American College of Physicians.

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Progress in public reporting in New Zealand since the Ombudsman's ruling, and an invitation

C Shuker, G Bohm, R Hamblin, A Simpson, D St George, I Stolarek, J Wilson, AF Merry

"The purpose is to unleash the power of data to change lives."[1]

Statistics NZ CEO Liz MacPherson

The process of increasing transparency around New Zealand healthcare has shown startling progress in the last two years. We summarise recent developments and suggest a way ahead.

In June 2016 Ombudsman Professor Ron Paterson ruled on a complaint by Martin Johnston of the *New Zealand Herald*.[2] Johnston had requested the volumes and types of operations performed by individual surgeons at five district health boards (DHBs) under the Official Information Act (the Act). He also requested rates and total, unadjusted numbers of mortality, readmissions and complications by individual surgeon, and was either turned down or provided with numbers at abstracted levels by DHBs.

Johnston's complaint, and a prior ruling by the Ombudsman (December 2014)[3] that Tairāwhiti DHB should release surgeon-specific case volume data, prompted considerable attention and debate in the sector. A discussion paper by the Medical Council[4] generated 57 response submissions, from the New Zealand Medical Association,[5,6] the Association of Salaried Medical Specialists (ASMS),[7] the New Zealand Society of Anaesthetists[8] and the New Zealand National Committee of the Australian and New Zealand College of Anaesthetists (ANZCA) among others.[9] In March 2016 the Health Quality & Safety Commission (the Commission), after consultation with these and other concerned organisations, including consumers in a day-long consumer workshop conducted with the Ministry of Health,[10] published a position paper on the public reporting of data, including surgical outcome data, with an accompanying editorial in this journal.[11,12]

The Ombudsman's ruling

Ultimately, the Ombudsman ruled that under the Act, DHBs were not obliged to provide individual surgeons' mortality and complications data on the broad basis that such data are not risk-adjusted and their publication would risk misinforming the public.[2] DHBs were required to provide data by individual surgeon on volume and type of procedure performed. The Ombudsman's opinion was widely covered in the media.[13–17]

The Ombudsman noted in his opinion that one of the purposes of the Act is "to progressively increase the availability of official information to the people of New Zealand". The Ombudsman has also suggested, in his 2014 opinion, that "New Zealand lags behind [international] developments" in the "proactive disclosure of performance and outcome information".[3] For these reasons, he appended the following new recommendation:

"that the Ministry of Health and Health Quality & Safety Commission work together to provide a publicly available annual update (commencing in June 2017) on the sector's progress towards, in five years (ie, by June 2021), the selection, development and public reporting of a range of quality of care measures (including outcomes data) across specialties that:[2]

- are meaningful to health care consumers;
- are meaningful to the clinicians who provide their care;
- are meaningfully attributable to the clinicians or service providing that care; and
- increase the availability of information to the people of New Zealand."

The Ministry of Health and the Commission, with the support of the Accident Compensation Corporation (ACC) and the Health and Disability Commissioner, have now jointly agreed a set of guiding principles that should apply to future publication of additional clinical performance and outcome information (see Figure 1).

These principles attempt to frame an evidence-based rationale of public reporting specific to New Zealand's current healthcare landscape and information technology architecture.

Figure 1: Guiding principles: towards the publication of clinical performance and outcome data (adapted for publication).

These guiding principles form a common platform from which to operate consistently to achieve effective public reporting of clinical performance and outcome information. They reflect the points in the process of public reporting: purpose; design; data capture and treatment; and publication.

Public reporting of clinical performance and outcome data is continuing to evolve in New Zealand and these principles for such reporting are based on current evidence. Through consultation, these principles have the support of consumers, regulatory and professional bodies, and key groups in the sector. The principles are aligned with key themes of the New Zealand Health Strategy 2016[18] and with the strategic directions of other key healthcare organisations, and with processes that oversee professional competency. The principles will be regularly reviewed to ensure they remain current with changing strategic and legislative documents. Innovations or changed models in healthcare should, where possible, incorporate these principles prospectively as part of implementation.

Our purpose is quality improvement and patient safety

The aim of publication of clinical performance and outcome information is to facilitate continuous improvement in the quality and safety of health services and to generate public trust and confidence in our system. Focuses for improvement include better service experience for consumers; practitioner learning and performance; and accountability to the public.

Co-designed publications and measures

Consumers, colleges, professional bodies, clinicians and employers have an important role to play in defining and selecting relevant outcomes and process measures. Strong measures should reflect the different needs of the interested parties, be outcomes-focused, reflect consumer experience and serve to assure quality and safety and drive improvement. Publication of data should promote a culture of continuous improvement, stimulate clinical focus and encourage open and honest reporting.

National standards

Digital technology supports the capture and management of clinical performance and outcome information during routine care. Wherever possible and appropriate, there should be agreed national standards of data collection with consistent definitions and measures across New Zealand.

Where possible, data should be risk-adjusted and/or accompanied by relevant contextual information to account for case complexity and risk. When measures are attributed to clinicians or services, attribution should be accurate and inferences should be statistically sound. The measures should be clinically credible and reliable and should provide the public, clinicians, healthcare providers, administrators and/or policymakers with useful and meaningful information.

Accessibility and clarity

Data should be published in different formats and media to ensure that the information is accessible to people of all levels of health literacy and acceptable and comprehensible to target audiences.

Data can be analysed and reported at multiple levels (national, regional, service, individual). Choice of level should, where appropriate, be related to purpose and audience, to facilitate understanding of causes, contributing factors and opportunities for improvement.

Quick look

- Consumer-focused
- Co-designed measures
- Co-designed publications
- Outcomes-focused
- Data capture part of routine care
- Electronic capture
- Agreed national standards of data collection
- Consistent national definitions and measures
- Risk-adjusted
- Contextualised
- Meaningfully attributable to clinician/s or service
- Accessible formats and media
- Related to purpose and audience

Present developments in public reporting

At present, most public reporting in New Zealand has a clinician rather than consumer focus. Data on the outcomes of certain surgical units in New Zealand have been reported in the peer-reviewed literature for decades.[19–23] Publication of various measures of the quality and safety of healthcare is also already a regular part of the work of the Ministry of Health, the ACC and the Commission. For example, the Commission presently publishes over 250 quality of care indicators for each DHB. These indicators link to the Ministry's System Level Measures (SLM) framework (see below).[24] Currently, these indicators are spread across different publication formats, such as the New Zealand Atlas of Healthcare Variation, the Health Quality and Safety Indicator set and the Quality and Safety Marker set. Work progresses toward the presentation of a selection of these indicators as one DHB-specific dashboard, which can be organised in relation to the Ministry's SLM framework.

The Ministry's SLM Framework is a system-level performance measurement and incentive system co-developed with the sector and designed to demonstrate district alliance progress towards agreed targets in line with the 2016 New Zealand Health Strategy.[24] The Framework consists of a set of system level measures with nationally consistent definitions that will be reported nationally. Contributory measures, designed to drive change at a local level and contribute to the system level measures, are selected locally and will not be reported. At present, DHBs and PHOs are required to develop and submit an improvement plan to meet agreed milestones for each system level measure on behalf of their district alliance.

The System Level Measures implemented from 1 July 2016 (apart from the latter two, which are still in development) and reported publicly are:[25]

- Ambulatory Sensitive Hospitalisation (ASH) rates per 100,000 for 0–4 year olds
- Acute hospital bed days per capita
- Patient experience of care
- Amenable mortality rates
- Number of babies who live in a smoke-free household at six weeks post-natal
- Youth access to and utilisation of youth-appropriate health services.

DHBs are in general already encouraged to collect and report outcome information, and DHBs approach this differently. For example, Waitemata DHB has recently published unit-level outcome information on their website for 2014 and 2015 in relation to gastro-oesophageal, hepatic, pancreatic and biliary surgery.[26] The information includes leak rates and 30-day/90-day mortality, with contextual information to assist lay readers. Work on development of a DHB-wide framework of patient-reported outcome measures (PROMs) and patient-reported experience measures (PREMs) linked to outcomes is in process. (Pers. comm. Grayson D. O'Brien J. May 2017.).

Registries and opportunities

New Zealand already has several active registries and some in development, many that may provide opportunities for consumer-focused publication of risk-adjusted measures of the outcomes of certain aspects of patient care that fit the criteria we have outlined for effective public reporting.

The All New Zealand Acute Coronary Syndrome Quality Improvement programme (ANZACS QI),[27] for example, is a clinical registry of patients with acute coronary syndrome (ACS) and other cardiac problems admitted to hospitals across New Zealand. The registry currently covers 41 public hospitals across New Zealand where acute cardiac patients are admitted. As at June 2015, 25,273 patients with suspected ACS and 30,696 referred for coronary angiography were registered. The registry explicitly has a quality improvement arm as well as a research arm—to identify and address variation in evidence-based practice (in timeliness of assessments and interventions and in the utilisation of secondary prevention therapy, for example). Publications arising from the registry are numerous and ongoing, and the clinicians involved are exploring other options for reporting.[27–40]

The New Zealand cardiac registry published their first New Zealand annual report in December 2016.[41] The report

presents analysis of all cardiac surgical procedures undertaken at the five DHBs performing publicly-funded cardiac surgery in New Zealand (Auckland, Waikato, Capital and Coast, Canterbury, Southern) between 1 January 2015 and 31 December 2015. The data present volumes, risk factors, and benchmarked, risk-adjusted outcomes such as mortality and measures of complications, including deep sternal wound infection, return to theatre and readmission rates following isolated coronary artery bypass grafting (CABG), isolated aortic heart valve replacement (AVR) and combined AVR and CABG. The registry also publishes some additional quality of care measures, including hours of mechanical ventilation, time spent in the intensive care unit and hospital length of stay. All measures are for the country or by the five DHBs with cardiac units.

The New Zealand Joint Registry publishes its report annually and now has more than 17 years of accumulated data of New Zealand joint arthroplasty practice encompassing both public and private settings. These data include metrics that are relevant to both consumers and to clinicians in terms of quality improvement work, such as prosthesis revision rates and more than 15 years of data from the Oxford Hip and Knee outcomes questionnaire, an arthroplasty-specific patient-reported outcome measure (PROM).[42] Surgical site infection data for hip and knee arthroplasties, which may be relevant to consumers, are also available at DHB level from the Commission.[43]

New Zealand has other registries at varying levels of sophistication and maturity, including the New Zealand stroke thrombolysis registry.[44] Stroke registry data are emerging in the literature,[45,46] and the registry has been used to raise awareness of regional variation in thrombolysis provision.

These and other instances are opportunities for development of measures to be reported along the lines of the principles in Figure 1—in the first instance, with a consumer focus.

Background developments internationally

Johnston's Official Information Act request and subsequent complaint has in part acted as a challenge for New Zealand healthcare, put by the media in much the way it was in the US in the 1990s and in England and the UK in the 2000s.

England

In England, a 2005 request by the *Guardian* under the Freedom of Information Act in the wake of the paediatric cardiac surgery scandal at Bristol Royal Infirmary[47] has now resulted in the publication of multiple metrics on the *NHS Choices* website, including mortality, complications and other metrics by individual surgeon across 20 specialties.

As the Commission reported in their March 2015 position paper, "Outcomes have clearly improved in the NHS [UK National Health Service] in the period since publication … [but] a causal link from publication to reduced mortality has not been shown."[11,48–50] The UK Society for Cardiothoracic Surgery has written to NHS England calling for the scheme to be abandoned, claiming "a damaging effect on individual surgeons, with destruction of confidence, disruption of functional teams and inappropriate suspensions, with unfair media attention."[51] *NHS Choices* data appear to show low public usage of the service: in the year between 7 March 2016 and 12 March 2017, the collected specialty sites had only 8,387 unique visitors, with the fewest looking up Interventional cardiology (192 visits). Hip replacement surgery outcomes by individual surgeon was the most popular, with 969 unique visits in the year. (Pers. Comm. NHS Choices Service Desk, 9 March 2017.) There were, however, approximately 100,000 hip replacement procedures performed in England and Wales in 2015.[52] Has the initiative improved care? The answer is unclear.

Several authoritative groups have warned of the dangers arising from insufficient statistical power to reliably detect variations in the performance of individual UK surgeons. Surgeons in the UK seldom, if ever, do enough procedures to reliably identify outliers on the basis of mortality. The risks lie both in the possibility of falsely (and unjustly) identifying an individual as a poor performer and in failing to identify one that really is performing poorly within a useful timeframe. The problem of volume and statistical significance is certainly even more the case in New Zealand.[53,54]

US

In New York in the US, a suit by newspaper *Newsday* resulted in publication by the Society of Cardiothoracic Surgeons (SCTS) of the risk-adjusted mortality and complications data of named individual surgeons. The New York cardiac reporting showed 41% decreased mortality in a year, in much-studied and contested results that are perhaps the most famous example of public reporting and its potential effects.[55–62]

In the US since, there has been a proliferation of forms of public reporting of quality information, from journalistic associations at the grassroots to the major agencies, alongside a proliferation of methodologies, standards and data sources.[63] At the centre, the US Affordable Care Act 2010 requires the Centers for Medicare & Medicaid Services (CMS) to make "publicly available through Physician Compare [a CMS website to help consumers find and choose physicians and other health care professionals enrolled in Medicare] information on physician performance that provides comparable information on quality and patient experience measures".[64]

States, regions, collaboratives, health systems and hospitals all publish their own self-reported metrics. Multiple independent for- and non-profit organisations are now publishing ranking and rating information, such as US News, HealthGrades, and Consumer Reports, targeted at consumers. These rating systems differ in their methodologies, measures and data sources, and, in practice, their ratings rarely agree[65] and are disputed by clinicians.[66,67] They lack therefore the clinical buy-in necessary to incentivise quality improvement, though they have the merit of being increasingly consumer-focused. Indeed, many of these independent ratings systems provide the information consumers in New Zealand have told us they want (see Figure 2).

The argument for public reporting in New Zealand—strategy, purpose, mechanism

Marshall and colleagues at the Nuffield Trust identify the many reasons cited for implementing a policy of public disclosure of performance or quality data. They conclude that a coherent rationale, a clear conceptual framework and "a clear and explicit purpose for introducing public disclosure is fundamental to its design, implementation and evaluation".[68]

The primary construct underpinning the expectation in the US that public reporting will improve the quality of care is based upon a disputed market mechanism of choice and competition, whereby patients act as informed consumers selecting

Figure 2: What consumers want from transparency.[10]

Consumer workshops held by the Ministry and the Commission in 2015 found that consumers wanted:

- Reassurance, trust and confidence in the system
- Information from a consumer perspective centred on the patient journey, such as wait times and cancellations
- Data on two to three key aspects of a procedure
- Details of the process
- Likelihood of different outcomes including quality of life
- Risks and benefits for themselves as individuals
- Opportunities for stories to come through a mix of data and personal accounts
- Patient experience surveys and the ability to access 'expert patients' who had had first-hand experience.

high-performing providers of healthcare on the basis of their quality. Thus public reports in the US are viewed by some as both a consumer right and a complex quality intervention, predicated upon the proposal that consumers once properly informed will "migrate" to better performers. Theoretically, providers will respond by improving the quality of their care to compete for market share.

However, it is very much unclear whether this construct is sound, even in the US. It requires that consumers access this information, understand it, and begin to make economically rational decisions for their health care such that an economically "efficient" market model for healthcare results. Much evidence suggests that consumers simply don't use data of this type to make healthcare choices in the way some providers thought they might.[59,69–75] This question of choice and selection is certainly academic in the context of the New Zealand public system: hospitals don't compete for patients and few patients are in a position to choose their institution or practitioners.

The latest evidence suggests that the importance of transparency as a mechanism to incentivise a shift in practice is based on reputation. This effect will probably operate most powerfully at the level of the institution, with a concomitant effect on all who work within each institution.

Change by reputation

Berwick identified the "change by reputation" mechanism in 2003[76] and the importance of reputation and the effects of public reporting of comparative institutional measures to incentivise better health care by reputation have been shown in the US, the UK, Italy and Zambia.[77]

Hibbard and colleagues have shown in controlled experiments in Wisconsin the different effects public reporting had on hospitals' quality improvement behaviors.[78,79] Three groups of hospitals were provided with a) no quality information; b) private information for internal use; and c) the same performance information but publicly reported in a way that explicitly targeted consumers (newspaper advertising etc.). Only in the third case did hospitals make substantial changes to institute quality improvement projects, regardless of market share. These effects were particularly marked in low-performing institutions. Chassin found that the positive results of the New York cardiac reporting, including reduced mortality, were attributable to reputational effects on low-performing providers, not effects on their market share caused by consumer choice and competition.[80]

Bevan and others have shown how, despite its shortcomings and ultimately its political unpopularity, the NHS star rating regime instituted by the Labour government between 2001–2005 caused dramatic improvements in England where easily graspable comparative results were published in a wide array of media.[77,81] Conversely, in Wales where no results were publicly published and failure to achieve targets was rewarded with extra resources, little improvement was seen. Hospital and ambulance waiting times in England improved dramatically, at some cost politically and in terms of clinical buy-in. Gaming was rife though much of it was "gilding the lily" of already substantial improvement.[82,83] Such ferocious public governance appeared to dramatically improve low-performing institutions, but not to foster or encourage the culture of excellence, teamwork and patient safety that New Zealand pursues.[77] How do we learn from these experiments, natural and controlled?

The importance of teamwork

The critical importance of teamwork to outcomes has been evaluated in some depth.[11] It is probably counter-productive to focus on individuals rather than teams, in part because doing so provides perverse incentives in relation to the performance of colleagues, but primarily because the outcomes of most modern medical and surgical interventions depend not only on multiple individuals from different disciplines (including but not restricted to surgeons, anaesthetists, intensivists, nurses, laboratory staff and managers) but also on how they work together towards a shared objective of excellence and patient-centred care.

What of individual practitioners? In its position paper, the Commission outlined many effective ways in which the performance of individual healthcare professionals can be assured.[11] It called for boards of DHBs to attest to the presence of such processes within their organisations as part of their annual reports.

We suggest that the true mechanism to make public reports effective in improving quality and generating public trust and confidence in the New Zealand context lies along a thoughtful and considered route sketched in the guiding principles in Figure 1 above. The motivation and stimulus to action through public reporting is readily comprehensible: professional pride, organisational competitiveness, threat of reputational damage at the publication of low performance and the drive to perform at the top of the scope of professional practice.[63]

Measures ought to be developed in concert with consumers, be consumer-focused, comprehensible and accessible, though consumers don't necessarily have to use the information.[78,79,84–87] [Hibbard pers. comm. Aug 31, 2016] These measures ought to be relevant to clinical practice and able to be improved by clinicians. Importantly, they ought to focus on the teams, units and departments to whom they are truly attributable. In this way sufficient numbers for statistical power can be achieved and teamwork can be promoted rather than idiosyncratic practices and behaviours by individuals.

One exciting area that is emerging is the use of new ways of evaluating healthcare, notably through PROMs and patient-reported experience measures (PREMs),[88] and through measures (such as days alive and out of hospital, or DAOH[89]) that are sensitive to more than just mortality and may provide better statistical power for evaluating the performance of clinicians.

We are at the historic moment when we can draw from proven benefits of public reporting and avoid the pitfalls. The evidence has shown us a culture of high performance and continuous quality improvement in New Zealand is not dependent simply on trust and altruism, nor on measurement alone, or choice and competition, but instead a complex interplay between regulation, professionalism and performance reporting that is imaginatively and intelligently done.[12,57,65,74,76,78,79,82,86]

The way ahead in New Zealand—the future and potential of public reporting relies upon us

"New Zealand is about open hearts … open minds. We think differently. We try things. We experiment. We are not afraid to challenge … I would also like us to be famous in the future for open data."[1]

Statistics NZ CEO Liz MacPherson

The iron is hot in New Zealand: we are lucky enough to have been challenged on our approaches to the public reporting of outcomes data from our health services at a time when international evidence is growing.

There is huge potential to develop processes to report a greater number of tailored measures at the appropriate level of unit or institution in cooperation between clinicians and consumers to increase transparency and continue to drive improvement in our already high-performing health services.

New Zealand has robust national data collections and a number of registries at different stages of sophistication and maturity, and all are rich sources of potential measures that consumers may value in their quest to understand their care and that providers can use to report upon the quality and safety of their services to drive continuous improvement. There are opportunities for further measures to be developed—PROMS and PREMs in particular.

We call upon the specialties, the Colleges and other professional bodies and the boards of DHBs to continue to engage with the Ministry and the Commission in the pursuit of informed and effective reporting of unit-, organisation- and provider-level outcome data. We can, as a country, advance the transparency agenda in a way that simultaneously informs and reassures the people of New Zealand and assists the clinicians who care for them in ensuring that the quality of the services they provide are excellent for everyone—not just for the few who can exercise choice.

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Rising medical student debt: should we be alarmed?

Tom M Wilkinson

A relatively recent phenomenon in medical training in New Zealand is the significant level of financial debt that currently burdens medical graduates. Although a subject of ongoing debate and speculation, firm data to quantify and explore the possible effects of this debt are lacking.

The article[1] in this issue of the *Journal* by Verstappen and Poole helps to bridge this gap by estimating the magnitude of debt currently taken on by medical students. Their findings suggest that not only is this magnitude significant, it is increasing over time: 46% of medical students graduating from the University of Auckland in 2014 and 2015 reported a student loan of greater than $90,000, whereas in 2006 and 2007 only 12.5% of medical graduates reported a debt of this magnitude.

These figures support the current reality that, for the majority of medical students, it is a necessity of their training that they enter into significant debt. The current annual tuition fee for each of years 2–6 of the medical degree of the University of Auckland is $15,082.80.[2] In addition, access to government-funded student allowances is limited to a select group. Most notably, in 2012 the eligibility criteria for student allowances changed to effectively exclude graduate-entry medical students.[3] Entering into employment during university holidays is an option, but the nature of the course makes part-time employment during semester difficult, particularly in those years with a significant clinical component. It is therefore unrealistic to expect any more than a small minority of medical students to cover their course fees and living costs without entering into debt in order to do so.

As a recent medical graduate, currently paying off a student loan myself, my perspective does include a vested interest. Clearly, for myself and my peers, we would be currently financially better off if we did not have to take on debt as a requirement of medical training.

Putting this perspective aside, there is an argument to be made that it isn't unreasonable to expect medical students to make some form of financial investment in their training. The direct financial impact of having a student loan is not truly felt until after graduation (when repayments generally start), and one could argue that eliminating student debt for medical students would simply amount to a taxpayer-funded financial subsidy for doctors.

It is also worth noting that a government student loan does not function like a "traditional" loan. Since 2006, government student loans have been interest-free for all graduates who remain in New Zealand.[4] (The introduction of this policy does appear to correlate with the findings of Verstappen and Poole:[1] students graduating in 2006 would have spent the majority of medical school believing that their loans would accrue interest on graduation; students graduating in 2015 would not). In addition, repayments are made, not in proportion to the magnitude of the loan, but in proportion to the income of the graduate. So regardless of whether the loan is $10,000 or $100,000, the annual repayment requirement is the same—12% of all income earned over $19,084 per annum.[5] Given the interest-free nature of the loan, there is no incentive to make any further repayment above this minimum amount. The effect of a larger loan, then, is not to make a graduate any financially worse off immediately after graduation, but rather to burden them with repayments for a longer period of time.

So there is a spectrum of perspectives here. It is difficult to argue that the current loan repayment schedule for a medical graduate is excessively onerous (at least on a per annum basis), and ultimately it is a question of personal philosophy as to whether medical student debt is viewed as inherently undesirable.

We must also be cautious, in that not all measures to reduce student debt are

necessarily beneficial to the students in question. Most notably, the "7 EFTS" policy, announced in 2010, threatened to limit access to government student loans to seven years of study.[6] It is easy to envisage this policy reducing the size of the average government student loan—but at the expense of cutting off all governmental financial support to graduate-entry medical students in their later years of study.

However, the sheer magnitude of debt now affecting medical graduates should give us all cause for some degree of alarm. As evidenced in the *Journal* article[1] in question, this is a recent and emerging problem, the effects of which are yet to be fully understood. But it is something of which we should all be cognisant, particularly when it comes to workforce planning.

Although student debt does not have any direct financial impact until after graduation, it is worth considering how the *possibility* of debt can influence medical school applicants. My concern relates to potential applicants from disadvantaged backgrounds, or who would be the first in their family to go to university.

It is relatively easy to argue for the merits of taking on a student loan to an applicant from a privileged background. Yes, you enter into a significant level of debt, but as a pathway into a profession that currently provides reasonable financial security, and with a manageable repayment schedule.

If you have not grown up surrounded by models of financial success, or in an environment with a stable income, the concept of debt may become noticeably more intimidating. Worse still, imagine a bright potential medical school applicant from a disadvantaged background, where debt has played a significant role in creating and perpetuating that disadvantage. It is not implausible that, for this group, the necessity of taking on a debt of potentially six figures, as a requirement of medical training, may be too intimidating—and potentially decisive when considering whether to apply for medical school. Yet this very group is already under-represented in medical school entrants.[7]

Moving along the training pathway, for medical graduates this emerging system carries the implication of entering into an unwritten social contract. Medical students enter into large student loans on the understanding that doing so will be rewarded with eventual financial security. To be fair, even in the absence of student debt, most medical students would probably still expect a stable and well-paying job after graduation. But it is not unreasonable to speculate that this expectation has now heightened, to the extent that some graduates may now feel that they are *owed* such a job. After all, they've made their financial contribution—now it's time to get something back in return. Should workforce pressures result in graduates working in a job different to what they were expecting during medical school, then this unwritten contract could create significant friction.

Of course, this perspective largely ignores the reality that, currently, for every $1 contributed by students towards their training, the taxpayer contributes $3—a social investment that acknowledges the necessity of having well-trained doctors to serve the public good.

Yet this may be precisely the problem. Although there is an absence of local research, it has been speculated previously in the *Journal*[8] that significant medical student debt may reduce altruism among graduates. Verstappen and Poole[1] discuss research from the US, which does support such an association in that context. Certainly it is harder for a medical graduate to appreciate the significant taxpayer investment in their training when they themselves had to pay $15,082.80 for each year of it. How this plays out in career aspirations and attitudes is yet to be seen. However, if increased student debt does truly impair altruism then efforts to encourage graduates to work in underserved communities may be undermined.

There is also the practical aspect of working overseas. Under current student loan rules, if a graduate moves overseas for a period of greater than six months, then they will generally start to accrue interest on their loan.[9] This can become a significant disincentive—and so, the student loan effectively helps to "bond" that graduate to remaining in New Zealand. This is arguably not a bad thing, but what about areas where it is helpful for a doctor in training to work abroad for some period of time before returning to New Zealand? If this is something to be encouraged and valued in certain

contexts, then we must have some awareness of the potential impact of student debt.

Putting all such speculation aside, what can we be sure of? Well, as Verstappen and Poole[1] have demonstrated, medical student debt is increasing and having a significant financial impact on a considerable number of medical graduates. This is an emerging issue that does merit further exploration. But clearly, although the exact effects of such debt are yet to be defined, it is likely to have influence in a number of areas—so we should all be aware of its presence. And, regardless of the justifiability of asking medical students to take on debt, there should be some alarm raised at the rate at which this debt is increasing.

Competing interests:
Nil.

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Haemochromatosis: evaluating the effectiveness of a novel patient self-management approach to venesection as blood donation

Sonam Mishra, Dalice Sim, Peter Flanagan

ABSTRACT

AIM: We set out to evaluate the effectiveness of a new model of self management of haemochromatosis, whereby patients with stable ferritin control were discharged from the New Zealand Blood Service (NZBS) therapeutic venesection clinic and educated to manage their own venesection by regular blood donation and annual serum ferritin check by their general practitioner.

METHOD: Data regarding the frequency of blood donation and serum ferritin level were collected from the NZBS and Concerto records of haemochromatosis patients in the Wellington region who had been discharged back to the care of their general practitioner between January 2014 and June 2015.

RESULTS: Of the 107 patients, 93% continued to donate blood after discharge. A serum ferritin level was checked in 78% of patients by their general practitioner. The mean number of blood donations per year decreased after discharge, with a corresponding rise in the average ferritin level (difference 28 mcg/L; range 13–43 mcg/L; $p<0.005$).

CONCLUSION: The new model of self management was effective for the majority of patients who were discharged from the therapeutic venesection clinic. Longer follow up is required to assess the overall pattern of ferritin control in patients who self manage their haemochromatosis by regular blood donation.

Hereditary haemochromatosis is an autosomal recessive condition in which mutations in the HFE gene (Hereditary Fe [iron] gene) can lead to excessive and dysregulated intestinal iron absorption with progressive iron deposition and injury to multiple organs.[1,2] Although the majority of patients are asymptomatic, left untreated, this disease can cause cirrhosis, endocrine problems such as diabetes, thyroid dysfunction, gonadal dysfunction, cardiac problems, arthritis and other complications.[1–4] Early diagnosis and treatment is important to prevent development of complications.

Treatment of haemochromatosis aims to reduce body iron stores by regular venesection. Once iron stores have been reduced, the goal of maintenance venesection is to avoid iron re-accumulation. There are no controlled trials to support a specific target ferritin level.[2] A target maintenance ferritin level of 50–100mcg/L is recommended by the Best Practice Advocacy Centre (BPAC) of New Zealand,[5] as well as numerous international guideline groups and journals.[2,4–6]

The New Zealand Blood Service (NZBS) provides a therapeutic veneseFlanagan Figure 1ction service for people with haemochromatosis at a number of sites across the country. Patients are referred by their general practitioner or specialist to the NZBS for regular venesection and monitoring of their serum ferritin. The therapeutic venesection clinic is run by medical staff and specialist nurses.

Patients undergo regular venesection following a management guide developed by the NZBS. Initially, patients undergo an induction phase to achieve a target ferritin of 30–50mcg/L. Once this is achieved, patients enter the maintenance phase. This involves regular venesection tailored to ferritin levels. Normally, patients will require venesection every two to four months.

Prior to late 2013, patients would continue to attend the venesection clinic once their serum ferritin reached the target range. Provided they met usual blood donor criteria, patients became 'therapeutic donors' ie, their blood was managed in the same way as standard voluntary donations. They continued to attend the clinic for therapeutic venesection and monitoring of ferritin levels.

The number of patients referred for therapeutic venesection continues to increase. Long-term venesection is required in order to maintain ferritin levels within an acceptable range. In late 2013 the New Zealand Blood Service implemented a new model for the management of haemochromatosis whereby patients who met the eligibility criteria to become blood donors were discharged from the venesection clinic when their serum ferritin reached the target range, and educated to manage their own venesection by regular blood donation and an annual serum ferritin check by their general practitioner.

We set out to evaluate the effectiveness of the new model of patient self-management of haemochromatosis by regular blood donation in the Wellington region. Specifically, we examined patient compliance and control of serum ferritin levels.

Method

Data were collected from the NZBS records of haemochromatosis patients that had been discharged back to the care of their general practitioner between January 2014 and June 2015. These are patients that had received therapeutic venesection via the NZBS and whose iron levels were deemed stable by the discharging doctor or nurse. For the majority of patients, this meant a serum ferritin of less than 100mcg/L. These patients are no longer being actively managed via the therapeutic venesection clinic. They make appointments to donate in the same way as whole blood donors using either the NZBS call centre or online appointment system. They are considered to be 'normal whole blood donors' and can be bled at either mobile or static collection sites.

In order to become normal whole blood donors, patients met the following eligibility criteria:

- Normal liver function tests
    - At least the last two liver function tests were normal if the highest ferritin value was greater than 500mcg/L
    - The last liver function test was normal if the highest ferritin value was less than 500mcg/L
- No documented cirrhosis, cardiac disease or diabetes due to iron overload
- Met the usual criteria for acceptance of blood donors in New Zealand

For each eligible patient, a control period was identified in the 12–36 months prior to discharge from the clinic, to allow comparison of the frequency of venesection and ferritin level before and after discharge from the therapeutic clinic.

In order to allow comparison of maintenance venesection before and after discharge, the following inclusion criteria were used for the study:

- The patient was actively undergoing venesection prior to discharge.
- The patient had been referred to the therapeutic clinic at least 36 months prior to discharge (in order to ensure that the patient was in maintenance rather than induction phase in the control period prior to discharge).
- A ferritin result was available within 12 months prior to the discharge date (to allow comparison between pre- and post-discharge ferritin results).
- At least 12 months of follow up was possible following discharge from the therapeutic clinic.
- The patient was discharged to their general practitioner (not to a specialist haematology service).
- The patient's NZBS medical file was available for review.

Data collection

For each patient, the number of blood donations (including all therapeutic venesections) during the control period and the post-discharge period was obtained using the New Zealand Blood Service "eProgesa" database. The average number of donations per year in each period was then calculated.

Serum ferritin results at the beginning and end of the control period were obtained from the patient files. The serum ferritin result after discharge was obtained via the electronic Concerto "Regional Lab Results". If a result was not available on this electronic system, the patient's GP practice was contacted. For patients who did not have a follow-up ferritin result, the GP practice was asked whether the patient was an enrolled patient and whether the patient was on a recall system to have an annual ferritin check.

The model was identified as "successful" for those patients who continued to donate after discharge and who also had their ferritin checked. The model was identified as "partially successful" for patients who either continued to donate but did not have their ferritin checked, or did not donate but had their ferritin checked. The model was identified as "failure" for patients who did not donate after discharge and did not have their ferritin checked.

One hundred and seventy patients were initially identified from the NZBS records, 63 patients did not meet the inclusion criteria, leaving a study group of 107 patients.

Statistical analysis

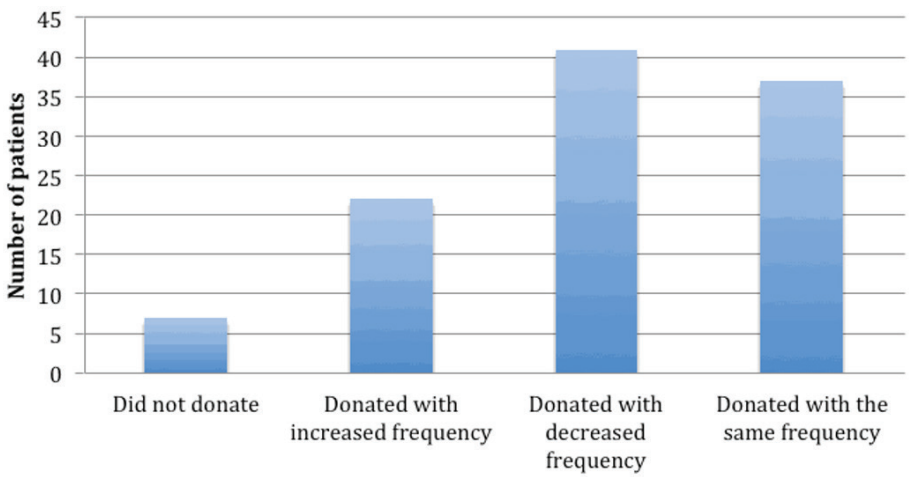
SPSS version 22 was used to compare ferritin levels, numbers of donations per year and follow-up period in the time intervals: from beginning of control period to end of control period, and from end of control period to the most recent evaluation. Mean values were compared using both paired t tests (which assume normally distributed data) and Wilcoxon rank sum tests (which do not). The results were the same, and so only the t test results are reported here. The level of ferritin control was also compared between time points by defining the subjects as being <100mcg/L, 100–200mcg/L, or 200–500mcg/L. To compare the subjects grouped ferritin results over time, the McNemar-Bowker extension of McNemar's test was used. This statistic is a chi-squared statistic, which tests whether there is a consistent trend over time, with subjects moving either to a higher or a lower group.

Results

Of the 107 patients included in the study, 81 patients were male (76%) and 26 patients were female (24%). The average patient age was 54 years. The average duration of follow up was 25 months in the control period, and 28 months in the post-discharge period.

Of the 107 patients, 100 patients (93%) continued to donate blood after discharge. Seven patients (7%) did not donate blood after discharge. Twenty-two patients (21%) continued to donate at an increased frequency compared to donations in the control period. Forty-one patients (38%) continued to donate at a decreased frequency compared to the control period. Thirty-seven patients (35%) did not change their frequency of donations in the two periods (Figure 1).

Figure 1: Donations after discharge from therapeutic clinic.



Follow-up ferritin

Of the 107 patients, 83 patients (78%) had a follow-up serum ferritin level checked after discharge from the therapeutic venesection clinic. Twenty-four patients (22%) did not have a serum ferritin level checked. Of the 24 patients who did not have a follow up ferritin checked, 20 patients (83%) were not on a recall system at their GP practice. Four patients were on a recall system (17%), however, they did not attend to have their blood test despite being sent reminders.

New model success or failure?

The new model was identified as "successful" for 76 patients (71%) as they continued to donate after discharge and had their ferritin checked. The model was identified as "partially successful" for 31 patients (29%). Twenty-four patients (22%) continued to donate and did not have their ferritin checked. Seven patients (7%) did not donate, however, they did have their ferritin checked.

No patient failed to both donate and have his or her ferritin checked; therefore, the model was not identified as a "failure" for any patient.

Comparison of serum ferritin level and frequency of blood donations during the therapeutic venesection programme versus after discharge

Figure 2 shows that at the beginning of the control period, 89 patients (83%) had a serum ferritin of <100mcg/L, 16 patients (15%) had a serum ferritin of 100–200mcg/L and two patients (2%) had a serum ferritin of 200–500mcg/L. No patient had a serum ferritin of >500mcg/L.

At the end of the control period, that is, at the time of discharge from the therapeutic venesection clinic, 77 patients (72%) had a serum ferritin of <100mcg/L, 27 patients (25%) had a serum ferritin of 100–200mcg/L and three patients (3%) had a serum ferritin of 200–500mcg/L (Figure 3). No patient had a serum ferritin of >500mcg/L.

At the follow-up point after discharge, 24 patients (22%) had not had their ferritin checked (Figure 3). Of the patients who did have their ferritin checked, 47 patients (57%) had a serum ferritin of <100mcg/L, 27 patients (33%) had a serum ferritin of 100–200mcg/L and nine patients (11%) had a serum ferritin of 200–500mcg/L. No patient had a serum ferritin of >500mcg/L.

Table 1 outlines the serum ferritin level and average number of donations per year during attendance at the therapeutic venesection clinic (control period) and after discharge from the clinic. The serum ferritin level measured after discharge was significantly higher on average than the serum ferritin level at the end of the clinic (mean difference 28mcg/L, 95% confidence interval 13–43mcg/L, $p<0.0005$). Additionally, the average number of donations per year was lower after discharge than before discharge (difference of 0.6 donations per year, 95% confidence interval 0.3–0.8, $p<0.0005$). The follow-up times were longer after discharge than pre-discharge (difference of three months, 95% confidence interval 2.0–3.9, $p<0.0005$). Equivalent results were found when using the Wilcoxon test ($p<0.0005$).

Figure 2: Serum ferritin value at the beginning and end of the control period, and post discharge.

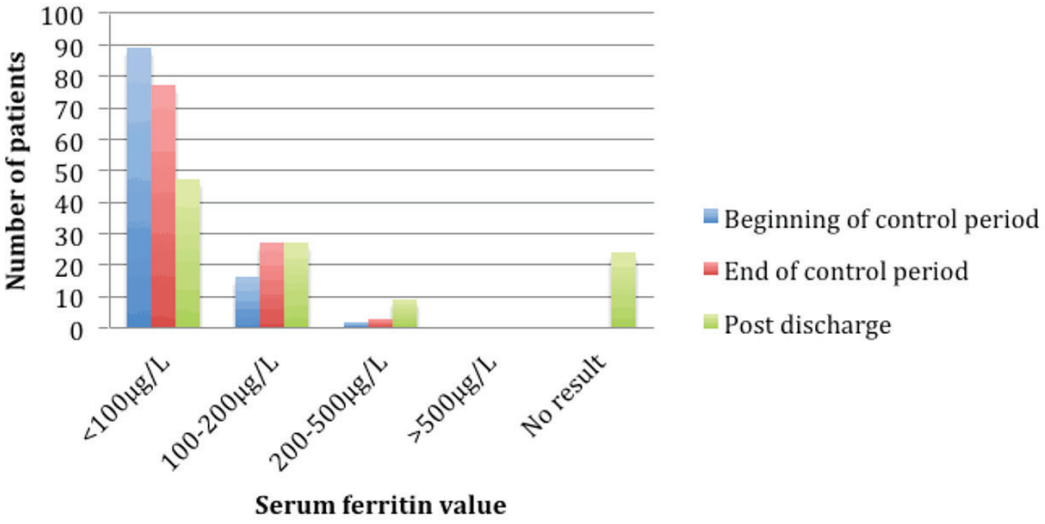


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Table 1: Comparison of serum ferritin level, number of donations and duration of follow up during the control period and the post-discharge period.

	Mean	Std. Dev	Median	Minimum	Maximum	Comparison between control period and post-discharge period
Ferritin result at end of control period (mcg/L)	79	49	65	11	249	Mean difference: -28 95% CI: -43 to -13 P<0.0005
Ferritin result after discharge (mcg/L)	106	76	91	15	337	
Average number of donations per year during control period	3	1.3	3	.5	6.5	Mean difference: 0.6 95% CI: 0.3 to 0.8 P<0.0005
Average number of donations per year: From discharge date to June 2016	2.5	1.2	2.6	.0	4.3	
Duration of control period (months)	25	4.7	25	8	39	Mean difference: -3.0 95% CI: -3.9 to -2.0 P<0.0005
Duration of follow-up period after discharge (months)	28	2.6	29	15	36	

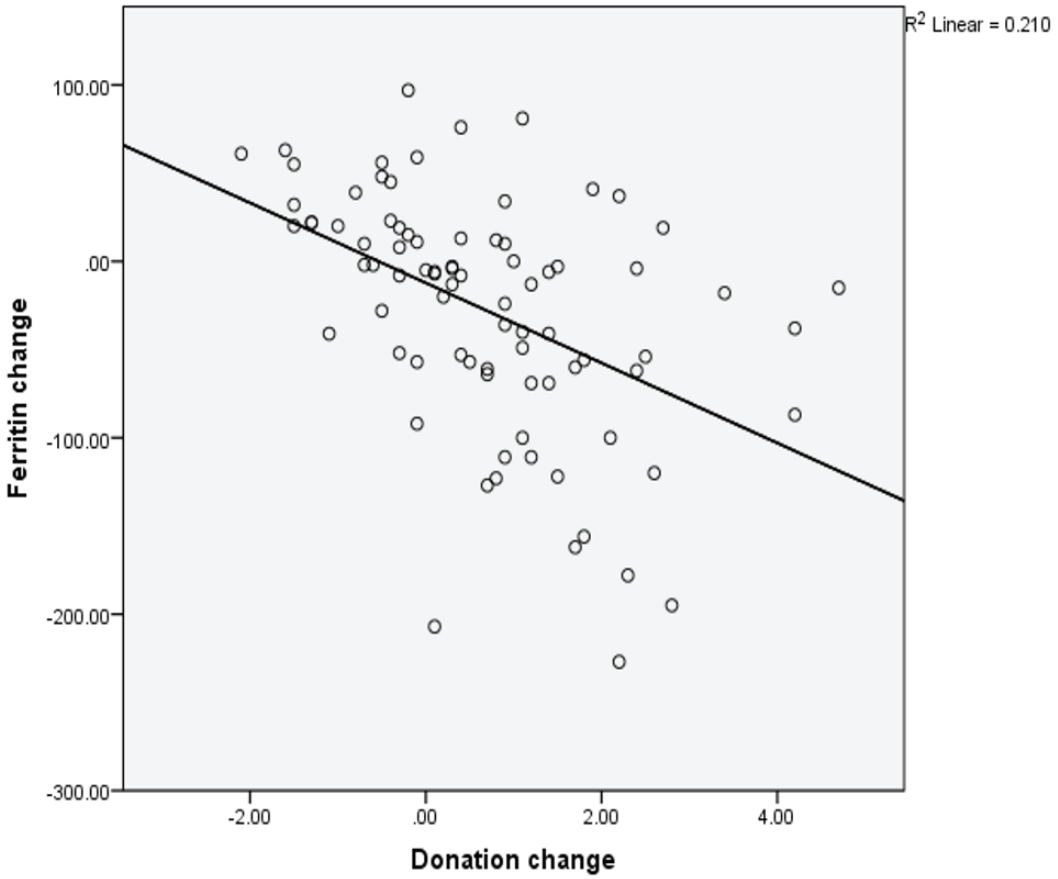
Table 2 compares the serum ferritin level over time. The serum ferritin level after discharge was more likely to be in a higher group than the ferritin level at the end of the venesection clinic (p=0.005).

Figure 3 examines the relationship between changes in serum ferritin level and changes in the number of donations. The change in ferritin level was negatively correlated with the change in the number of donations (p<0.0005).

Table 2: Comparison of change in serum ferritin level over time.

			Ferritin result post discharge (mcg/L)			Total
			200–499	100–199	<100	
Ferritin result at the end of control period (mcg/L)	<100	Count	41	18	3	62
		% of Total	49.4%	21.7%	3.6%	74.7%
	100–199	Count	5	8	5	18
		% of Total	6.0%	9.6%	6.0%	21.7%
	200–499	Count	0	1	2	3
		% of Total	0.0%	1.2%	2.4%	3.6%
Total		Count	46	27	10	83
		% of Total	55.4%	32.5%	12.0%	100.0%

Figure 3: Relationship between the change in the number of donations and the change in ferritin (mcg/L).



Discussion

This study showed that after discharge from the NZBS therapeutic venesection clinic, 93% of haemochromatosis patients continued to donate blood. Seventy-eight percent of patients had a follow up serum ferritin level checked. Of the patients that did not have a follow up serum ferritin level checked, 83% were not on a recall system by their general practice.

Based on our criteria of ongoing blood donation and monitoring of serum ferritin after discharge from the therapeutic venesection clinic, the new model of patient self management was successful for the majority (71%) of patients who were eligible for the scheme. Twenty nine percent of patients were partially successful, in that they either continued to donate or had their serum ferritin level checked. No patient failed to achieve at least one of the criteria.

The mean number of blood donations after discharge from the venesection clinic was lower than that during the maintenance phase when patients were attending the clinic.

Several factors are likely to affect donation frequency and serum ferritin control after discharge from the therapeutic venesection clinic. As the patient no longer receives appointment times for venesection after discharge, it becomes his or her responsibility to remember to attend to donate blood. Furthermore, as blood tests to monitor serum ferritin are no longer performed at the blood donor centre after discharge, it becomes the patient's responsibility to attend the community laboratory for a blood test, and also to liaise with his or her general practitioner regarding serum ferritin control.

The period of monitoring of patients in the self-management phase was relatively short and it is probably too early to assess the overall effectiveness of the new model. In particular it will be important to evaluate the overall pattern of ferritin levels over a longer period to ensure that patients are able to modify donation frequency based

on the trend in ferritin level. Ferritin levels may have increased in many patients during the period of monitoring but it is reassuring to see that in no patient did this increase to more than 500 mcg/L.

The number of blood donations may also be influenced by factors that are outside of patient control. For example, patients may present to donate but be deferred due to various health reasons. A short-term deferral is unlikely to have significant consequences for overall control of ferritin levels. However, patients developing criteria that will lead to longer or permanent deferrals may need to be referred back to the clinic for ongoing venesection.

This study was limited by its retrospective design, and the control and follow-up period for each patient was variable. Additionally, not all patient files were available. Further, the follow-up time was short, as the new model was implemented two and a half years ago. Nonetheless it showed that many patients continued to donate after discharge from the therapeutic venesection clinic, albeit with decreased frequency.

When patients are discharged from the therapeutic venesection clinic they receive a letter outlining the ongoing need to donate and have their ferritin checked. Compliance might be improved if clearer written instructions are given to them outlining the transition of responsibility to the patient to donate blood as a method of self management of their haemochromatosis.

For patients who do not donate blood in a 12-month period, reminder letters or phone calls via the New Zealand Blood Service may also improve compliance. Systems are now being developed to ensure that this occurs.

Twenty-two percent of patients in the study failed to have their serum ferritin level monitored after discharge. Further steps could be taken to increase follow-up rates, such as reminders from more general practices for patients to have a follow-up serum ferritin level checked annually. Furthermore, on discharge from the therapeutic clinic, clear recommendations for patients to have their own reminder system, for example, using a calendar on their phone may be useful.

This study also highlighted that some patients were discharged from the therapeutic clinic with serum ferritin levels exceeding 100mcg/L. This is not consistent with the clinical protocols developed for the new model. The therapeutic venesection clinic provides an opportunity for frequent venesection with close monitoring, and further attempt should be made to reduce iron stores in these patients prior to discharge.

Competing interests:
Nil.

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Audit of *Trichomonas vaginalis* test requesting by community referrers after a change from culture to molecular testing, including a cost analysis

Liselle Bissessor, Janet Wilson, Gary McAuliffe, Arlo Upton

ABSTRACT

AIMS: *Trichomonas vaginalis* (TV) prevalence varies among different communities and peoples. The availability of robust molecular platforms for the detection of TV has advanced diagnosis; however, molecular tests are more costly than phenotypic methodologies, and testing all urogenital samples is costly. We recently replaced culture methods with the Aptima *Trichomonas vaginalis* nucleic acid amplification test on specific request and as reflex testing by the laboratory, and have audited this change.

METHODS: Data were collected from August 2015 (microbroth culture and microscopy) and August 2016 (Aptima TV assay) including referrer, testing volumes, results and test cost estimates.

RESULTS: In August 2015, 10,299 vaginal swabs, and in August 2016, 2,189 specimens (urogenital swabs and urines), were tested. The positivity rate went from 0.9% to 5.3%, and overall more TV infections were detected in 2016. The number needed to test and cost for one positive TV result respectively was 111 and $902.55 in 2015, and 19 and $368.92 in 2016. Request volumes and positivity rates differed among referrers.

CONCLUSIONS: The methodology change was associated with higher overall detection of TV, and reductions in the numbers needed to test/cost for one TV diagnosis. Our audit suggests that there is room for improvement with TV test requesting in our community.

Trichomonas vaginalis (TV) is a globally important sexually transmitted infection responsible for an estimated 250 million new infections annually; more than those attributable to *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) combined.[1] Infections are more commonly detected in women than men. Clinical manifestations of this parasitic infection range from asymptomatic carriage through to vaginitis and pelvic inflammatory disease.[2] Infection may also lead to serious reproductive health outcomes, including pregnancy complications, pelvic inflammatory disease and infertility. Infection is also associated with an increased risk of HIV transmission in both males and females.[3]

Labtests is the sole community laboratory in Auckland, New Zealand, and provides community (outpatient) testing for a population of approximately 1.5 million. Here, we present data of an audit of changes to our TV diagnostics.

Methods

In April 2016 we moved from testing for TV using micro-titre broth culture to performing a nucleic acid amplification test using the Aptima *Trichomonas vaginalis* (ATV) assay for the detection of TV-specific 18S rRNA on the Hologic Panther system (Hologic, San Diego, CA), as the laboratory had changed to the Aptima assay for CT/NG

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detection, a singleplex assay. Nucleic acid amplification tests such as the ATV assay are significantly more sensitive than other methods of testing for TV.[2] Before April 2016, culture was performed on all vaginal swabs received from female patients aged 13–60 years and on TV specimens from males if requested.

Prior to introducing the ATV assay, referrers were provided with education on the epidemiology of TV in Auckland with prevalence rates of 424/100,000 and 21/100,000 population among females and males, respectively (unpublished data), with significant differences among genders, ethnicities and socio-economic groups. For females, prevalence rates peaked at 15–29 years (1,622/100,000), while for males prevalence rates peaked later at 30–39 years (109/100,000). These data also demonstrated the superior sensitivity of the Aptima assay compared with culture for detection of TV; where both tests were performed, culture was positive in only 48% of cases that were positive for TV by Aptima. Referrers were consulted on the change from routine culture to ATV testing, and after feedback the laboratory protocol was changed to ATV testing only in the following circumstances: 1) TV specifically requested on the laboratory request form; 2) specimens received from urogenital sites of females aged 13–17 years old; and 3) specimens found to be positive for *Chlamydia trachomatis* (CT) and/or *Neisseria gonorrhoeae* (NG) (reflex testing). The second and third criteria were added after consultation with referrers and at the request of a number of practitioners who work in high-risk areas of Auckland, including high schools.

Data for TV detection in our laboratory for the months of August 2015 and August 2016 were collected from the laboratory information system, including patient age, gender, unique identifying number, laboratory number, referrer and results of CT, NG and TV testing. In August 2015, TV testing was by micro-broth culture (TYM Trichomonas broth, Fort Richard Laboratories, Auckland) incubated in O_2 at 35°C and examined by microscopy at 24 hours for the presence of motile trichomonads.

The Aptima Combo 2 (AC2) assay was used for the detection of CT-specific 23S rRNA, NG-specific 16S rRNA and the ATV assay for the detection of TV-specific 18S rRNA. All testing was performed on one of three Panther systems according to the package inserts. In order to perform a cost analysis, the current price charged to the public funder (Auckland Regional District Health Boards) of the ATV was used ($19.55). As there was no price for standalone TV culture, we estimated that the cost attributable to TV culture and microscopy was used ($8.15). All prices are in New Zealand dollars. Positivity rates and total number of requests per referrer were used to estimate possible over- and under-requesting of TV testing. As this was an audit of referrer TV requesting and laboratory processes, no formal ethics approval was sought in accordance with the New Zealand Ethics Committee guidelines.

Results

In August 2015, 10,299 specimens were cultured for TV. Almost all (10,273, 99.7%) specimens were from females; the median age was 30 years (range 13–60). Of the 10,299 specimens tested, 93 (0.9%) specimens from 93 patients were positive. In August 2016, 2,189 specimens were tested by the Aptima; 1,922 patients were female (88%) and the median age was 21 years (range 6–77). Of the 2,189 specimens tested, 116 (5.3%) specimens from 116 patients were positive. Of the 2,189 specimens tested by ATV, 740 (33.8%) were on request, 816 (37.3%) were reflex tests and 577 (26.4%) were tested because of female gender and age (13–17 years).

Of the 2,189 tested by the Aptima in August 2016, 348 (15.9%) of the specimens were urine; 268 from males and 80 from females. Of the urine samples from males, five (1.5%) were positive, and of the urine samples from females, seven (8.8%) were positive for TV.

Specimens with a specific request for TV were received from 740 referrers; the median number of tests per referrer was 1 (range = 1–65). Positivity rates for referrers ranged from 0% to 100% with a median of 0%. Some examples of apparent misalignment between requesting and rates

of TV identified include a family planning clinic and a general practice where relatively high numbers of requests (16 and 29 requests, respectively) were associated with no positive results. In contrast, a family planning clinic in an area of Auckland where TV prevalence is expected to be relatively high (based on population demographics), only 10 tests were requested in August 2016, with a positivity rate of 20%. Similarly, a female correctional facility requested TV testing on 12 patients, and had a 50% positivity rate.

We performed a cost analysis to compare the cost per positive for culture and ATV (Table 1).

In August 2015, the total cost of samples tested by culture was calculated to be $83,936.85, with a cost per positive result of $902.55. In August 2016, the total cost for ATV was $42,794.95, with a cost per positive result to $368.92. Reflex testing was most cost-effective with a cost per positive result of $332.35. We also estimated the numbers needed to test for one positive result; for culture the NNT was 111, compared with 19 for ATV. Routine testing for specimens collected from females in aged 13–17 years was not as effective as reflex testing of CT/NG positive samples from both females and males (Table 1).

Discussion

The Centers for Disease Control STI Guidelines recommend testing symptomatic women for TV.[4] In addition, they recommend asymptomatic screening on patients who are at risk (based on history) or are receiving care in a high-prevalence setting. They also comment that "decisions about screening might be informed by local epidemiology". However, it is noted that the epidemiology of TV in the US differs from that in New Zealand, with high rates (>10%) reported among socio-economically deprived African-Americans, and peaking in older patients, compared with CT/NG.[1] The epidemiology of TV infection in New Zealand has not been well studied. Using culture for diagnosis, 2.2% of women attending Auckland Regional Sexual Health Clinic were positive.[5]

Prior to the introduction of ATV testing we were testing for TV by culture, by a labour intensive and time-consuming method, in a largely indiscriminate fashion on all females aged 13–60 years who had a vaginal swab collected. It is probable that we were culturing TV on specimens from many asymptomatic women with no or minimal risk factors, and we were testing almost no males. Routine screening is not indicated by our epidemiology (unpublished data), and would be expensive using molecular

Table 1: Price (New Zealand dollars) and number needed to test per positive for different approaches to testing for *Trichomonas vaginalis* (TV).

	Culture	ATV[1] (all specimens)	TV[2] request	TV reflex on basis positive CT/NG	TV on 13–17 year old females
Total specimens tested	10,299	2,189	740	816	577
Price per specimen	$8.15	$19.55	$19.55	$19.55	$19.55
Total cost	$83,936.85	$42,794.95	$14,467.00	$15,952.80	$11,280.35
Number positive	93	116	39	48	22
Percentage positive	0.9%	5.3%	5.3%	5.9%	3.8%
Cost per positive	$902.55	$368.92	$370.95	$332.35	$512.74
NNT[3] per positive	110.7	18.9	19.0	11.4	26.2

[1]ATV, Aptima *Trachomonas vaginalis* assay; [2]TV, *Trichomonas vaginalis*; [3]NNT, Numbers needed to test.

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technology, and so the laboratory relies on referrers to identify patients in whom TV testing is indicated by either clinical presentation or risk factors. Changing our methodology to the ATV assay, with its superior sensitivity and turn-around times,[6] has allowed us to improve efficiencies in the laboratory by testing fewer samples but detecting a greater number of TV infections overall. While these data indicate a cost saving to the laboratory, we expect that over time numbers of requests will increase as the change in approach is embedded among referrers.

A limitation of this audit is that we did perform reflex (on basis of positive CT and/or NG) and on-request testing on specimens from males, for which the assay does not have a label. Review of our data indicate that positivity rates for urines from males are low and we plan to review this practice; however, we will continue to test urethral swabs from males. In addition, we will be reviewing our routine testing for TV on all specimens received from females aged 13–17 years.

These data suggest possible over- and under-requesting by referrers, resulting in inefficiencies in resource allocation and barriers to testing and treatment for some at-risk patients. We will continue to engage with our referrers to improve the quality of this vital pre-analytical step; appropriate test selection.

Competing interests:
Nil.

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Rising levels of New Zealand medical student debt

Antonia Verstappen, Phillippa Poole

ABSTRACT

AIM: There is little recent data on the debt levels accrued by New Zealand medical graduates. We aimed to quantify the level of student loan debt accrued by medical graduates upon completion of their medical degree, and to investigate the association of New Zealand Government Student Loan (GSL) debt with gender and age.

METHODS: At graduation each year from 2006–2015, students from one New Zealand medical programme were invited to complete a career intention survey that included information on levels of GSL debt and the number of income sources used.

RESULTS: The overall response rate was 83.8%. On average, 92% of domestic students reported having some student loan debt, with 28% a debt of $90,000 or more. The proportion of students reporting a student loan debt of $90,000 or more increased over the period of the study (P<0.0001). While older students were more likely to have a larger student loan debt than younger students, there was no difference in debt levels by gender. Students with larger student loans were more likely to rely on a larger number of financial sources to fund their studies.

CONCLUSIONS: New Zealand medical students are carrying higher levels of student loan debt year on year. The effect of this on the future medical workforce is not certain; however, this could be negative if graduates choose to enter careers that are more highly paid over areas of high need. The full impact of large loans on individuals and the health system will take years to determine.

Medical students, like other tertiary students in New Zealand, contribute around a quarter of the full cost of their tuition. There are two medical programmes in New Zealand, based in Auckland and Otago, which are of six years duration. Both admit school leavers as well as about a third with a prior degree. In 2016, the annual fee for a full-time New Zealand citizen or resident (domestic) student in years two to six of the medical programme at the University of Auckland was $14,787.60.[1] Domestic students in year six are eligible for a stipend of $26,756, in acknowledgment of their contribution to health care delivery.[2] Annual course fee increases have typically been 4% per annum, although the maximum allowable increase is to be 3% per annum from 2016.[3]

For domestic students, New Zealand Government student loans (GSLs) may be used to cover compulsory student fees, course-related costs up to the value of $1,000, and living costs up to $176.86 per week. From 2005, GSLs have attracted no interest unless a student is overseas for six months or more. Loan repayment begins with paid employment. From 2011, the Government introduced changes to GSLs so that students could borrow for no more than seven equivalent full-time student years (EFTS).[4] This was relaxed slightly in 2015 for medical students with a prior degree who became limited to eight EFTS.[5] This would cover a bachelor's degree and a further five years of medical study.

Concerns have been expressed as to how debts accrued by medical students impact on individuals and their careers. In 2001, New Zealand medical students estimated their average student loan debt was between $60,000 and $70,000, with significant positive correlations between the predicted debt size and future medical career intentions, specifically an intention to practise medicine overseas.[6,7,8] The actual debt level was not quantified in that study. Another New Zealand study found 55% of doctors in their first year of medical practice post-graduation (PGY1) considering leaving

the country due to student loan debt, and 43% reported student debt influencing their choice of specialty.[9] Debt may also impact on individual wellbeing, with large proportions of New Zealand medical students reporting that they experience worry as a result of their student debt.[7] In 2008, Auckland medical graduates reported the average burden of GSL (but not total debt), was $63,880 for students with a student loan, with 33% having a GSL debt over $75,000.[10] In contrast to other studies, debt was not reported by them to be a major factor in career intentions.

There is limited international evidence regarding influence of debt on student career choices. Several studies show that a preference for general practice is more likely to be associated with smaller medical student debts.[11,12,13] However, much of this evidence comes from the US, where student debt levels are higher, with less evidence from comparable health and education systems, such as the UK and Australia.

The present study seeks to update the New Zealand situation on medical student debt, with aims to:

- describe the patterns of debt of New Zealand medical students over the past decade;
- analyse whether demographic factors such as age and gender are associated with the size of GSL.

Methods

Since 2006, all medical students at the University of Auckland have been invited to participate in the Tracking Health Professional Students and Graduates Project (TP).[14] The purpose of the TP is to support the development of an appropriate range of health care professionals for New Zealand's health needs through informing curriculum and workforce planners regarding career trends and factors important in career choice. Ethics approval for the study was granted from the University of Auckland Human Participant Ethics Committee in 2006 and remains current.

The questionnaire for medical students at the end of their programme is comprised principally of questions around anticipated future career intentions and investigates factors that may influence those career decisions, including levels of student debt. Students indicate their GSL debt at the time of the survey by selecting from a table arranged in $15,000 increments. Furthermore, they indicate what financial sources they had accessed from a given list, but not the amount for sources other than GSL. All data were anonymised prior to analysis. Individual cohort years and ages were combined into larger categories to reduce the chance of individual student identification, and to simplify the analysis. Continuous data were compared with a single factor ANOVA test and categorical variables by Chi Square.

Results

Response rate

The average response rate for surveys conducted between 2006 and 2015 was 83.8% (n=1,353). Of these, international students (10.8%, or 146) were excluded, as they are not eligible to apply for a New Zealand GSL. Another 19 students did not provide details of their residency status and were excluded from the analysis. This study is based on the responses of 1,188 New Zealand domestic medical students who answered at least some of the debt question.

Size of Government Student Loan

Overall, 1,169 students reported their level of GSL debt at graduation. Of these, 1,088 had any GSL debt (93%), with a further 81 students indicating they had no debt (7%). Over 27% of students had a GSL of $90,000 or more, with over 80% having a loan of $30,000 or more. The number of students in each GSL debt category, by years, is shown in Table 1.

The proportion of students reporting no GSL debt showed a downwards trend from 2006–2007 (13%) to 2014–2015 (5%), while the percentage of students reporting a balance of more than $90,000 increased over this time period from 12.5% to 46% ($P<0.0001$).

Using the centre amount of each loan category as an estimate, and assigning $100,000 for the top category, the mean GSL loan size over the decade was $64,677 (all students). For those reporting any loan, it was $69,492. The mean GSL debt for all students (including those with no debt) increased from $57,359 in 2006–7 to $76,198

Table 1: Number of students in GSL categories, by years.

Years	Total	$0	$1–$14,999	$15,000–$29,999	$30,000–$44,999	$45,000–$59,999	$60,000–$74,999	$75,000–$89,999	$90,000 or more
2006–2007	160	21	3	8	9	33	36	30	20
2008–2009	221	16	16	13	17	27	48	46	38
2010–2011	236	14	27	18	25	29	49	33	41
2012–2013	262	16	16	14	14	27	36	50	89
2014–2015	290	14	6	14	11	25	31	56	133
Total (%)	1,169 (100%)	81 (7%)	68 (6%)	67 (6%)	76 (7%)	141 (12%)	200 (17%)	215 (18%)	321 (27%)

in 2014–15. The mean loan size for those with a GSL increased from $66,025 (139 students) to $80,063 (276 students) over the same time period.

Sources of income

Students indicated whether or not they had used income from any of the following eight sources during their study: GSL; paid employment; personal loan; savings/trust fund; scholarship; family support; partner support or other. There was no increase in the number of sources used over time; however, there was a positive relationship between the number of financial sources and GSL debt (P<0.0001sf ANOVA). The group with the highest debt level accessed an average of 3.5 sources, which was higher than for those with no or low GSL debt (2.4).

Table 2 demonstrates the number of students accessing each income source during their programme, by category of GSL debt at graduation, along with the proportion of students within each GSL category who accessed each income source.

Over 40% of students in each category reported paid employment, with a non-significant trend upwards at higher debt levels. Over 60% of students in each category had parents/family support (P=0.446). On the other hand, there was significant positive relationship of debt level with having a personal loan (P=0.018) and inverse relationship with savings/trust fund (P=0.007).

Gender

Overall, 1,165 students provided information on their gender as well as their GSL debt, of whom 56% were female and 44% male. There was no difference in pattern of GSL debt by gender (P=0.17) (see Table 3).

Age

Overall, 1,162 students provided information on their age and their GSL debt. Figure 1 shows the proportion of students in each age bracket at each level of loan. Older students are more likely to have a larger GSL debt than younger students (P<0.0001).

Table 2: Number (proportion) of students using each income source, by student loan debt.

Income source	$0	$1–14,999	$15,000–$29,999	$30,000–$44,999	$45,000–$59,999	$60,000–$74,999	$75,000–$89,999	$90,000 or more
Parents/family support	70 (86.4%)	42 (61.8%)	41 (61.2%)	62 (81.6%)	99 (70.2%)	133 (66.5%)	154 (71.6%)	215 (67%)
Student allowance/ government assistance	17 (21.0%)	51 (75%)	37 (55.2%)	42 (55.3%)	84 (59.6%)	100 (50%)	101 (47%)	160 (49.8%)
Paid employment	35 (43.2%)	32 (47.1%)	40 (59.7%)	47 (61.8%)	81 (57.4%)	129 (64.5%)	139 (64.6%)	221 (68.8%)
Partner	5 (6.2%)	2 (2.9%)	3 (4.5%)	7 (9.2%)	16 (11.3%)	16 (8%)	21 (9.8%)	24 (7.5%)
Savings/trust fund	28 (34.6%)	8 (11.8%)	18 (26.9%)	19 (25%)	45 (31.9%)	62 (31%)	51 (23.7%)	59 (18.4%)
Scholarship	36 (44.4%)	52 (76.5%)	47 (70.1%)	42 (55.3%)	73 (51.8%)	91 (45.5%)	73 (34%)	120 (37.4%)
Personal loan*	1 (3.3%)	0	5 (17.9%)	2 (8%)	5 (9.6%)	7 (10.4%)	5 (4.7%)	39 (17.6%)
Other	2 (2.5%)	2 (2.9%)	0	3 (3.9%)	6 (4.3%)	6 (3%)	12 (5.6%)	10 (3.1%)

*This was only asked for years 2012 onwards.

Table 3: Student loan balance by gender (% of gender cohort).

Gender	$0	$1–$14,999	$15,000–$29,999	$30,000–$44,999	$45,000–$59,999	$60,000–$74,999	$75,000–$89,999	$90,000 or more
Female	6.3	6.4	5.7	6.7	14.7	17.1	18.0	25.0
Male	7.8	5.1	5.9	6.3	8.8	17.2	18.6	30.3

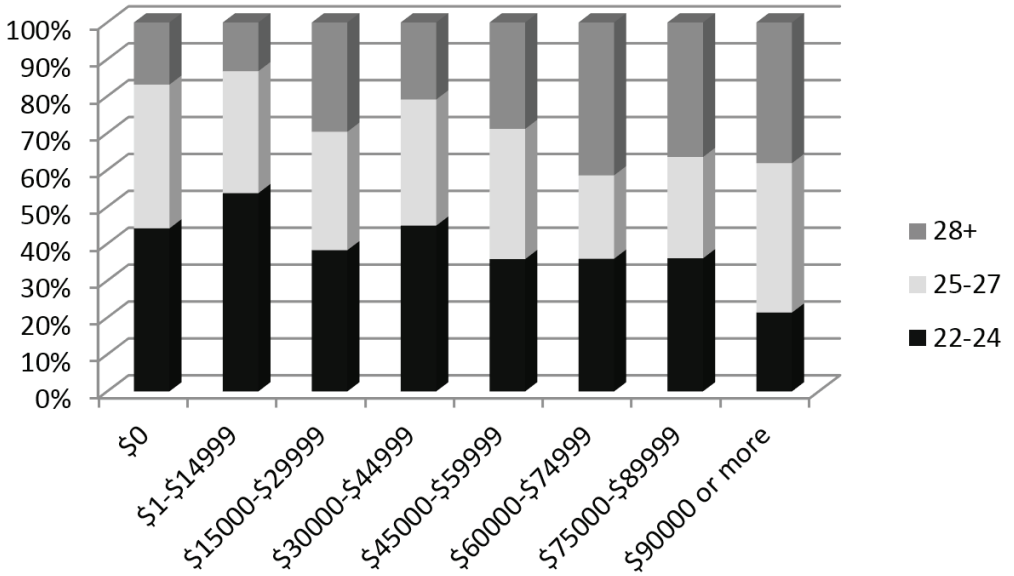
Discussion

Medical training is expensive, both to taxpayers and to students. The longitudinal career intentions project at the University of Auckland has enabled real-time tracking of self-reported medical student debt at graduation since 2006. Trends since this time show mean GSL debt increasing by nearly $20,000 over the decade; fewer students with no GSL debt; and over four times the proportion of recent graduating cohorts owing more than $90,000 at graduation than in 2006–2007. Nearly half of the most recent domestic graduates have accrued a debt from their GSL alone of over $90,000.

Further, we confirmed an association between the number of sources of financial support accessed by medical students and their debt levels. On average, the group with the highest debt obtained financial support from 3.5 other sources, including employment. We also found an association between the types of income sources accessed by students during their course of study, and their GSL debt. Students with no GSL debt were more likely to have access to savings or a trust fund to fund their studies than students with high GSL debt, and students with high GSL debt were more likely to take out personal loans or tended to be in paid employment. This suggests that the reality for the majority of current medical students is managing a range of debts and employment, in addition to their study.

While it is not possible to determine the reasons, increasing student debt levels will be partially due to yearly increases in student fees at the maximum allowable 4% per annum. Other factors might be increased living costs in Auckland, reduced opportunities for part-time employment, erosion of buying power of other income sources, increased course costs, such as having to travel further for clinical placements, or changes in borrowing behaviour by students.

Figure 1: Age distribution at each level of loan.



The burden of GSL debt falls more on older students, which may not be surprising given they are likely to have had more years of tertiary study, during which to accrue a loan. Recently, a cap on years of study during which a student may apply for a GSL was introduced. For those students already with a master's or PhD, a consequence is they will have to access other sources of income, which may come at higher cost than a GSL.

High debt levels may impact upon the future medical workforce. The extent to which the size of loan will affect where a student chooses to work, and their specialty, is not able to be determined from this study, nor is the personal impact of these loans. Yet, medical graduates in the US have a median debt of around $US170,000, with those with higher debts reporting higher levels of stress and delay starting a family.[13] Students with high debt felt more callous to others and less likely to work in under-served locations.[13] It is not unreasonable to believe this may also apply in New Zealand.

Yet past New Zealand medical students reported little influence of debt on future specialty,[10] which may reflect adequacy of salary across all specialties, or that the reality of the impact of a large loan had yet to materialise. Others have indicated debt would drive a decision to head overseas.[9] Since these earlier studies, the rate of New Zealand medical graduates seeking work overseas has plummeted. This is mainly due to more limited work opportunities, but it may reflect loan conditions, which become more stringent if graduates travel offshore. Almost all New Zealand doctors work in the public sector for at least the first two years after graduation, with public system salary commensurate more with work conditions and seniority, not necessarily specialty. Starting salaries range from $70,000 to $116,000, depending on hours worked,[15] with first year jobs largely guaranteed, at least for now. Having a high GSL will inevitably impact on the capacity to buy a house, especially in Auckland where mean prices approach $1 million,[16] and may make practice in smaller centres more desirable.

It is well-established that, on average, men and women doctors have different career trajectories, with women more likely to participate in part-time medical practice, take time out of practice to have a family or work in less procedural areas of medical practice,[17,18] all of which may impact on earnings and capacity to pay back debts. In contrast to an earlier study which found lower levels of GSL debt in women than in men,[10] the present study found no difference in loan size by gender. At one level this is reassuring; however, when one considers female doctors on average have less earning capacity over a working lifetime,[19] this is potentially inequitable. Priorities for future studies are to look at the influence of debt for those individuals with the highest debt levels, particularly by gender and age, over the longer term.

The high response rates and internal consistency seen both in the relationship of debt with debt sources and in debt patterns over different cohorts of students over time, suggest the findings are robust. In 2000,[6] Auckland medical students anticipated that their total debt from all sources would be between $60,000 and $70,000. This was close to the actual levels of GSL debt alone in the early cohorts in our study, but not the latter ones, which are higher. On balance, we believe our findings and conclusions may be conservative, as only GSL debt was quantified, and because the top category was open-ended at >$90,000. To be absolutely certain of the true GSL debt levels would require information from the New Zealand Inland Revenue Department, but this would not take into account all debt.

As class sizes have nearly doubled in the study period, the study raises concerns that well over a hundred medical graduates each year from this medical programme alone will be a taking forward a six-figure debt into their early post-graduate training and beyond, with this number rising yearly. The effect of this on individual doctors and the New Zealand health system is uncertain, but has the potential to be negative if it forces graduates into higher paid careers away from areas of need, or impacts on the way individuals live or conduct their practice. Many of the medical students in this study will be invited to complete surveys until their eighth post-graduate year, allowing a prospective view of the extent to which student debt impacts on their early careers. Arguably, it will take far longer to be sure about the effect of student debts on New Zealand's future doctors.

Competing interests:
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Age at referral for undescended testes: has anything changed in a decade?

Mohit Bajaj, Vipul Upadhyay

ABSTRACT

AIM: Undescended testis (UDT) affects 1–6% of males and is one of the most common disorders in paediatric surgery.Updated consensus guidelines now recommend surgical management of UDT by 18 months. We compare the age at referral and subsequent timing of orchiopexy with data published from 1996–1998 at our institution, prior to the advent of updated guidelines.

METHODS: A retrospective review of all patients undergoing an orchiopexy for UDT from 2014 to 2016 was conducted. The age at time of first referral, first outpatient review and age at date of surgery were recorded. Calculations were made for time between referral and clinic visit (T-1) and between clinic visit and surgery (T-2). Data are reported as median (range).

RESULTS: In the 2014–2016 group (n=216), the median age at time of referral was 5.3 (range 0–182) months. Following referral, children were seen in the clinic at a median interval 1.84 (T-1: range 0.16–17) months. The median interval between the clinic visit and operation was 2.95 (T-2: range 0–30.7) months. The median age at time of surgery was 12.6 (range 4.6–191.3) months.

Compared to the data from 1996–1998 (n=325), there was a drop in the median ages both at time of referral (23 months vs 5.3) and at time of operation (38.8 months vs 12.6). In this cohort, 66% (n=143) of boys had surgery before eighteen months of age. The median times between referral and clinic visit (T-1: 1.7 months vs 1.84) and between clinic and operation (T-2: 3.3 months vs 2.95) were essentially unchanged.

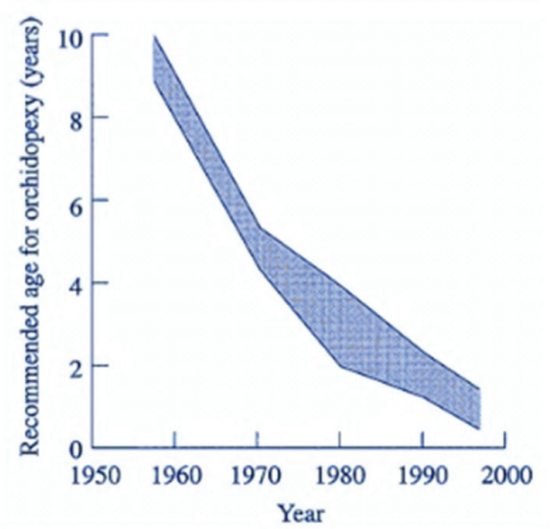
CONCLUSION: Our second snapshot in time (2014–2016) shows improvements in median age at referral (under six months) and age at time of operation (at 12.6 months) when compared to the older snapshot (1996–1998). These timings are more in keeping with recommendations for orchiopexy.

Cryptorchidism or undescended testis (UDT) affects 1–6% of males at birth and is one of the most common disorders in paediatric surgery.[1,2] Spontaneous descent of the testis occurs early in life, such that the overall incidence of congenital UDT is approximately 1% in males at one year of age.[3]

Undescended testis (UDT) represent the most common congenital anomaly of the urogenital system, and the association with malignancy and infertility, especially in bilateral cryptorchidism, is well described in the literature.[4–6] Boys with UDT have an overall relative risk of 2.75–8 of testicular malignancy.[4] In addition, multiple factors, including abnormal testicular development, reduced germ cell counts and anti-sperm antibodies, have been implicated in long-term fertility issues in cryptorchid males.[5,6]

Orchiopexy represents the current standard of care for UDTs. Timely placement of the testis in the scrotum has been shown to address the increased risks of malignancy and ensure optimal future spermatogenesis.[7–8] Consequently, recommended age for operation has decreased over the last few decades (Figure 1)[9–10] with updated consensus guidelines (Table 1) now advocating for surgical management of UDT by 12 to 18 months of age.[11–13]

Figure 1: Schematic graph of recommended age for orchiopexy, showing a rapid fall in recent decades.



(Picture reference: Paediatric Surgery and Urology: Long Term Outcomes 2nd Edn).[9]

The aim of our study is to compare the age at referral and subsequent timing of orchiopexy with data published from 1996–1998 at Starship Hospital,[14] prior to the advent of updated guidelines.

Methods

Starship Children's Hospital provides paediatric surgical care for the Auckland region, as well as much of the northern half of the North Island in New Zealand. A retrospective review of children with undescended testes managed with orchiopexy at our institution in the period between January 2014 and May 2016 was performed.

Patients were identified from the theatre database using ICD-9 procedure codes for orchiopexy. Outpatient visit details and inpatient surgical management records were retrieved electronically. Data collected included patient's demographics and clinical characteristics, age at time of referral, first outpatient review and age at orchidopexy.

Only patients with testes that were undescended at birth were included in our analysis. 'Acquired' UDT, testes that had been previously documented to be scrotal in position, were excluded. Patients who had their first surgery prior to 2014 were excluded from the study. In individuals who underwent a staged orchiopexy or a redo-procedure, only the first encounter was considered to avoid duplication.

Calculations were made for time between referral and clinic visit (T-1) and between clinic visit and surgery (T-2). This data was compared with data from a previous two-year period of orchidopexies performed at our institution between 1996–1998. Data are reported as median (range).

Table 1: Global consensus guidelines recommending early surgical management of UDT.

Organisation	Year	Age at referral	Timing of surgery
Nordic Consensus Statement[11]	2007	<6 months	6–12 months old
American Urology Association (AUA) Guideline[12]	2014	<6 months	Before 18 months old
British Association of Paediatric Urologists (BAPU) Statement[13]	2013	3–6 months	Before 12 months old

Table 2: Median age of children with congenital UDT at referral, clinic visit and time of operation at Starship Children's Hospital.

	Median age at referral (months)	Median age at clinic visit (months)	Median age at operation (months)	Referral time to clinic T-1 (months)	Clinic to operation T-2 (months)
2014–2016 (n=216)	5.32 (Range: 0–182.2)	8.16 (Range: 0.4–185.5)	12.63 (Range: 4.6–191.4)	1.84 (Range: 0–17.0)	2.95 (Range: 0–30.7)
1996–1998 (n=325)	23 (Range: 0–179.0)	26.5 (Range: 0.5–180.6)	38.8 (Range: 0.5–181.3)	1.7 (Range: 0–16.9)	3.26 (Range: 0–57.1)

Results

The median age of children at the time of referral (Table 2) was 5.32 months. Following referral, children were promptly seen in a specialist clinic within a median wait time of 1.84 months (T-1). The interval between the clinic visit and the operation was a median time of 2.95 months (T-2). At operation, the median age of children was 12.63 months. In the current cohort, 66% (n=143) of boys had surgery before 18 months of age.

Our second snapshot in time (2014–2016) shows improvement in median age at referral (under six months) and age at time of operation (at 12.6 months) when compared to the older snapshot (1996–1998). The critical improvement comes from faster referral times from primary care doctors to specialists, allowing for improved adherence to international guidelines for orchiopexy.

Discussion

Orchiopexy should not be performed too early, as testes may descend spontaneously during the first few months of life.[12] Updated guidelines released by key global paediatric surgical groups now recommend surgical management of UDT between 6–18 months of age,[11–13] reflecting the growing body of evidence in the literature. The primary concerns regarding timing of surgery surround the impact of fertility of cryptorchid males and the increased risk of developing testicular cancer.

The effect of age at orchiopexy is more pertinent when considering the outcome of fertility. The most direct measure of male fertility is paternity rates and time until conception. These outcomes are difficult to assess clinically and previous research studies have used surrogate markers of fertility potential instead. These include testicular growth/size, histology at orchiopexy and semen analysis in adulthood. Histological changes such as reduced germ cell counts, Leydig cell depletion and delayed appearance of adult spermatogonia have been demonstrated in undescended testes as early as 1–2 years of age.[5,15]

The exact mechanism linking cryptorchidism to testicular malignancy is unknown, although several risk factors have been proposed, including carcinoma in-situ and the increased temperature of the inguinal or abdominal region where the cryptorchid testis is located.[6] Wood et al have noted an overall relative risk of 2.75–8 of malignancy in males with cryptorchidism.[4] Similarly, performing orchiopexy earlier has been associated with a two-fold reduced risk of testicular malignancy compared to surgery performed post-puberty.[7]

Unfortunately, the average age at orchiopexy seen in several studies from around the world remain higher than the recommended guidelines. Implementation of these guidelines has been analysed in studies throughout the world. Recent studies from New South Wales (Australia)[16] and New Zealand[17] have reported the median age of orchiopexy as 16.6 months and 31.1 months respectively. In another Australian study based in Victoria, up to 55% of boys had their surgery after the age of five, well beyond the presumed optimal age.[18] Poor adherence to orchiopexy guidelines is also seen in European and American studies.[19,20]

Several reasons have been put forth to explain this discrepancy, including failure of screening, lack of knowledge among primary care doctors, prolonged subspecialty referral waitlist times and parental reservations about early surgery.[19] A

particular problem with UDT has been the multiple changes in guidelines that have transpired in a fairly short period of time, thus placing a burden on community paediatricians and general practitioners to maintain current practices.

In our series, the improvement in median age at surgery was primarily attributable to earlier primary care referral for surgeon assessment (5.32 vs. 23 months). A possible reason for this improvement could stem from increased awareness among general practitioners and paediatricians of the sequelae of untreated UDT.

Another possible reason could be the early identification of undescended testes during the 'well-child' checks conducted by Plunket nurses. Plunket nurses review more than 90% of newborns in New Zealand annually.[21] The nurses have paediatric-specific education and skills and the 'well-child' checks provide an ideal screening opportunity for early detection of UDT.

Conclusion

Our second snapshot in time shows a considerable improvement in both age at referral and age at surgery from the data reported over a decade ago. This is primarily attributable to an earlier age at initial referral. Our data shows that we fulfil the criteria outlined by international bodies for the management of undescended testes.

Competing interests:
Nil.

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Adequate adherence to benzathine penicillin secondary prophylaxis following the diagnosis of rheumatic heart disease by echocardiographic screening

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ABSTRACT

AIMS: The primary aim of this study was to determine adherence to benzathine penicillin (BPG) for individuals diagnosed with rheumatic heart disease (RHD) by echocardiographic screening between 2007–2012.

METHODS: BPG records were obtained for 57 patients, median age 12 at time of diagnosis. A 'days at risk' analysis was undertaken. Annual adherence was calculated for each individual. A comparison with the Wellington region's Rheumatic Fever 2013 adherence data was undertaken.

RESULTS: Adherence to BPG was good with a median follow-up time of 5.8 years. Days at risk analysis: median 0% at year one and 2.7% at year five. The median adherence for the entire cohort over the entire follow-up period was 92%, range 0–100%. There was no difference of proportions of late doses compared to the Wellington region. Median adherence was higher for register based (94%, n=48) compared to primary health care penicillin delivery (37%, n=7), $p<0.005$. During follow-up, 30% of the cohort moved between regions or overseas.

CONCLUSIONS: Good adherence rates are achievable for secondary prophylaxis when RHD is diagnosed by echocardiographic screening. This likely reflects the benefit of rheumatic fever registers and community nursing services rather than the pathway of the diagnosis for RHD.

Secondary prevention with intramuscular benzathine penicillin (BPG) has been known for many years to be effective to prevent recurrences of acute rheumatic fever (ARF) and prevent progression of chronic rheumatic heart disease (RHD).[1,2] Regular BPG is evidence-based treatment, reducing the risk of recurrent ARF by 87–96%.[3] Prophylaxis has usually been instigated after an acute episode of ARF, and in the New Zealand setting this has been very successful in reducing ARF recurrences in recent decades.[1,2,4] In the past decade a growing number of studies have utilised echocardiography to detect latent or subclinical RHD,[5] both internationally and in New Zealand.[6,7] Health system capacity to deliver effective treatment is a core requirement for population health screening programmes. In the RHD context, initiation of BPG and long-term adherence are key measures.

School-based echocardiographic screening for RHD was performed in five known high prevalence ARF regions of New Zealand between 2007 and 2012, specifically South Auckland, Gisborne and Ruatoria, Kaitaia,

Bay of Plenty and Porirua, predominantly in 10–13 year-old children. Across these regions, 3,600 students were screened and 150 had abnormal cardiac findings. Secondary prophylaxis with BPG every 28 days was recommended empirically for individuals diagnosed with probable or definite RHD,[6–8] and for some with borderline or possible RHD who, after consultation with a paediatrician, had a previous history suggestive of an ARF episode or a strong family history of ARF/RHD. Individuals were also commenced on BPG if they were found on follow up to have progressive disease.

Following episodes of ARF, high secondary prevention adherence rates were reported in patients receiving BPG through the Auckland Regional Rheumatic Fever Register in the 1990s.[4]

The primary aim of this study was to determine adherence to BPG secondary prophylaxis for patients diagnosed with RHD by echocardiographic screening. We hypothesised that adherence after echocardiographic case detection may not be as good as that following an episode of symptomatic ARF,[9] as the latter involves hospitalisation and intensive family education.[1]

Methods

BPG administration records were sought and obtained from local providers in Counties Manukau, Tairawhiti, Bay of Plenty, Northland and Capital Coast District Health Boards. In New Zealand, BPG delivery is provided by a variety of community nursing providers according to region (district nurses, paediatric community outreach nurses and primary health care nurses) facilitated by regional RF registers[10] as per the New Zealand Heart Foundation guidelines.[1] The start date of penicillin injections was determined from the records of the initial clinical assessment and first injection. If patients moved between regions, injection dates were sought from the new provider in that region. Similarly, data was sought from other regions if patients were temporarily out of town on the due date of an injection.

Adherence definitions

The recommended RF/RHD secondary prophylaxis regimen in New Zealand is 28 days IM BPG.[1,2] An injection was defined as given on time, if given less than or equal to five days after the due date of injection.[1] An injection was defined as late if the injection was given greater than five but less than 28 days after the due date, and defined as missed if late by greater than or equal to 28 days.[1,4]

Annual adherence was calculated for each patient, based on the number of injections given on time compared to the number of injections due for the year, taking account of whether the patient should have received 12 or 13 injections in a year.[4] Adherence for the entire cohort was calculated for each year since commencement of BPG on an intention to treat basis, ie, patients who became non-adherent were included in this analysis. Overall adequate adherence was defined for each patient as receiving >80% of injections on time per year.[1,11]

In addition, as the percentage of injections given on time may not best reflect the time a patient is at risk of a potential ARF recurrence, an additional 'days at risk' analysis was performed for each year per patient.[12] Days at risk was defined as the number of late (>5) days plus missed days (>28 days) expressed as a percentage of days per year. Note that those patients who had discontinued adherence were also included as missed days for the year in this analysis, as they clearly remain at risk of ARF recurrence and RHD progression.

A comparison with the Wellington region (Capital Coast, Hutt Valley and Wairarapa DHBs) adherence data for patients following episodes of RF for the year 2013 was undertaken.[13]

Statistics

The annual adherence and days at risk analysis was expressed as mean and median. Group data was compared with a two sample Z-test or Wilcoxon Rank-Sum test.

Ethics

Ethics approval was obtained HDEC NTY/06/12/139/AM06 as an extension of "A prospective school-based study of the prevalence of rheumatic heart disease in children from a high-risk New Zealand population".

Results

Secondary antibiotic prophylaxis was recommended for 62 individuals. Two individuals were commenced on oral prophylaxis and were excluded from further analysis; one refused IM injections and one started on erythromycin for penicillin allergy. Two cases moved overseas shortly after diagnosis and one individual's records were not available. The remaining 57 cases formed the cohort for analysis of BPG adherence.

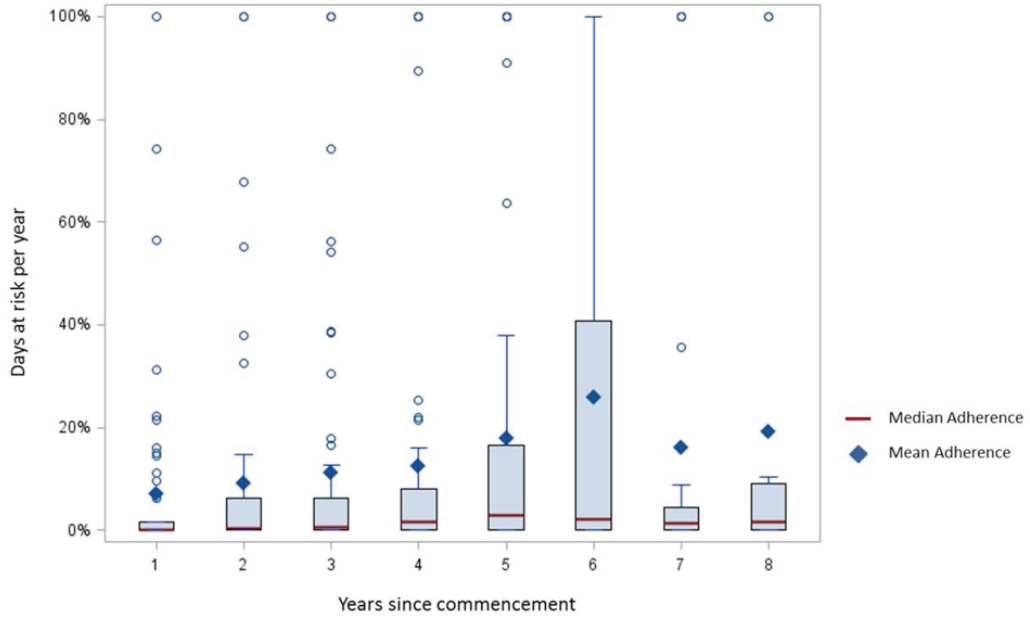
Forty-six of the 57 individuals commenced BPG after their initial echocardiogram and consultation, and 11 commenced prophylaxis after RHD disease progression at follow-up. Due to the staggered echocardiographic screening in the different regions over time, the maximum duration of follow-up for each region varied: South Auckland (maximum eight years), Tairawhiti (seven years), Bay of Plenty and Kaitaia (six years) and Porirua (three years). The median follow-up period was 5.8 years (range 16–95 months, interquartile range (IQR) 57–81 months).

The median age range of the cohort at commencement of BPG was 12 years, range 10–17 years. Twenty-seven of 57 (47%) were female. 39% of the cohort were Māori, 59% Pacific.

Seventeen of 57 individuals, ie, 30% of the cohort moved to another region in New Zealand (n=11) or overseas (n=6) during the follow-up period. Adherence data was not obtained for the time-period any individuals were overseas. Six individuals (11% of the cohort) became non-adherent during follow-up. Of these six, one had an episode of ARF 11 months after discontinuing BPG. Eleven patients were medically discharged from BPG after median duration 5.7 years (range 23–85 months, IQR 61.5–76 months). Nine of these were discharged because they had reached 18 years of age and completed over five years of BPG and had no progression of RHD on follow-up echocardiography. One patient was discharged after

Figure 1: Mean and median days at risk of a recurrence of ARF expressed as a percentage of days in the year.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
n	57	57	53	46	45	38	23	12
Mean	6.9%	8.9%	11.1%	12.5%	17.9%	25.9%	15.9%	20.7%
Median	0%	0.3%	0.5%	1.5%	2.7%	2.2%	1.4%	2.7%



five years as follow-up echocardiography suggested a congenital rather than rheumatic mitral valve lesion and one individual with borderline RHD was treated for two years only, after a suggestive history of ARF, which was later refuted.

Days at risk analysis (risk of recurrence of ARF or RHD progression)

Figure 1 shows a low percentage time at risk for the cohort, rising slowly over time. The median days at risk was 0% at year one (n=57), 1.5% by year four (n=46) and 2.7% in year eight (n=12). Note that this median analysis of 0–2.7% days at risk is equivalent to 0–10 days at risk per year only, representing a very low proportion of time without penicillin cover. The mean days at risk (Figure 1) rises largely due to the non-adherent patients.

Adherence rates

The mean adherence for the entire cohort over the entire follow-up period was 81%, median 92%, range 0–100%. By individual years, the mean and median adherence rate were 90% and 100% at year one (n=57), falling to 78% and 85% by year four (n=46) and 66% and 88% in year eight (n=12) (Figure 2).

The decline in adherence over time was largely due to six patients (11% of the cohort) who became non-adherent at 0, 0.3, 0.6, 2.7, 4.6 and 5.5 years. The reasons for non-adherence were not consistently identifiable. One of these six patients had an episode of ARF 11 months after discontinuing BPG.

Table 1 shows the distribution of overall adherence during the study period for the whole cohort. Sixty-eight percent of the cohort received adequate adherence (greater than 80% of injections on time) over the follow-up period to a maximum of eight years. Note that this analysis includes those that became fully non-adherent (n=6).

Table 2 shows the results of the 2013 Wellington region (Capital Coast, Hutt Valley and Wairarapa DHBs) data[13] compared to the current study 2013 data. There is no significant difference between the proportions of late doses for the two age brackets.

Figure 2: Adherence to BPG by year since commencement.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
n	57	57	53	46	45	38	23	12
Mean	90.4%	85.5%	82.6%	77.6%	75.7%	66.6%	74.7%	66.1%
Median	100.0%	100.0%	92.3%	84.6%	91.7%	84.0%	87.5%	87.5%

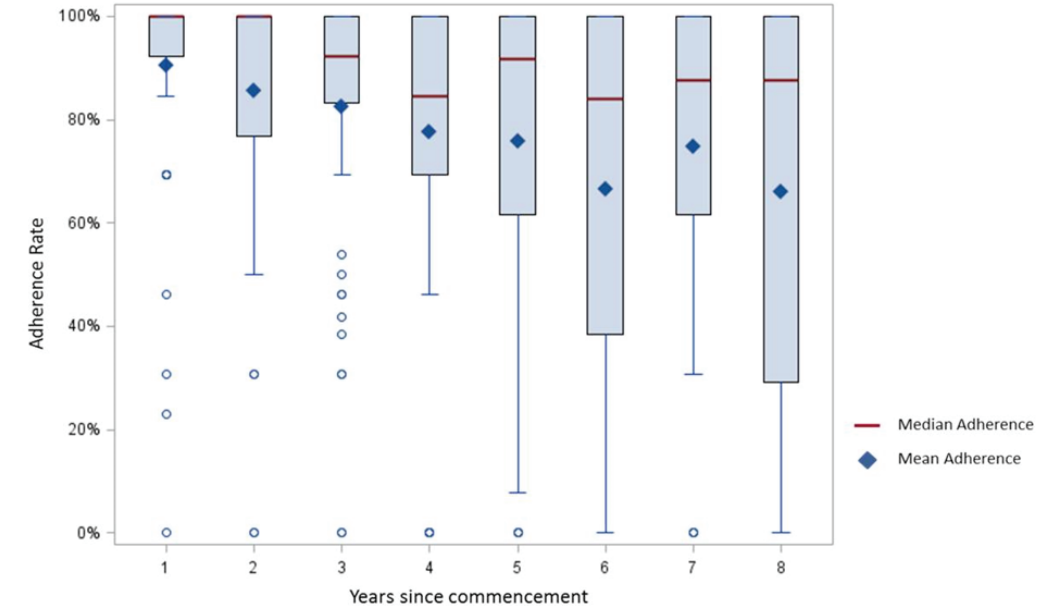


Table 1: Distribution of adherence for the cohort over entire follow-up period.

Overall adherence (% of injections on time)	Percentage of cohort (n=57)
>80%	68.4% (n=39)
70–79%	12.3% (n=7)
60–69%	3.5% (n=2)
50–59%	5.3% (n=3)
<50%	10.5% (n=6)

Table 2: Comparison of 2013 percentage of late or missed doses.

Age group	**Percentages of doses late**		
	Wellington	**Echo detected RHD**	**p**
<16	3.6% (n=58)	4.8% (n=13)	0.4692
16–21	11.4% (n=58)	8.4% (n=39)	0.1051
Age group	**Percentages of doses missed**		
	Wellington	**Echo detected RHD**	**p**
<16	0.5%	9.6%	<0.0001
16–21	14.4%	21.7%	0.0017

Table 3: Register versus non-register BPG adherence comparison.

	Overall median adherence	**IQR**	**p**
Register (n=48)	93.8%	82.2–97.6%	0.0001
Non-register (n=7)	37.2%	4.3%–61.3%	

There was a higher percentage of missed doses in the echocardiographic detected cohort.

Adherence for those receiving register compared to primary health care-based secondary prophylaxis is shown in Table 3. Forty-eight of 57 patients had 'register-based' penicillin delivery by community nursing services, and seven received BPG injections at their primary health care clinic. Two cases who had part register-based and part primary health BPG delivery were excluded from this analysis. Adherence was higher for register-based penicillin delivery compared to primary health care penicillin delivery despite the numbers of patients in the primary health care group being fewer. This likely reflects that there are fewer patients being managed in the primary care setting, and systems for recall are less well-developed.

Discussion

This study provides important contemporary data concerning adherence to secondary prevention for individuals with echocardiographically detected RHD in New Zealand. Although the cohort is relatively small, this has allowed a detailed analysis of every intended injection of penicillin in the follow-up period, due to the high-quality records kept by nursing staff responsible for the penicillin delivery. Thirty percent of the cohort moved region within New Zealand or overseas during the eight years of follow-up, which has important implications for organisation of secondary prevention services, including support for a national register.

The study shows that BPG adherence can be adequate for disease control following a diagnosis of RHD detected by echocardiography, especially over the first five

years when patients with RHD are most at risk of a recurrence of ARF or progression of RHD.[1,14] This is of significance for RHD screening programmes internationally. The data suggests that the infrastructure for BPG delivery is more important than whether individuals were started on penicillin following an episode of ARF or following case detection of RHD by echocardiography. Qualitative research methodology could better elucidate this question.

Engelmann et al 2016, recently reported the first international analysis of secondary prophylaxis following echocardiographic screening in Fiji.[15] Only 6% of individuals received adequate adherence with median follow-up of three years. Without a comparison group from that country it was not possible to determine whether it was the infrastructure for secondary prophylaxis or the pathway of diagnosis that was the dominant reason for the low adherence. An extensive programme is currently being undertaken to strengthen the infrastructure for secondary prevention by the Fiji RHD control programme.[16]

Following an episode of ARF, it is well established that there is a high recurrence rate of ARF and often progression of RHD and thus secondary prophylaxis is strongly recommended.[1,14] However, rates of progression of RHD and risk of ARF following echocardiographic detection are less certain and are still being studied internationally.[5,17] It is also not known whether the duration of prophylaxis should be as long as that recommended following an episode of ARF. Over the study period, the New Zealand community paediatricians in conjunction with cardiology advice have empirically recommended a minimum duration of BPG of at least five years or to age 18. This is a shorter period than that following ARF in the New Zealand setting.[1] Part of the rationale is that the onset of the previous ARF episode may have been some years earlier in those with RHD detected by echocardiography.

The analysis of days at risk provides a more detailed assessment of adherence than the 80% threshold,[11] for which there is no biological basis, but enables comparison with previous New Zealand and international data. Like Edwards,[12] we believe days at risk is more valid biologically. For example, a patient who has three injections late in a year would be classified as 75% adherence for the year, but if the three late injections were each given seven days late, that patient would only have six days at risk (2% of the year). The five days grace post-28 day regimen is justified by previous New Zealand data: a 28 day BPG regimen resulted in a very low ARF recurrence rate of 0.07 per 100 patient years.[2] The median days at risk (Figure 1) reveal that BPG adherence was very good. The WHF and RhEACH handbook recommend that adherence be expressed as median percentage of doses delivered rather than the mean percentage.[11]

It is pertinent that 11% of the cohort became non-adherent, and this group influenced the overall adherence rates. The results of the current study suggest that adherence is lower than 1–2 decades ago in the Auckland region where very high rates of adherence (mostly over 90%) were reported following clinically diagnosed ARF.[2,4] However, direct comparison with that data is not valid, as patients who had opted out of secondary prevention or moved region were not included, and a number of patients with 'poor or incomplete' nursing office forms were not included.[4] It is important that analysis of adherence includes these patients who no longer engage health services as Engelman and colleagues[15] have done, otherwise a falsely high adherence rate can be reported.

The only New Zealand contemporary *published* data of adherence following clinical diagnosis of ARF/RHD is from the Wellington region for 2013.[13] Their data showed decreasing compliance with increasing age and time from commencement of BPG. This Wellington cohort showed a similar proportion of late doses compared to the current study. The higher proportion of missed injections in the current study likely reflects the intention to treat analysis, but it is possible that some patients opted out as they did not accept the need for secondary prophylaxis following echocardiographic detection of RHD.

Unpublished contemporary New Zealand adherence data collected by the Ministry of Health as part of the Primary Prevention Programme, indicated the proportion of late doses in one Auckland DHB over a three-month period in 2016 were 5–7% (Ministry of Health personal communication 2016). Complete data sets were available for 91–92% of the patients in that DHB, suggesting that some patients had moved region or have opted out of care. Another Auckland DHB recorded 1% late injections in the under-15 year age group rising to 13% for those greater than 15 years for two months in 2016 (Dr Tim Jelleyman, personal communication, 2016). Again, that DHB does

not collect data for secondary prevention undertaken by primary care.

Taken together, it can be concluded that in New Zealand overall there are very high rates of BPD adherence, particularly for those receiving BPD via a register and for those attending school. Adherence levels fall for those over 15 years of age, but it is well established that the risk of recurrence diminishes with age.[1] Little is known about adherence for those receiving BPG through primary health clinics in New Zealand. Our data showing low adherence, albeit for a small number of patients, supports that best practise for secondary prevention of ARF/RHD is referral to a register.[11] The findings of low adherence for primary health care delivery of secondary prevention and the high mobility of RHD patients in New Zealand found in our study both give support for the establishment of a national rheumatic fever register in New Zealand.

Conclusions

We conclude that adherence rates for echocardiographically detected RHD are similar to adherence rates following ARF or clinically detected RHD for at least the first five years after diagnosis. Enrolment in a rheumatic fever register is likely to have greater influence on penicillin adherence than the pathway to the diagnosis of RHD. The study results give support to the formation of a national rheumatic fever register in New Zealand.

Limitations

The overall cohort is small, but this is offset by the meticulous record keeping by nursing staff. The comparison with the Wellington regional data are not strictly comparable as the time on prophylaxis was not stated in the Wellington analysis nor was it stated that non-compliant patients were included in their analysis.

Competing interests:
Nil.

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Clinical management and patient persistence with antibiotic course in suspected group A streptococcal pharyngitis for primary prevention of rheumatic fever: the perspective from a New Zealand emergency department

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ABSTRACT

AIM: Rates of acute rheumatic fever in the Northland region are historically among the highest in New Zealand, impacting disproportionately on Māori children and youth. The primary aim of this study was to determine patient persistence to antibiotic treatment for group A streptococcus (GAS) pharyngitis in patients presenting with sore throat to the Whangarei Hospital Emergency Department. Secondarily, this study sought to determine prescriber adherence to the national antibiotic guideline for sore throat management.

METHOD: A retrospective audit of patients presenting to ED with presumed GAS pharyngitis between 1 May 2016 and 31 August 2016 was carried out. Data on patient demographics, clinical examination findings, investigations and antibiotic prescription were extracted from electronic medical records. Patients were contacted and after obtaining consent, were asked about their antibiotic treatment using a standardised telephone interview script.

RESULTS: The patient population audited reflects those at high risk for acute rheumatic fever. All patients were discharged on the recommended medication, but only 82.7% (62/75) received the correct length (10 days) of oral antibiotics. Of the total of 75 patients audited, 61 (81%) had a swab taken and 41% (25/61) of these were confirmed positive for GAS. Patients were either advised to commence medication without waiting for a swab result (96%, 72/75) or delay treatment and commence only if no improvement in symptoms (4%, 3/75). Of those advised to commence medication immediately, 94% (67/72) obtained their medication from a community pharmacy. Three patients were advised to stop treatment after confirmation of a negative result. Of those patients assessable for medication persistence (n=65), 73.8% (48/65) of patients were compliant in completing the full course of antibiotic therapy.

CONCLUSION: This is the first study to assess patient persistence to an antibiotic course for GAS after presentation at an emergency department in Northland and possibly New Zealand. The results indicate a relatively high persistence rate with oral antibiotic treatment by patients treated for suspected GAS pharyngitis. An important finding is that community pharmacy dispensing does not appear to be a major barrier to patients acquiring medications. Additionally, the study shows low levels of follow up of patients with negative throat swab results, resulting in these patients completing the course of antibiotics unnecessarily.

Acute rheumatic fever and rheumatic heart disease are rare but significant complications of group A streptococcus (GAS) pharyngitis, causing significant morbidity and mortality in young people.[1] There is a disproportionate disease burden on Māori and Pacific people. Webb et al (2013)[2] reported an incidence of 34/100,000 among Māori and 67/100,000 among Pacific children and young teenagers, which was approximately 10 and 20 times the rate of their New Zealand European counterparts.[3]

Nearly 30% of Northland's population and 46.3% of those under 15 years identify as Māori according to 2013 census data.[4] Thirty-eight percent of the population living in the Northland DHB region live in the most deprived quintile, NZ Deprivation Index (2013) 9–10.[5,6] The annualised rheumatic fever incidence rate between 2002–2011 was 7.7 per 100,000, with incidence rates for Māori school-aged children over 40 times that of non-Māori.[7] At the start of this decade, Northland had the second highest rate of rheumatic fever of all district health boards in the country.[8] Whangarei hospital is the largest secondary level hospital (~300 beds) in the Northland region, and its emergency department (ED) provides acute emergency services for the area, but predominantly the Whangarei district.

The high and increasing incidence of rheumatic fever among Māori and Pacific populations in New Zealand led to a "whole of government" effort to reduce the rates of rheumatic fever, with the establishment of a national target and the Rheumatic Fever Prevention Programme (RFPP) in 2011.[2]

The RFPP has three key approaches: to increase awareness of ARF and how to prevent it; to reduce household transmission of GAS; and improve access to effective treatment of GAS. The programme has included strategies to address household overcrowding for high-risk families, mass media communications to enhance awareness and importance of sore throat management for high-risk children and increase access to treatment (eg, school and pharmacy-based throat swabbing). Key public messaging has included the importance of taking the full 10-day course of antibiotics.[9] In a separate initiative, government policy to expand free general practice access for 6–<13 year olds was implemented nationwide in July 2015, potentially increasing access to throat swabbing for this age group.

Treatment of GAS in New Zealand is based on the national Heart Foundation's Group A Streptococcal Sore Throat Management guidelines.[10] This recommends a 10-day course of oral amoxicillin or penicillin as first line, with a focus on rapid treatment for high-risk groups (defined as those with a family history of RF or those who meet two more of the following criteria: Māori or Pacific, aged 3–35 years, or living in lower socio-economic areas of the North Island).

The primary aim of this audit was to determine patient persistence to antibiotic treatment for presumed GAS pharyngitis. The secondary aim was to assess emergency department clinicians' adherence to the antibiotic recommendations of the National Heart Foundation guidelines for management of GAS sore throat.[10] The study was given ethics exemption as per the New Zealand Health and Disability Ethics Committees (HDEC) and was granted locality assessment approval by Northland District Health Board.

Methods

A retrospective audit of suspected group A streptococcal (GAS) pharyngitis admissions to Whangarei Hospital's ED was carried out. Audit cases were identified by searching the NDHB data warehouse sourced from the patient management system Alpha for discharge diagnoses coded as "Rheumatic Fever" and "Pharyngitis" for the period 1 May 2016 and 31 August 2016. Additionally, patients with "Throat" and "URTI" (upper respiratory tract infection) recorded in the presenting problem to the ED were identified. Patients were included in the audit based on their most recent presentation to the ED if they were discharged with antibiotics for pharyngitis. Some of these patients had already been started on an antimicrobial regimen, which was initiated in the community by the GP. These patients were included only if the assessing ED physician agreed that the patient should remain on this treatment.

Patients of all ages with presumed GAS infection who received antibiotics were included, as the primary aim was to assess antibiotic persistence. The study was not

able to evaluate prescriber adherence with the HF guidelines in terms of risk assessment and decision making about swabbing and/or empiric treatment, only whether an appropriate antibiotic for GAS had been prescribed according to the guideline dosage and length of treatment.

Excluded from the audit were cases involving admissions to other services, patients not waiting for their assessment or whose medical notes were unavailable. Diagnoses of viral URTI, foreign body in throat, generalised unwellness, asthma, peri-tonsillar abscess, dermatitis, congestive heart failure, influenza, urinary tract infections, herpes gingivostomatitis, otitis media, cervicalgia, epistaxis, conjunctivitis, bronchiectasis, haemoptysis, dysphagia, obstructive laryngitis and lower respiratory tract infections were also excluded.

The initial search yielded a total of 426 patients. After excluded cases were removed, 95 patients met all the inclusion criteria. These were all patients with pharyngitis who were prescribed antibiotic treatment in the four-month period from 1 May 2016 and 31 August 2016. Of these, 75 patients were able to be contacted for interview, one patient declined because of "being busy" and the remainder were not contactable.

Data was collected from patients' electronic discharge summaries, investigation record and dispensing record. This data is summarised in in Table 2. Self-reported ethnicity was used prioritised according to Ministry of Health protocols.[10] Patients were contacted by telephone and after obtaining consent, interviewed by the same interviewer according to a standardised telephone interview script (Appendix).

Data collection and statistical analysis was performed using Microsoft Excel and QI Macros 2010 version 14.0.7015.1000 (Microsoft Corporation, Washington, USA). The two tailed unpaired T-test was used to compare differences in means when analysing results. Differences in mean were considered statistically significant if p values were less than 0.05.

Results

Audit population characteristics

Eligible patients discharged with a prescription for antibiotics for presumed GAS pharyngitis represent 0.76% (96/12,628) of all patients presenting to the Whangarei ED during the study time period. 60.0% (45/75) of respondents identified as Māori, 1.3% (1/75) as Pacific and 38.6% (29/75) of patients as 'Other' ethnicities (grouped as "non-Māori and non-Pacific", Table 1). The proportion of Māori was significantly higher than in the population presenting to the Whangarei ED for the same time period, and than in the Northland DHB catchment population (4) (p=0.000). There was only a single Pacific person in the study population. For remaining analyses, this person was grouped into a combined "Māori/Pacific" group. The mean age was 19.5 years (median of 18.0 years), with a range of 1–52 years. There was no significant difference in the age of presentation between the Māori/Pacific group and the 'Other' ethnicities group (p=0.396).

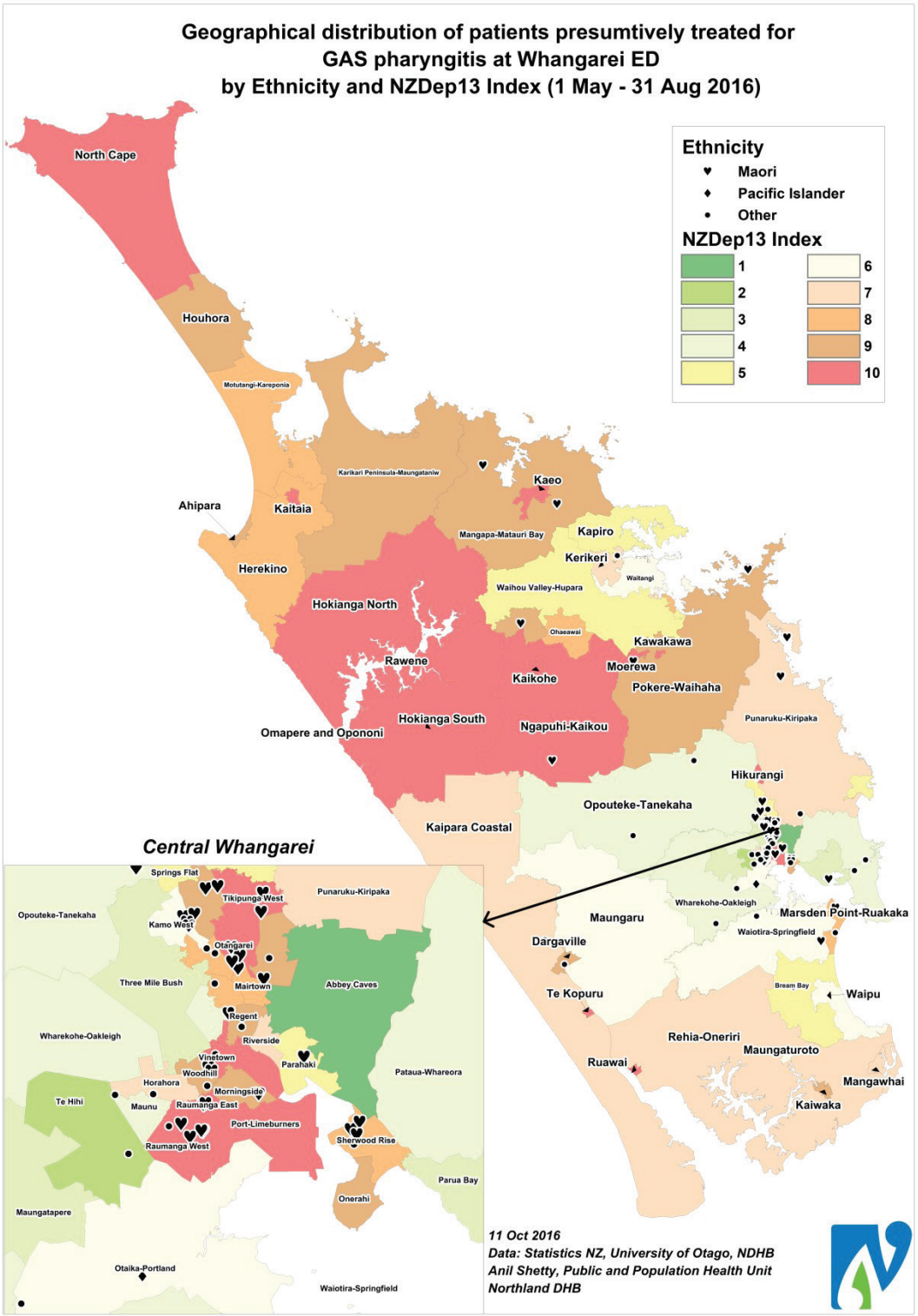
Comparison of the audit population with the ethnicity distribution of all presentations to the Whangarei Emergency Department (n=12,628) for the same time period and the Northland DHB catchment population (n=170,560).[5]

The mean NZDep 2013 deprivation score for the entire population was 7.4 points; 95% confidence interval [CI], 6.9 to 7.9. The Māori/Pacific group was more deprived

Table 1: Ethnicity data.

Ethnicity	Percentage by population (%)		
	Study population	Whangarei Emergency Department population	Northland District Health Board population
Māori	60.0	37.1	34.6
Pacific	1.3	1.6	2.0
Other	38.6	61.3	63.4

Figure 1: Distribution of patients treated with antibiotics for GAS pharyngitis from the Whangarei Hospital Emergency Department from 1 May 2016 to 31 August 2016 by place of residence and NZDep Index.



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than the "Other" group (p=0.008), with a mean score of 7.9 points; 95% CI, 7.3 to 8.5 compared with 6.6 points; 95% CI, 5.8 to 7.4 for the "other" ethnicities grouping.

The usual residence of patients was distributed widely across Northland, but concentrated in/around Whangarei (Figure 1). One patient had an address outside Northland and is not plotted on the map. The majority of audited sore throat cases lived within more socio-economically deprived areas. Compared to a map plotting all cases of rheumatic fever in Northland between 2002–2011,[7] Figure 1 shows a similar concentration of sore throat cases in the Central Whangarei area.

A higher deprivation index correlates to more deprived neighbourhoods.

Clinical features, investigation and treatment of patients included in the audit are summarised in Table 2.

Table 2: Studied population summary.

	n
Initial database search	426
Eligible patients	96
Total patients contacted (included)	75
Clinical examination	
Temperature documented	66/75
Throat findings documented	70/75
Investigations	
Swabbed	61/75
Treatment	
• Prescribed a course of oral antibiotic	75/75
• Prescribed correct antibiotic	75/75
• Prescribed correct 10-day course	62/75
• Prescribed a "back pocket script"*	3/75
• Patients assessable for medication acquisition from pharmacy**	72/75
• Antibiotic obtained from pharmacy	68/72
• Did not fill script	4/72
• Treatment stopped by medical professional	3/72
• Patients assessable for medication persistence	65

* "back pocket" scripts are scripts that are issued with instructions to patients to only fill the script if symptoms worsen.
** The three patients who were provided with back pocket scripts did not redeem their scripts because of symptom improvement and were thus excluded from analysis of medication acquisition from pharmacy. These patients were in fact GAS negative.

Baseline characteristics: contactable patients vs non-contactable patients

There were no significant differences found in mean age of presentation, ethnicity, proportion swabbed and proportion prescribed the correct drug and duration in those contacted (N=75) in comparison to those who couldn't be contacted (N=21) (data not shown). However, there was a significant difference (p=0.023) in the number who had acquired medications from the pharmacy according to the community dispensing record, with fewer of those unable to be contacted having obtained medication.

Presentation times to the emergency department

Twenty percent (15/75) of presentations were between 8am–5pm, Monday to Friday, while 80% (60/75) were "after hours" (31/60 were after 5pm on week days and 29/60 were during weekends). There was no significant difference in presentation time by ethnicity.

Examination findings, investigations and management

Temperature was not documented in nine patients. In the patients with a documented temperature, only 27% (18/66) had a temperature ≥38^{0}C. Throat exam findings were not documented in five patients. In the remaining patients, most [96% (n=67/70)] had positive findings of swelling, large tonsils, erythema, exudate or pus. Four percent (n=3/70) had no throat signs.

Swabs were performed in 81% (n=61/75) of patients, and 41% (25/61) of these were positive for group A streptococcus (GAS). Temperature over ≥38^{o}C was not correlated with GAS positive results; in swabbed patients with temperature ≥38^{o}C, 42% (5/12) were GAS positive while in swabbed patients with temperature <38^{o}C, 45% (18/40/) were GAS positive. In the three patients with negative throat findings, one patient had a GAS-positive throat swab. There were no significant differences in age, gender or ethnicity between GAS positive and GAS negative subpopulations (p≥0.109). There were no significant differences between ethnicities for swabbing rates.

Other streptococcal subtypes were cultured in seven swabbed patients as outlined in Table 3. All GAS positive cultures were penicillin sensitive.

Table 3: Distribution of streptococcal subtypes in swabbed patients.

All streptococcal-positive swabs (n=32)	
Streptococcal subtype	**% (n)**
Group A streptococcus	78 (25)
Streptococcus agalactiae	3 (1)
Streptococcus Lancefield group C	13 (4)
Streptococcus Lancefield group G	6 (2)

The average length of stay in the emergency department was 173±92 minutes (mean ± one standard deviation) for all patients.

Antibiotic prescription, medication acquisition and community follow-up

All patients received a recommended medication as per the New Zealand Heart Foundation sore throat guidelines. 82.7% (62/75) received the correct 10-day course of oral antibiotics, 13.3% (10/75) received a seven-day course and 4.0% (3/75) received a five-day course. There was no significant difference in the prescribed duration of antibiotics between ethnic groups.

Ninety-four percent (68/72) of patients were able to obtain their medications from a community pharmacy. Of the four patients who did not get their script, reported reasons included: could not afford the medications (n=1), too busy (n=1), patient had the prescribed antibiotic at home from a non-related medical visit (n=1) and one could not recall the reason for not being able to collect the medication (n=1). Three patients who received "back pocket" scripts (that is, given instructions to only fill the script if they did not feel better), and who did not fill their prescriptions due to clinical improvement were excluded from the analysis of persistence.

In the 26 GAS-negative patients, 22 (85%) did not receive a written instruction to stop antibiotic treatment by a medical professional. One patient had completed the full 10-day course despite medical advice given on day eight of the antibiotic course, reportedly because of fears of developing

antibiotic resistance. Three swab-negative patients who were initially started on a course of antibiotic subsequently stopped on advice of a medical professional. In these three cases, two had re-presented to hospital, one to the emergency department where they were told to stop the antibiotics because of a negative swab. One had presented to the ENT service where the treatment was changed and the remaining patient had been instructed to stop antibiotics in the community.

Patient persistence with antibiotic course

For patients who had started on antibiotic treatment and did not have their treatment changed by a medical professional, 73.8% (48/65) of patients reported that they were compliant with the full prescribed course of oral antibiotic therapy. Symptom improvement was the main reason given for treatment non-persistence (Table 4). For patients who were not fully compliant, the average length of antibiotic therapy was 5.6 ± 0.2 days. There were no statistically significant differences by patient ethnicity or deprivation score for non-persistence to medications ($p \geq 0.08$).

Table 4: Reasons for non-persistence.

Patient reasons for non-persistence with antibiotic course	N
Improvement in symptoms	11
Used limited home supply of antibiotics*	1
Medication side effects	2
Medication damage**	1
Patient forgot to complete dose	1
Patient unsure of reasons	2

* Patient had a home supply of medications from a non-related medical visit, which was not sufficient to comply with the full course of antibiotics prescribed.
** Medication damage: patient had found the prescribed liquid antibiotic frozen in the refrigerator and did not use it afterward.

Discussion

In this audit, all patients presenting at the Whangarei Hospital ED with sore throat who received antibiotics were prescribed the appropriate antibiotic for treatment of GAS. However, an important proportion of prescriptions (17.3%) were not for a 10-day course of oral antibiotics, as recommended for the prevention of rheumatic fever by the national sore throat guidelines.[10] This proportion is similar to findings in a recent study reporting that 20% of children did not receive the correct treatment for pharyngitis in the primary care setting in Northland.[12] The 10-day penicillin course recommendation is based on studies demonstrating that a 10-day course is superior to shorter courses in eradicating and preventing recurrence of GAS carrier and disease rates.[13,14,15] A 2009 Cochrane Review found that shorter courses of more expensive newer antibiotics may be equally effective in the treatment of GAS pharyngitis,[16] but the currently recommended treatment regimen is still regarded as the most effective and cost-efficient treatment for GAS pharyngitis in New Zealand. It is concerning that, despite long-standing clinical guidelines and extensive publicity about the importance of effective sore throat management in preventing acute rheumatic fever, this audit indicates that more than 1:6 of patients at high risk of acute rheumatic fever still receive suboptimal treatment.

Our result of 41% of swabs being positive for GAS is high in comparison to a recent Australian study reporting 25.7% in an emergency department and less than 20% of patients in a New Zealand primary care setting who were tested and returned positive results for GAS.[17,12] However, this is likely related to narrower inclusion criteria (having pharyngitis with antibiotic prescription) in this audit and thus selection bias. There were no differences in patient age, gender, ethnicity, socio-economic deprivation, recorded temperature or clinical throat examination findings between GAS-positive and GAS-negative cases. These results are supportive of the commonly accepted view that GAS pharyngitis cannot be predicted on clinical grounds alone.[18,19]

On average, the Māori and Pacific patients in our study population were living in higher deprivation areas compared to other ethnicities, had very high rates of GAS+ pharyngitis and must be considered a very high-risk population for ARF.[20] Although the empiric antibiotic treatment for primary prevention of rheumatic fever comes with an opportunity cost of over-treatment of viral pharyngitis, this is considered desirable in the Northland context, and is based on the national guidance for management of sore throat in populations at high risk for ARF.

The higher proportion of Māori and Pacific patients included in this audit than in the general population suggests that the national guideline risk algorithm is being appropriately used by clinicians in ED, although it is not possible to conclude this without doing a prospective audit of all sore throat presentations. It may also reflect greater awareness in these population groups of risk of ARF following sore throat. The finding that neither patients of Māori/Pacific ethnicity nor those people living in the most deprived quintile were more likely to have a GAS positive swab than the remainder of the study population may seem incongruent with the disproportionate rheumatic fever burden in Māori and Pacific people,[2,3] and those living in areas of higher socioeconomic deprivation,[21] but is not dissimilar from findings from primary care audits and results in school programmes in Northland.[12] The higher disease burden of RF more likely reflects historically poorer access to GAS treatment for these groups.

Encouragingly, 2015/2016 Ministry of Health data demonstrates a reduction of 37% in the number of first hospitalisations for rheumatic fever nationally, with a 56% reduction for Māori. In 2015/16 the Northland district for the first time recorded fewer than four cases of first hospitalisation for rheumatic fever.[8]

There is a strongly held notion by many clinicians that many patients will not comply with a 10-day course of oral antibiotics.[22, 23, 24] In fact, previous prospective randomised controlled trials document persistence rates with a 10-day course of penicillin as greater than 60% (62%[25] and 67%[15]). These reported figures are slightly lower than in our audit, which was not a "controlled" trial setting. Self-reported treatment persistence with the full prescribed course (of any length) of oral antibiotics in this audit was 73.8%. Specifically, the persistence among patients prescribed a 10-day course was 71.7% (38/53). The smaller proportion of patients in the "non-contactable" group who had picked up their script may indicate that the group interviewed was more compliant.

There is also clearly potential for over-reporting of adherence by patients. However, the use of a telephone script, which was non-threatening, and normalised patient experiences aimed to mitigate this potential bias. Additionally, access to the community dispensing record allowed independent verification of whether patients had filled their prescriptions. Increasing awareness and understanding among patients at high risk of acute rheumatic fever about the importance of effective treatment of sore throat, including taking the full duration of antibiotics, may be contributing to improved adherence. Other limitations in this study are that diagnoses were made retrospectively by different doctors with differing opinions on the interpretation of the sore throat guideline as to who required treatment, and this could have biased our inclusion group.

The apparent lack of follow up of GAS-negative patients as evidenced by 85% who did not receive instruction to stop antibiotic postulates the possibility of a lack of follow up in patients with GAS-positive results. Our study design did not permit the assessment of this hypothesis since the inclusion criteria was restricted to patients who were discharged with oral antibiotics and as such did not include those who were swabbed but not discharged with antibiotics.

The major limitation of this study is that the methodology did not allow full assessment of clinician adherence to the national risk assessment and prescribing guidelines for sore throat management.[10] We were thus not able to evaluate whether all patients presenting to ED with sore throat were appropriately risk assessed, or the completeness of follow up. A prospective audit would be useful in gauging clinical adherence to the prescribing guidelines.

In light of efforts to increase access for sore throat treatment for ARF prevention, the emergency department remains an important access point for young adults at high risk of ARF in Northland. This may be due to the convenience of a "walk in" 24-hour service without prior appointment needed, the perception of ED as a "one stop" shop for diagnostics and treatment, the lack of availability of timely primary care appointments, and no consultation costs. Improvements can be made in ensuring clinician adherence to sore throat management guidelines, use of standing orders for nursing staff, supporting patient persistence with the 10-day prescription and encouraging appropriate follow up of negative swab results.

Appendix

Telephone interview script		
Introduction	Kia ora, Am I speaking to…My name is…, I am calling from Whangarei Hospital Emergency Department. I see that you/your child attended Whangarei Hospital with a sore throat on [date], is that correct? I would like to ask you a few questions about the treatment you received, which will take less than five minutes. Is now a good time to talk?	
Explanation	We are doing some research here in the hospital to check out how well we have done our job of making available the best treatments for sore throats and to understand whether people have any difficulties with their treatment. We are not judging at all, just want to know what we can do better.	
Confidentiality	All the information will be kept strictly confidential with the researchers and no personally identifiable information will be included in our final report.	
Patient choice	It is up to you whether or not you would like to answer these questions and if you decide not to take part, it will not affect your future health care in any way. May I ask you the questions?	
	If "No"	Would it be possible for me to ring you back at a more convenient time?
	If hard "No"	Thank you, that is no problem at all, I would appreciate it if you could tell me why so that I could take that into account in this study.
	If "Yes" but antibiotics not taken from pharmacy	For a lot of people, there are some real challenges with taking their prescriptions to the pharmacy to get the antibiotics and we are looking at some of these reasons and challenges so that we can do something to better aid people in getting their medications. These might be losing the prescription, financial difficulties, using Rongoā (Traditional Maori medicine) or other reasons. I noticed on the computer that you didn't manage to get these medications from the pharmacy. Can I please ask what was the main challenge for you to get the medications?
	If "Yes" and antibiotics taken from pharmacy	1. Many people find it difficult to get their medications from the pharmacy for various reasons—did you manage to get the antibiotics from the pharmacy? 2. For some people, actually taking the medications is difficult for lots of different reasons; did you manage to take the antibiotics? 3. Many people are also unable to take the medications for the full 10 days for various reasons, how many days did you manage to take the medications? Or do you know if …managed to take the medications for the full 10 days? i. **If not taken 10 days—there are many reasons for taking the meds for a shorter time compared to the 10 days, what was the main reason for you?**
Conclusion	Thank you for your time. I wish you all the best.	

Competing interests:
Nil.

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Mapping housing for the disabled in New Zealand

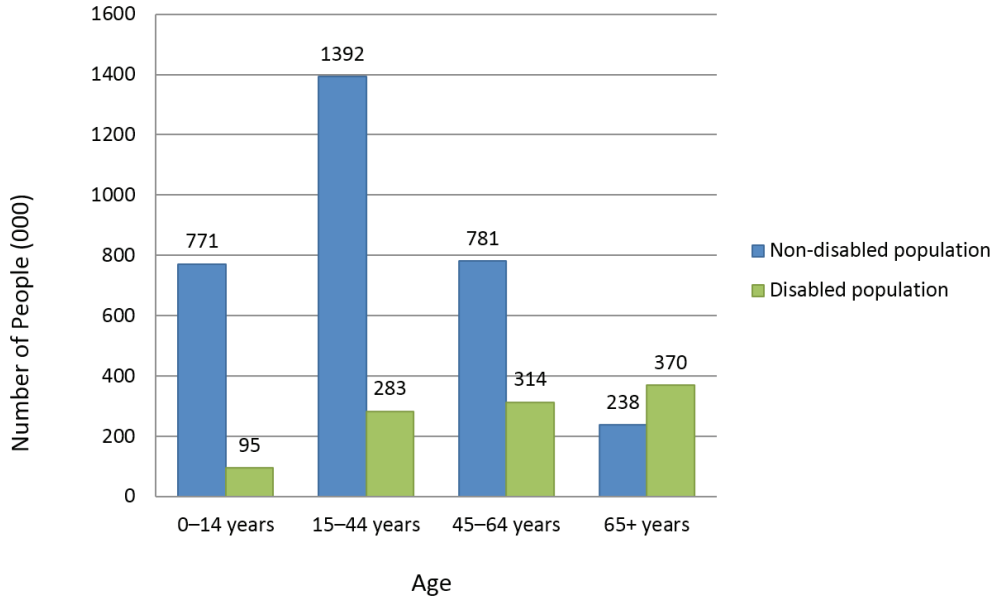
Jacqueline McIntosh, Adele Leah

The relationship between health and housing has been well documented in New Zealand, finding that decent housing is important for both physical and psychological well-being, and that health and overall life satisfaction are affected by housing standards.[1,2] For public buildings, official building standards specifically address the particular vulnerability of young children and the elderly through the requirement for facilities such as day care centres and nursing homes to maintain an indoor temperature of a minimum 16 degrees. However, these standards do not extend to housing; nor do they address the health concerns of those with impairments. With an ageing population and the attendant increase in impairment, this article seeks to connect issues of housing with issues of health, and to identify patterns of change that have implications for public health services and facilities.

The post-census Disability Survey is currently the primary source of information on disabled people in New Zealand. The survey consists of the Household Disability Survey (children and adults living in private households) and the Disability Survey of Residential Facilities (adults living in residential facilities), both of which rely on self-reporting.[3] The definition of 'disability' in the 2013 Disability Survey is *"...an impairment which has a long-term limiting effect on a person's ability to carry out day-to-day activities. Long-term means six months or longer, and limiting effect means a restriction or lack of ability to perform".*[4] People are not considered to have a disability if an assistive device (such as glasses or crutches) eliminates their impairment.

The 2013 survey identified that almost one-quarter (24%) of people living in New Zealand are currently disabled. Disabled adults living in households account for 92% of this population while disabled children living in households account for 8%.[5] The results also show that disability increases with age and in the 2013 survey, nearly 60% of people aged 65 years or over were identified as disabled (Figure 1).

Figure 1: Number of non-disabled and disabled people in New Zealand in 2013, according to age.



Source: Statistics New Zealand 2013 Disability Survey.

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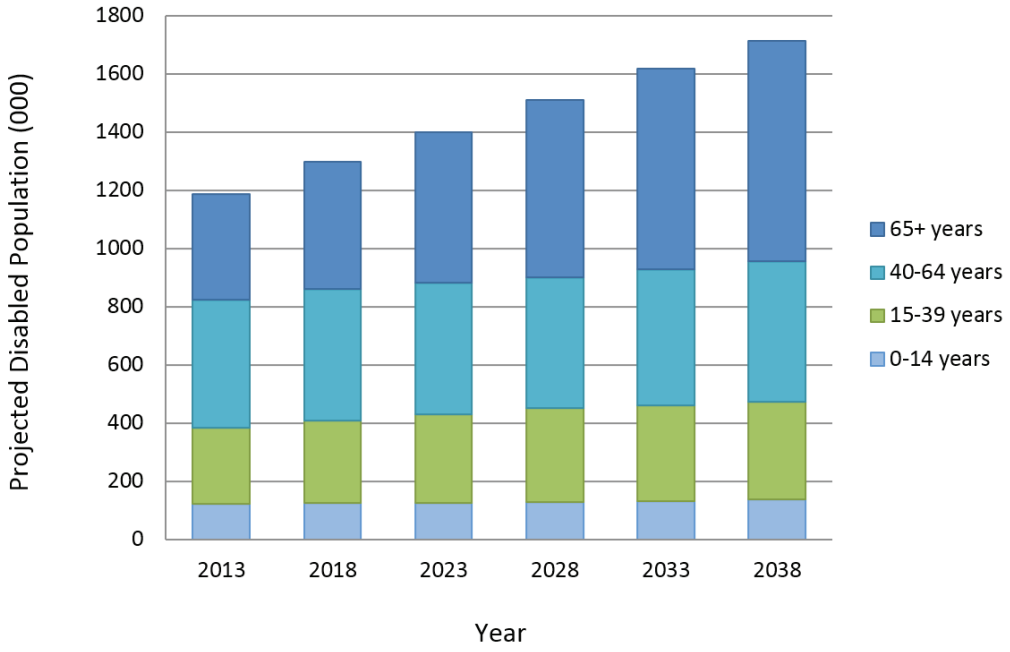
Figure 2: New Zealand disabled population projection according to age with Median (50th percentile) birth, death and migration assumptions.



Source: Author.

New Zealand disabled population projections

In order to anticipate future health needs, the patterns of disability have been analysed and projected, given specific consideration to ethnicity, changing birth and death rates and migration. Figure 2 shows the disabled population projection based on age and ethnic group-specific disability prevalence rates, with medium median (50th percentile) birth, death and migration assumptions, created using the latest census data, which includes:

- Population Projections from Statistics NZ National Population Projections 2014–2068 issued 28 November 2014
- Ethnic Population Projections from Statistics NZ National Ethnic Population Projections 2013–38HOTP issued 21 May 2015
- Disability rates according to age group and ethnicity from Statistics NZ 2013 Disability Survey issued 17 June 2014.

Percentiles indicate the probability that the actual result is lower than this percentile. The 50th percentile (median) indicates a 50% probability that the actual result for a given year is lower than this percentile.

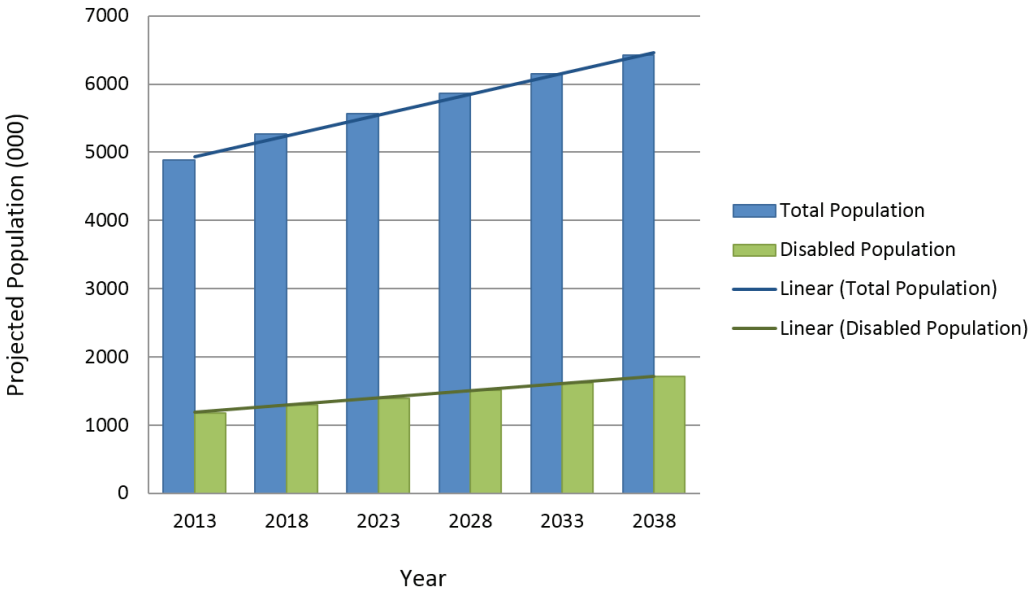
Figure 3 shows the population projection for the total population and disabled population between 2013 and 2038. The New Zealand population is projected to increase by 31% between 2013 and 2038, but the disabled population is projected to increase by 45%. In 2013, 24% of the population were identified as disabled and this figure is projected to rise to 27% of the population in 2038. Disability trends consider the current and projected demographics of the New Zealand population and are the best attempt at mapping disability based on the current data.

The big increases in disability between 2013 and 2038 are projected to fall in two main clusters: the 15–39 year age group (28% increase) and the 65+ year age group, which is set to double during this timeframe. The population projection for people aged over 85 years is shown in Figure 4.

Impairment types

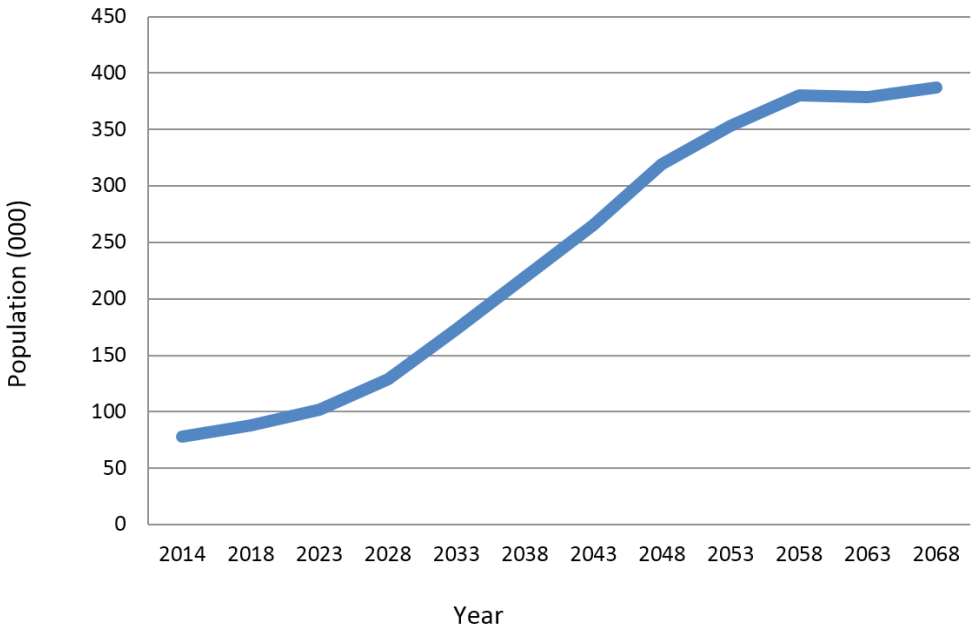
The types of impairment and their trends are significant for health care and for housing. The 2013 Disability Survey showed that both physical and sensory impairments are most common for adults (15 years or over) and are low for children (0–14 years). Figure 5 shows the disabled population projection according to impairment type

Figure 3: New Zealand population projection for the total population and the disabled population from 2013 to 2038 with median (50th percentile) birth, death and migration assumptions.



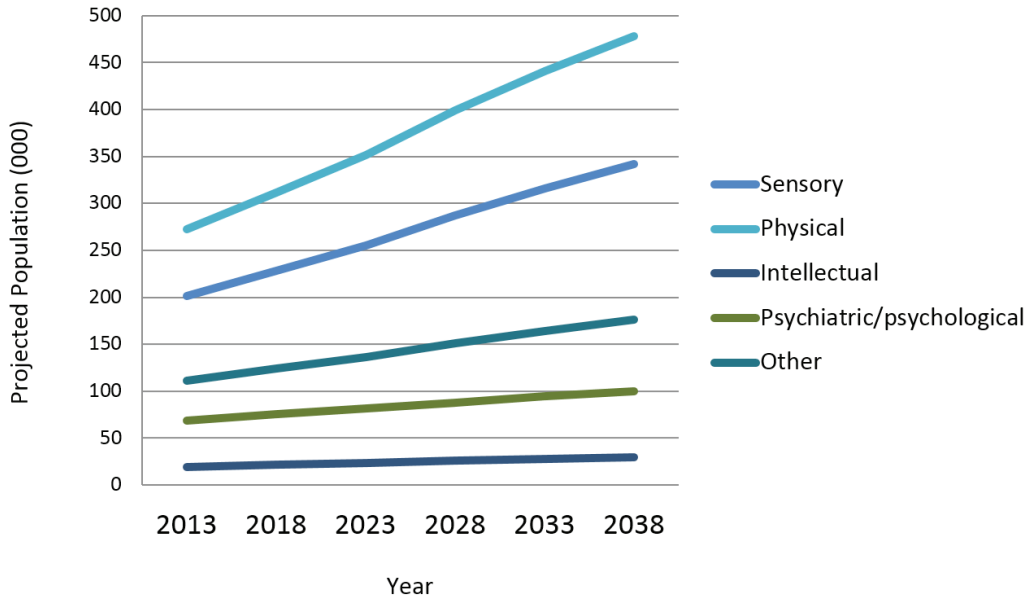
Source: Author.

Figure 4: Population projection of people aged over 85 years with median (50th percentile) birth, death and migration assumptions.



Source: Population projections from Statistics NZ National Population Projections 2014–2068 issued 28 Nov 2014.

Figure 5: New Zealand disabled population projection according to impairment type with median (50th percentile) birth, death and migration assumptions.



Source: Author.

between 2013 and 2038 created by using Figure 3 as a base and undertaking further calculations from statistics found in the document 'Impairment types according to age group' from Statistics NZ 2013 Disability Survey issued 17 June 2014.

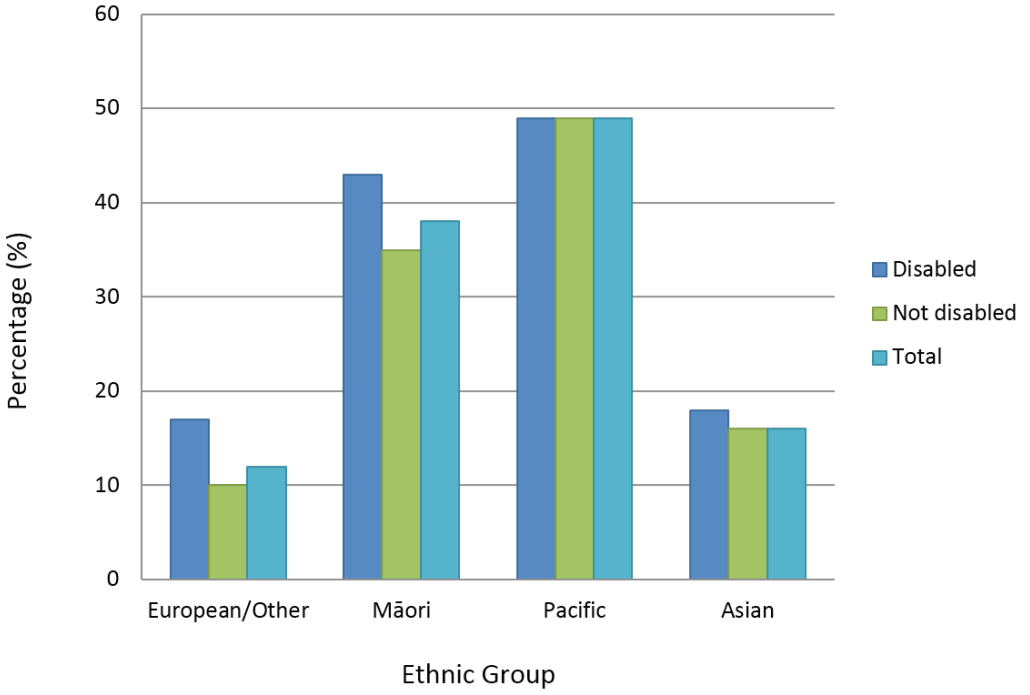
The largest increase can be seen in physical impairment types (76% increase over 2013), followed by sensory (70% increase over 2013). The significant increases in the physical and sensory impairment types are explained by the ageing population. In the 2013 survey, the median age of disabled people in each ethnic group was Māori (40 years), European/Pākehā (57 years), Pacific (39 years) and Asian (45 years). After adjusting for differences in ethnic population age profiles, Māori and Pacific people had higher-than-average disability rates. The incidence of disability increases with age and therefore, in the future, there will be greater demands for accessible housing stocks and services.

Disability and deprivation

The New Zealand Deprivation Index is a measure of socioeconomic deprivation in New Zealand. It is created using census data for variables, which include: car and telephone access, receipt of means-tested benefits, unemployment, household income, sole parenting, educational qualifications, home ownership and home living space.[6] Forty-three percent (43%) of Māori disabled and 49% of Pacific Island disabled live in the most deprived areas (Figure 6). This compares to 17% of the European/Other and 18% of the Asian groups. The same pattern is observed in the location of the non-disabled population, with 35% of Māori not disabled and 49% of Pacific not disabled living in the most deprived areas, compared to only 10% and 16% of the European/Other and Asian groups.

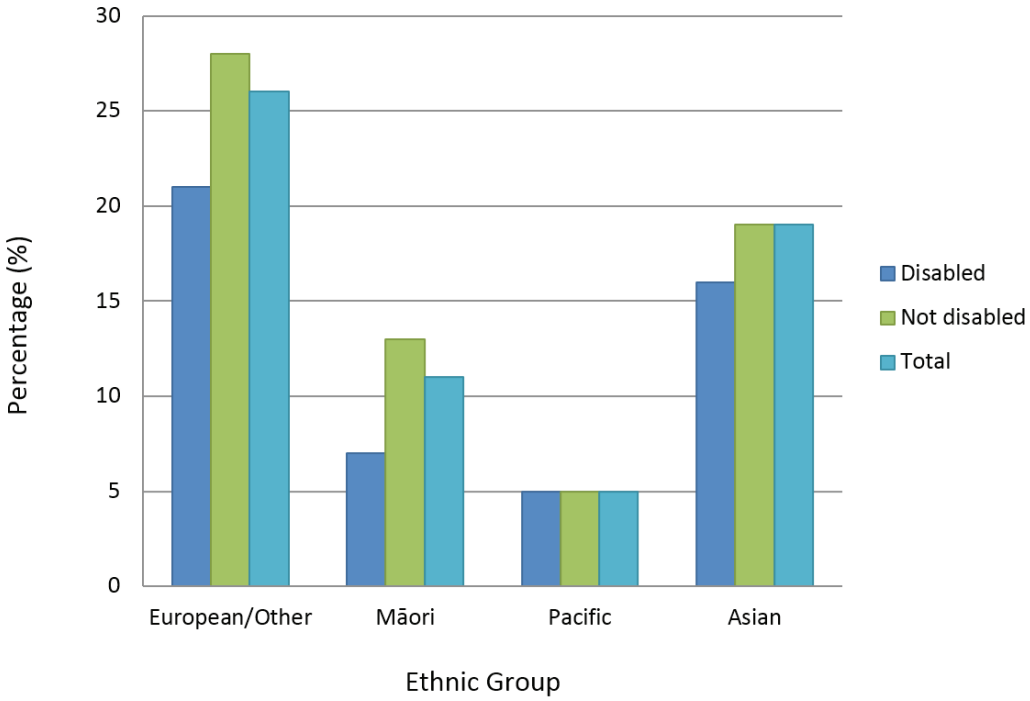
The least deprived areas contain 21% of the disabled European/Other group and 16% of the disabled Asian group, but only 7% and 5% of the disabled Māori and Pacific groups (Figure 7). Similarly, 28% of the European/Other not disabled and 19% of the Asian not disabled live in the least deprived areas, compared to only 13% and 5% of the Māori and Pacific not disabled groups.

Figure 6: Percentage of the disabled, not disabled and total population, according to ethnicity, who live in the most deprived areas of New Zealand.



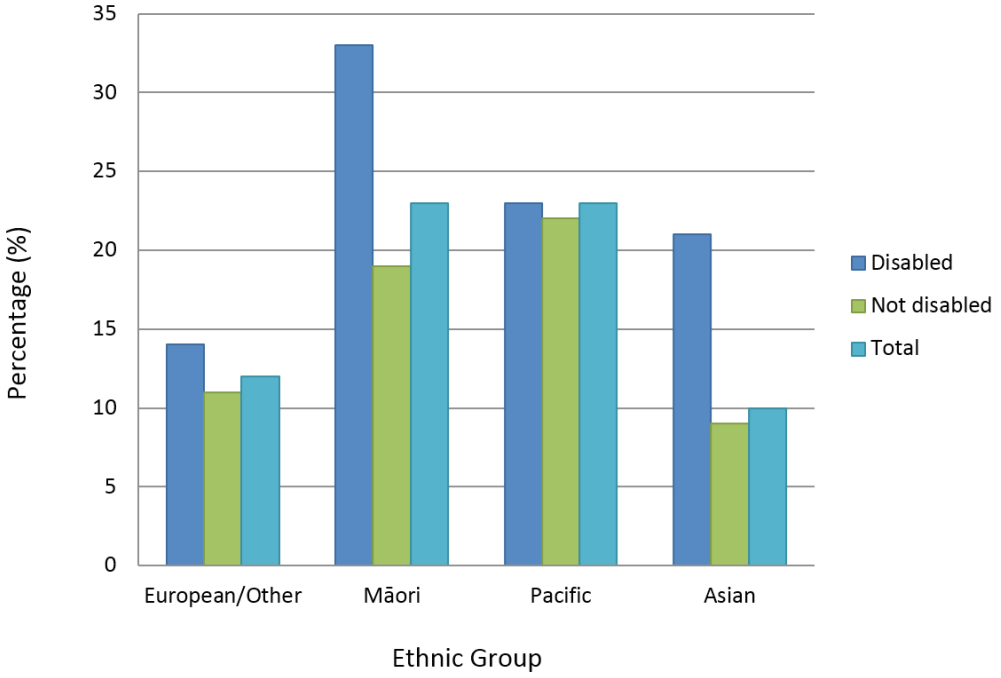
Source: Author, from customised data provided by Statistics New Zealand.

Figure 7: Percentage of the disabled, not disabled and total population, according to ethnicity, who live in the least deprived areas of New Zealand.



Source: Author, from customised data provided by Statistics New Zealand.

Figure 8: Percentage of the disabled, not disabled and total population, according to ethnicity, who find their house damp.



Source: Author, from customised data provided by Statistics New Zealand.

Significantly higher percentages of the Māori and Pacific groups are living in in the most deprived areas with the least deprived areas being occupied by higher percentages of the European/Other and Asian groups. Higher percentages of disabled people from all ethnic groups live in the most deprived areas.

Healthy housing

The 2013 census included questions about house dampness and coldness. Figure 8 shows the percentage of people who find their house damp according to ethnicity, and highlights the considerable differences between the responses from the different ethnic groups. One-third (33%) of Māori disabled find their house damp compared to 23% of Pacific disabled, 21% of Asian disabled and only 14% of disabled European/Other.

In addition to concerns of dampness, poor-quality housing is generally difficult to heat. Figure 9 shows the percentage of people who find their house difficult to keep warm according to ethnicity, and there are significant differences between the responses from the different ethnic groups.

Over one-third of the Māori, Pacific and Asian disabled groups (36%, 37% and 33% respectively) are living in houses that they find difficult to keep warm, compared to 22% of disabled European/Other. These figures differ considerably from the able-bodied population in each ethnic group. The disabled population in each ethnic group find their houses more difficult to keep warm than the able-bodied in each group. Overall, 25% of disabled people are living in houses which are hard to keep warm, compared to 16% of the not disabled population. In all ethnic groups and in all age groups, higher percentages of the disabled population are living in houses that they find difficult to keep warm compared to those of the not disabled population. In particular, the Pacific people would appear to be living in housing that is in worse condition from the other ethnic groups.[7]

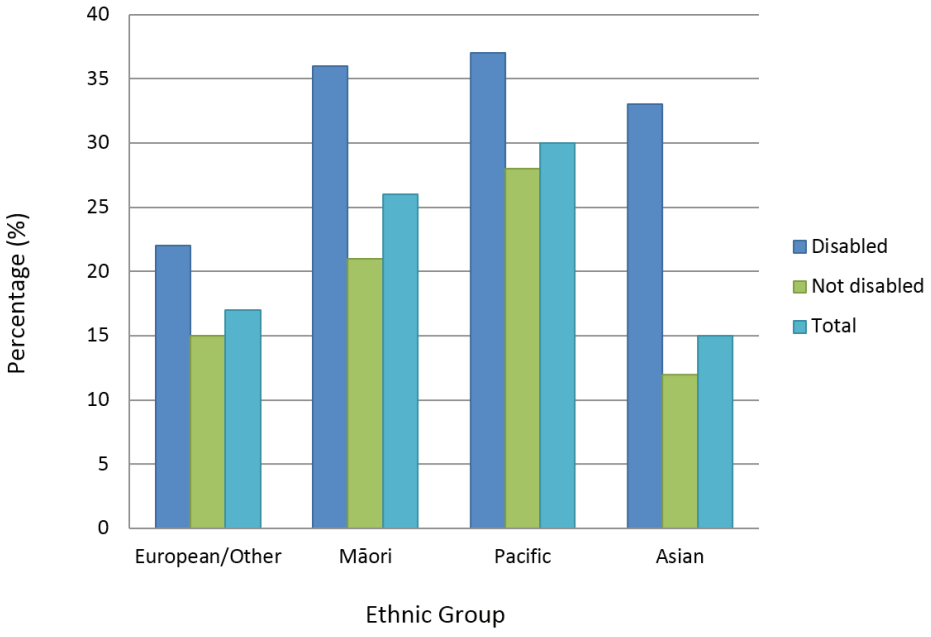
Living in the community, with some level of independence, will always be preferable to many, and there is likely to be a continued emphasis on "ageing in place". However, BRANZ research indicates that it is more cost effective to build universal design

features into a new home than retrofit the same house later, estimating that the cost of equipping a new house with UD features on average is $1,720, compared to approx. $16,990 for retrofitting at a later date.[8] Research has shown that existing houses are cold and damp, are expensive to heat and need modifications to be useable, indicating that "ageing in place" may not be an option for many. The elderly will require housing which is safe, warm, secure and easily maintained, with access to public transport, health, and other services. International studies have found that the majority of people aged over 65 years want to live outside of master-planned or age-restricted communities,[9] however, demand for retirement homes and residential facilities is growing with increasing numbers of people needing full-time care. The two largest growing demographics in disability are Māori and Pacific populations, however, both ethnicities prefer private households compared to residential facilities like retirement villages.

In general, Māori and Pacific Island households are larger than the standard houses can accommodate in New Zealand. Relatives often live in the same house and multi-family housing needs to be located in greater quantity to create compatible relationships in a community. Historically, housing in New Zealand has neglected the needs of ethnicities in the design and supply of social housing, catering mainly for the nuclear family of two parents and two children, but the growth of non-European ethnic populations is likely to mean more multi-generational families living together[10] and provision should be made to facilitate this. The lack of suitable housing for the growing numbers of ethnic groups whose culture and lifestyle necessitate larger houses can lead to overcrowding in undersized dwellings.[11]

Housing tenure also plays a critical role in healthy housing. The 2014 New Zealand General Social Survey showed that people living in rented housing were more likely to have a problem with dampness or mould (12%) than people living in housing which

Figure 9: Percentage of the disabled, not disabled and total population, according to ethnicity, who find their house difficult to keep warm.



Source: Author, from customised data provided by Statistics New Zealand.

was owner-occupied (3%). Similarly, 35% of people living in rented housing indicated that their house was always or often colder than they would like, compared to only 15% of the people living in their own houses.[12] Research has indicated that rental housing in general is in worse condition overall than owner-occupied housing,[13] and it could be argued that current rental accommodation is not generally suitable for the elderly or for people with disabilities.

Current housing supply is short of good-quality rental housing suitable for the ageing population requiring one or two bedroomed affordable and accessible units. It is also short of good-quality large houses for rental to ethnic groups where multi-generational families are living together. It is considered unlikely that the market will address the shortfall in housing supply, and the current housing stock requires significant modification and up-grade in order to accommodate these people groups. These patterns predict poorer health outcomes for the ageing in the future.

Location of the disabled population

As the population ages and impairments increase along with the costs of living, the elderly in New Zealand have traditionally located to more rural settings. More than 22% of the population in the districts of Kapiti Coast, Thames-Coromandel, Horowhenua, Waitaki and Waimate are aged 65+ years. Other areas with a high proportion of people aged 65+ years include Wairarapa and the districts of Hauraki, Buller, Marlborough, Timaru and Central Otago. Currently, the very aged tend to be concentrated in larger urban areas, presumably due to the need to close to facilities and services dedicated for high-dependency needs. More research is required to fully understand the very aged group (85+ years).

Table 1 shows the percentage of disabled people in private households in each region in New Zealand. 'Rest of South Island' contains the Tasman, Nelson, Marlborough and West Coast regions.[14]

The Auckland region, while containing the highest absolute number of disabled people, has the lowest percentage of disabled people in New Zealand (19%). Possible reasons for this include the younger age structure of the Auckland population and the large Asian population who have lower-than-average disability rates. The highest percentages of disabled people are in Taranaki and Northland (30% and 29% respectively),

Table 1: Percentage of disabled people in private households in New Zealand according to region.

Region	Total private household population (000)	Disabled population in private households (000)	Disabled population in private households as a % of the total population (%)
Northland	153	44	29
Auckland	1,419	271	19
Waikato	423	105	25
Bay of Plenty	268	73	27
Gisborne/Hawke's Bay	200	46	23
Taranaki	121	36	30
Manawatu-Wanganui	243	67	27
Wellington	514	114	22
Canterbury	575	143	25
Otago	201	52	26
Southland	105	27	26
Rest of South Island	155	41	27

Source: Statistics New Zealand 2013 Disability Survey.

followed by Manawatu-Wanganui (28%), Bay of Plenty (27%) and Otago, Southland and the Rest of South Island (each 26%). Further research is required matching the quality and availability of health services and housing in these locations with disability projections.

Conclusions

The factors that affect the rates and types of disability are changing. Quantifying the change in demand is useful in determining the suitability of the future supply of appropriate housing but also the availability of appropriate health care. The most significant impact of a growing non-European population is that of intergenerational families living together,[15] which results in a preference for larger households or the flexibility to open and close spaces to adapt to family structures. Further research is required to investigate and explore the specific housing needs of those Māori, Pacific Island and Asian groups who prefer more collective living options.

The population is ageing and the incidence of persons with a disability in New Zealand is increasing. This study indicates that large numbers of the disabled population in New Zealand are living in the most deprived areas, in rental housing that is damp and difficult to keep warm. It would appear that the poorest and most vulnerable are living in the worst conditions. Research that specifically quantifies the physical and psychological impacts of poor-quality housing on the disabled population is currently lacking, and further research is needed to direct policy to address current or prevent future health impacts.

This study finds that a significant proportion of the existing housing stock is far from suitable for the elderly and/or disabled. The cost of home modification is expensive and not possible for many. Rental housing is generally in worse condition than owner-occupied housing, and considerable financial investment is required in order for it to be made suitable. “Ageing in place” is highly expensive and may be beyond the reach of many. These issues have significant implications for the demands for care in cities outside of major centres. The lack of attention to this situation has had a deleterious impact on both cost and quality of housing in New Zealand.

This article suggests that New Zealand is ill prepared for the projected increase in disability. More overcrowding is predicted in suburban areas for ethnic groups who prefer to live with their families. Worse health outcomes are predicted for those who remain in their current, unmodified houses. Rental housing will come under increased pressure to be accessible, affordable for those on low incomes and suitably situated and designed to meet the needs of the growing elderly and the disabled populations.

Competing interests:
Nil.

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Simultaneous bilateral snowboarder's fractures in a young woman: a rare entity

Avijit Barai, Ralph Scorgie, Bruce Lambie

ABSTRACT

BACKGROUND: Talus is a well-supported bone in the foot. A fracture of talus requires a high-impact injury. A wedge-shaped inferolateral component is the lateral process of the talus (LPT). A fracture of LPT is also known as a 'snowboarder's fracture'. Simultaneous bilateral snowboarder's fracture is rarely reported in English literature.

CASE: We present here a case of simultaneous bilateral snowboarder's fractures in a slow-moving motor vehicle accident in the icy conditions. The injuries were unique because the snowboarder's fractures were accompanied by fractures of the inferior aspect of talus bilaterally and a fracture of the anterior process of the calcaneus in the right foot. To our knowledge, no such case has been reported in the past. Our patient underwent successful open reduction and internal fixation with plate and screws.

CONCLUSION: Snowboarder's fractures are frequently missed by the clinicians, which causes significant morbidity of the patients. Adequate knowledge and awareness among the physicians about this type of injury may improve the patient care.

The talus is the only tarsal bone which does not have any muscular or tendinous attachments.[1] As the talus is well protected by bones and ligaments, a fracture of talus usually warrants a high-impact injury.

Although the general perception is that forced dorsiflexion and inversion of ankles cause the fracture of the wedge-shaped lateral process of the talus (LPT),[2] some researchers demonstrated that external rotation[3] or eversion[4] of ankles might be the underlying mechanism of such fractures. Snowboarding is a common cause of such LPT fractures[3] as the static foot is attached to the snowboard, which results in forced dorsiflexion and inversion of the ankle. Therefore, this is also known as a 'snowboarder's fracture'. However, overboarding[2] or any other injuries causing dorsiflexion of the ankle with inversion or external rotation might cause a snowboarder's fracture. A snowboarder's fracture constitutes less than 1% of all fractures of human body.[5] We present here a rare case of simultaneous bilateral snowboarder's fractures in a young woman.

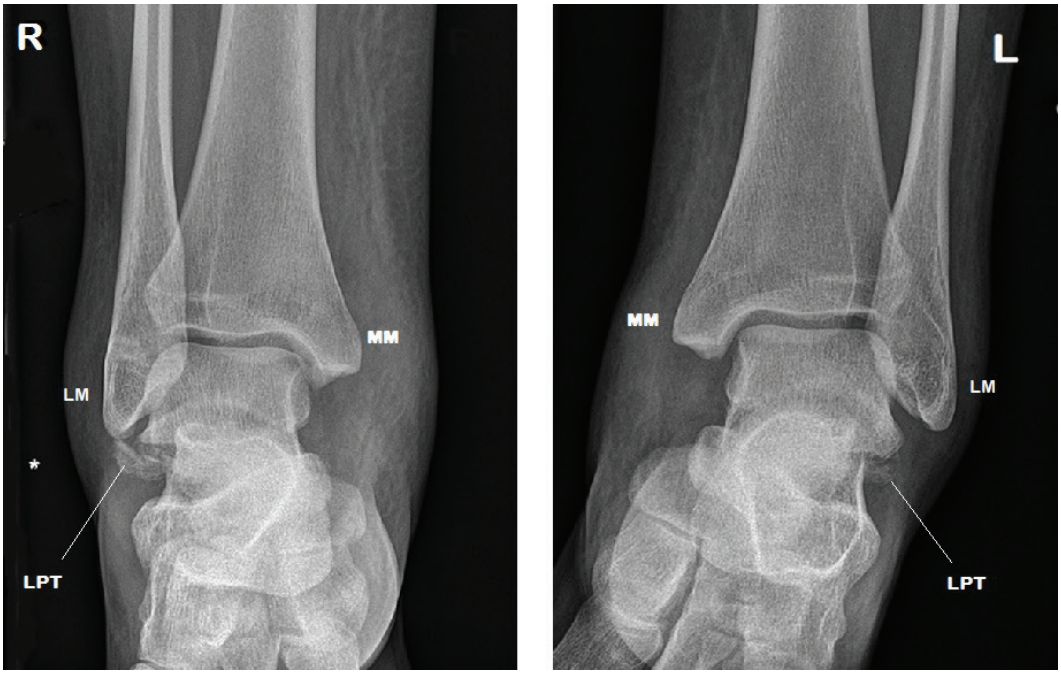
Case report

A 17-year-old lady was brought in to our emergency department (ED) following a motor vehicle accident. She was a front-seat passenger in a car which was traveling slowly when the car skidded on icy roads. She was found restrained with her feet up on the dashboard. She was complaining of pain in the back, abdomen, left hip, right knee and both ankles. She was quite anxious during her presentation to the ED and her main complaint was the pain in her ankles. Although she could not explain exactly how her feet went up the dashboard, it is assumed that her feet sustained dorsiflexion and inversion injuries against the dashboard.

Both of her ankles were mildly swollen, but the skin was intact and there was no obvious deformity. Medial aspect of the right ankle, right knee, left ankle and left hip were tender. Distal neurovascular status was intact. Her upper abdomen and mid lumbar spines were tender.

Her initial x-rays of both ankles revealed bilateral snowboarder's fractures (Figure 1), though there was some doubt about the left ankle fracture.

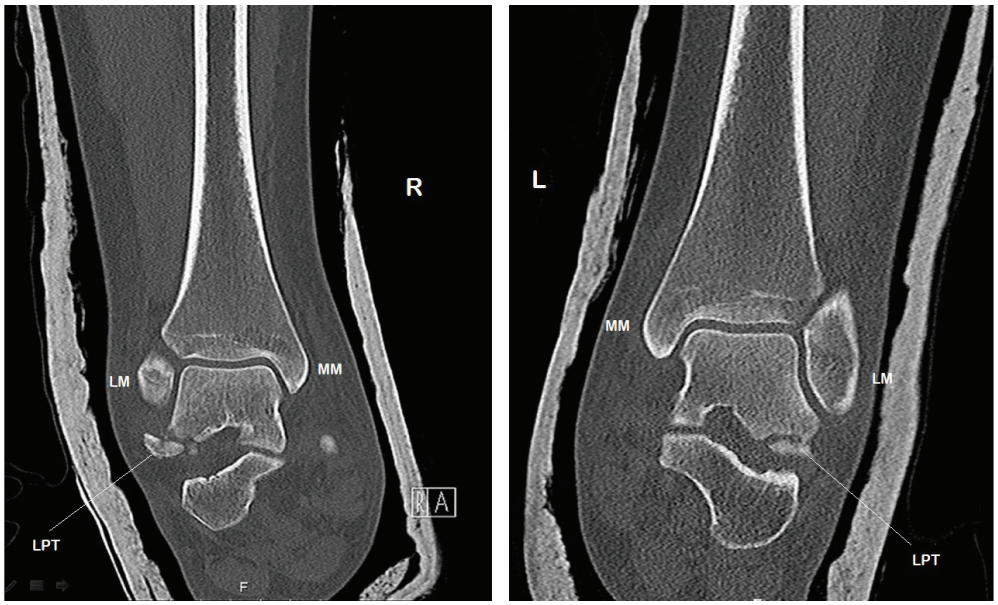
Figure 1: Plain radiographs of both ankles AP view showing snowboarder's fractures.



X-ray ankles AP view showing fractures of LPT. LM, lateral malleolus; MM, medial malleolus; LPT, lateral process of talus; APC, the anterior process of the calcaneus; R, right; L, left.

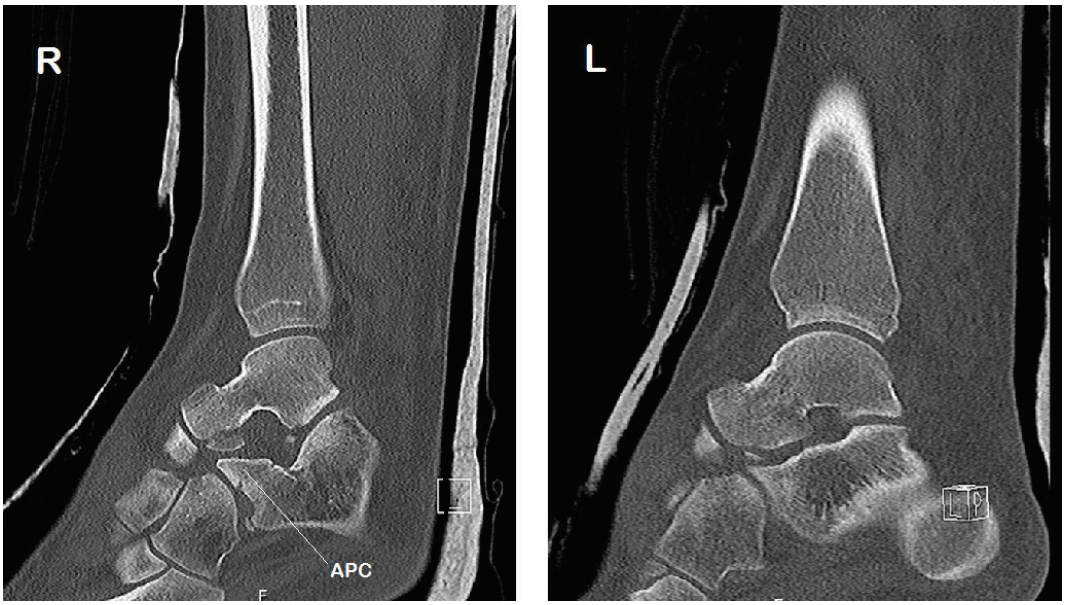
Her x-rays of feet, pelvis, knees, lumbar spines and chest did not show any fractures. The bedside ultrasound scan did not show any intra-abdominal free fluids. CT scans of both ankles showed bilateral snowboarder's fractures associated with fractures in the inferior aspect of anterior talus bilaterally and anterior process of the calcaneus in the right foot (Figure 2 and 3).

Figure 2: CT scan of both ankles' coronal sections showing snowboarder's fractures.



CT scan of ankles coronal sections showing fractures of LPT bilaterally. LM, lateral malleolus; MM, medial malleolus; LPT, lateral process of talus; APC, the anterior process of the calcaneus; R, right; L, left.

Figure 3: CT scan of both ankles' sagittal sections showing snowboarder's fractures.



CT sagittal sections showing fractures of LPT bilaterally and APC on right foot. LM, lateral malleolus; MM, medial malleolus; LPT, lateral process of talus; APC, the anterior process of the calcaneus; R, right; L, left.

We placed her in bilateral below knee back slabs and admitted her under the orthopaedic team where she was treated with open reduction and internal fixation with plates and screws. Her other x-rays and CT scan of abdomen did not show any fractures. However, there was a small laceration of the liver which was considered to be insignificant by the surgical team and was treated conservatively.

Discussion

Our case was unusual for a number of reasons. Firstly, her mechanism of injury was a low-impact injury, which contradicts other authors.[6–9] It is not obvious how an axial traction to her ankles caused forced dorsiflexion, and inversion[2] or external rotation[4] of her ankles as were proposed as the probable mechanism of a snowboarder's fracture. This case might illustrate that there might be some other mechanism for a snowboarder's fracture.

Secondly, her tenderness was on the medial aspect of the right ankle, and diffuse tenderness of left foot, which warranted foot x-rays that completely missed the fractures. This might highlight the reason why snowboarder's fractures are frequently missed by the inexperienced clinicians.[2] Bonvin et al reported that snowboarder's fractures may be misdiagnosed as ankle sprain in up to 50% of cases in plain x-rays.[11] The issue may be addressed with knowledge and awareness of the condition.

Thirdly, she had distracting injuries on her back, abdomen and knee joints, which diverted our attention, and we could have easily missed the snowboarder's fractures. In fact, snowboarder's fracture is frequently missed by inexperienced clinicians and cause significant long-term morbidity of the patients.[2,3,10,11] This might focus on the importance of a thorough clinical examination in the diagnosis and management of relatively rare entities.

Fourthly, she had bilateral snowboarder's fractures in addition to the sub-talar fractures bilaterally, and an anterior process of calcaneus fracture in right foot, which to our knowledge has not been previously reported in English literature. Table 1 illustrates a summary of comparable cases.

Table 1: Comparable cases of snowboarder's fractures.

Author	Summary	Comparison with our case
Barnett et al[7]	A case of bilateral LPT fractures, which by definition are snowboarder's fractures.	Our case was of a different type of injury, especially considering the fact that there were sub-talar fractures bilaterally and the right foot had an anterior process of calcaneus fracture as well.
Mussmann et al[2]	A case of a snowboarder's fracture in left ankle following a wakeboarding injury, which was treated conservatively.	This is clearly different from our patient who had bilateral snowboarder's fractures associated with other bony injuries, which were treated with plate and screws.
Balaji et al[6]	A case of bilateral open fracture-dislocations of talus resulting in avascular necrosis (AVN).	Our case was closed fracture, which was treated successfully with plate and screws. Due to the nature of blood supply of talus and a lack of dislocation in our case, we don't believe that an AVN is likely to develop.

The Otago region of New Zealand is a popular tourist destination all year round. During the winter months, tourists from all over the world travel to Otago for participation in the winter sports such as skiing and snowboarding. Although we encounter some unique injuries, a simultaneous bilateral snowboarder's fracture was a once-in-a-lifetime experience to even the most experienced ED clinicians. Thorough knowledge of this rare entity may prevent this to be missed, and thus will improve the care of the patients.

Competing interests:
Nil.

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Survival of *Legionella* in earthquake-induced soil disturbance (liquefaction)

David Murdoch

The recent paper by Graham and Harte on the survival of *Legionella* in earthquake-induced soil disturbance (liquefaction) is misleading.[1] In particular, it incorrectly implies that there is no clear reason for the dramatic increase in Legionnaires' disease case detection in Christchurch from September 2010.

While an influence of earthquake activity cannot be ruled out completely, this increase in case detection is almost certainly the result of a change to a more rigorous testing algorithm in Christchurch for suspected Legionnaires' disease. From October 2010, all sputum samples sent to Canterbury Health Laboratories from patients with suspected pneumonia have been tested for *Legionella* by PCR, whether requested or not by clinicians.[2] This major intervention resulted in a marked increase in case detection that has persisted ever since. Indeed, a similar increase in case detection has been observed when the same testing algorithm was rolled out in other regions of New Zealand from May 2015. Although, by coincidence, this testing algorithm started about the same time as the commencement of intense earthquake activity in Canterbury, the persistence of the increased case detection ever since that time, following expected seasonal patterns, and the lack of associated increases in pneumonia admissions in Christchurch during the earthquakes, do not support an association between earthquakes and the increase in Legionnaires' disease case detection.

While Graham and Harte make passing reference to the change in testing algorithm in their discussion, they fail to highlight the significance of this intervention, which is widely acknowledged to be responsible for the increased case detection for which New Zealand is renowned. By doing so, they provide an imbalanced view and place undue emphasis on the potential effects of earthquake activity.

In addition, the claim that liquefaction-affected soil does not support the growth and survival of legionellae is not justified based on their findings. The majority of cases of Legionnaires' disease were caused by *Legionella longbeachae*, yet Graham and Harte used a different species, *Legionella bozemanae*, for their seeding experiments. *L. bozemanae* is a relatively uncommon cause of Legionnaires' disease in New Zealand. Although both species are environmental bacteria, *L. bozemanae* is a poor choice as the sole species used in experiments given the ready availability of isolates of the species that was actually causing the majority of human disease. Also, the reliance on culture-based methods alone meant the experiments had inadequate sensitivity to address the study questions.

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New Zealand infants weaned onto a high sugar diet from four months old: better health or better business? Part II

Gerhard Sundborn, Simon Thornley, John Malcolm, Caryn Zinn, Bodo Lang, Richard Johnson

Although excess sugar intake is a major cause of ill health,[1–4] restricting sugary drinks has been the main focus of programmes to improve population health.[5–8] Sugary diets can and do start well before sugary drinks are even considered.

In Canada, the US and the UK, researchers, health professionals and health advocates have found that many commercially-prepared baby foods contain unacceptably high concentrations of sugar—with serving sizes that frequently exceed recommended daily allowances. Further, parents and people responsible for public policy tend to overlook this issue.[9–12]

Recommended intakes of sugar in infants permit no more than 5% of energy, which means less than two teaspoons per day for an average six month old. Even less (<3% of energy) is recommended to prevent dental caries.[13] Furthermore, the World Health Organization (WHO) and the New Zealand Ministry of Health (MoH) recommend exclusive breastfeeding for infants up to six months old to achieve optimal growth, development and health.[14,15] These Guidelines for Healthy Infants and Toddlers both emphasise savoury weaning foods.

We are concerned that infants from four months of age are exposed to foods high in concentrated sugar as their first foods. Some commercial baby foods contain up to four teaspoons of sugar per serve. For example, a 120g pouch of Kraft-Heinz-Wattie's *Apple, Peach and Mango* fruit puree contains 16g of sugar.[16] This equates to four teaspoons of sugar and the package is labelled as a single serve. On a visit to a local Auckland supermarket, of the 33 single serve Kraft-Heinz-Wattie's baby food products stocked, 22 (66%) exceeded two teaspoons of sugar per serve. Of these, 11 contained two to three teaspoons of sugar, a further 10 items contained three to four teaspoons, and one product contained four teaspoons.

What concerns us is that many of these products, in particular the entire Kraft-Heinz-Wattie's baby food product range, is endorsed by Plunket—the majority health provider for support services for pre-school children. This is confusing and likely to mislead the New Zealand public and parents into thinking these products are healthy food items for their infants.

When Plunket was approached about these concerns, they responded that "Plunket has a 25-year relationship with Kraft-Heinz-Wattie's, and all the Plunket-endorsed products adhered to strict nutrition guidelines".[17] It was also explained that "the Infant Nutrition Advisory Group (INAG) advises Kraft-Heinz-Wattie's on all issues relating to infant food and nutrition".[17]

It would seem, however, that there is disagreement between the strict nutrition guidelines adhered to by Kraft-Heinz-Wattie's and those prescribed by the WHO and New Zealand MoH.[14,15]

The INAG is described as "an independent group of New Zealand's foremost experts in child health and nutrition"[18] that give advice to Kraft-Heinz-Wattie's about food and nutrition. After further enquiry, we found that the INAG consists of three members: a

Plunket representative and two independent dietitians.[19] A number of concerns we have about the INAG include:

- Lack of transparency of membership of the group (not listed on any public website and not available on request)
- Lack of publicly available reports or minutes
- The claim that the group is independent, which is untrue as at least two members receive an honorarium for their services to the INAG from Kraft-Heinz-Wattie's,[19] and the Plunket member has an interest with Kraft-Heinz-Wattie's because Plunket receives their funding
- This group is 'advisory' only: Kraft-Heinz-Wattie's can reject advice
- INAG provides advice to Kraft-Heinz-Wattie's rather than to Plunket.

Further, we believe that the advice this group provides should align with WHO guidance about sugar intake, and scientific evidence relating to the risk of dental caries, as well as MoH guidelines.[13–15]

From our investigation, we cannot determine whether the i) INAG have provided advice that has supported baby foods with concentrated sugar to be produced and marketed as healthy **OR** ii) whether INAG have determined that these products are unhealthy, yet their advice was ignored by the manufacturers.

Regardless of which statement is true, high-sugar baby foods feature prominently on our supermarket shelves of which the entire Kraft-Heinz-Wattie's range carry the Plunket logo endorsing their product.

Plunket receive sponsorship funds for their endorsement of the Kraft-Heinz-Wattie's range of infant and baby-foods. Plunket provides vital health care to the community and funding is needed to support this, but is this commercial relationship likely to result in best practice from a public health nutrition perspective, or is it another form of marketing?

Considering these points, we suggest that:

1. Plunket re-assess which baby-foods they endorse, paying attention to concentrated sugar content.
2. The New Zealand MoH establish an Infant Nutrition Advisory Group and prepare guidance about the composition of baby foods.
3. Sugary 'baby foods' that exceed 5g/100g or 8g per serve be subject to health warnings, and are not endorsed by health agencies.
4. The New Zealand government adequately fund Plunket, so that their work is not influenced by the food industry.

Finally, we propose that these sugary baby foods be removed from supermarket shelves, or at least Plunket remove their endorsement from these products until a comprehensive assessment of the issues raised in this letter is completed.

This paper has been prepared by FIZZ (Fighting Sugar in Soft drinks) New Zealand; a public health advocacy group established by researchers that aims to address child and adult obesity by reducing sugar intake and specifically sugary drink consumption to zero by 2025.

Competing interests:
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The consequences of courage: the US Surgeon General, the National Rifle Association (NRA) and the Trump regime

Frank Houghton

"Courage is not a man with a gun in his hands"—Atticus Finch in *To Kill a Mockingbird.*

Amidst the tumult of US President Trump's first one hundred days in office, many people may have overlooked his appointment of a new Acting Surgeon General. The new appointment could be seen as progressive from at least three perspectives. Firstly, the new Surgeon General is a woman, and just the fourth woman to hold this position. Secondly, she is African American. This prestigious position has formerly been held by just two other African American women, and one African American man.[1] Third, she is the first non-physician to be appointed to the position (she does hold a PhD). One former incumbent in the position was both a nurse and a physician.[2]

It must be acknowledged that the appointment of Rear Admiral Sylvia Trent-Adams as Acting Surgeon General does not fit the usual portrayal of the US President as a 'racist-misogynist'.[3] However, his 'progressive' appointment may in fact be a smoke-screen for another more sinister agenda.

It should be noted that the appointment of the prior incumbent, Dr Vivek Murthy, was held up for over a year by opposition led by the powerful US lobby group the National Rifle Association (NRA).[4] The NRA was an influential and vocal supporter of Donald Trump's campaign for the Presidency, with over five million members.[5] The reason for the NRA's opposition to Murthy's appointment was simply because he openly discussed gun violence as a public health issue.[4,6] The NRA is well known for its rabid opposition to almost any proposal that they see as infringing on the second amendment to the constitution right to bear firearms.

Many suspect that Murthy's recent removal from the post of Surgeon General was purely in response to his questioning of the issue of access to firearms.[7] Politics, healthcare and firearms have long been highly contentious in the US. Funding for gun control research at the Centers for Disease Control & Prevention (CDC) ceased in 1997 when an amendment was added to an operations bill in Congress, which barred the CDC from conducting research that would 'advocate or promote gun control'.[8–9] Known as the Dickie Amendment, after its instigator Republican Jay Dickie, its influence continues today.[10–12]

Although the National Institutes of Health (NIH) continued to fund gun control research,[12] it was noted that funding to the CDC was cut by exactly the amount that it had spent on gun control research in the year before the 1997 ban.[8] It appears as though this action effectively stopped all CDC research on firearms as it feared a loss of further funding. In 2013, 17 years later, (then) President Obama ordered the CDC to resume gun control research via Executive Order. Interestingly, even this action failed to encourage substantive research on this crucial issue.[8,10,12]

At a recent NRA convention, Trump addressed the audience stating "You have a true friend and champion in the White House". He continued to state that

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the "eight-year assault on your second amendment freedoms has come to a crashing end".[13] In evaluating this statement, it is prudent to explore something of the history of firearms and public health in the US over the last eight years to understand why attempts to curtail firearm ownership might have been mooted.

Table 1 details a composite listing of mass shootings that have occurred in the US, gathered from media reviews of the issue since 2009.[14–15] While every life lost to preventable firearm deaths is a tragedy, this list includes particularly emotive incidents, such as the 14 December 2012 Sandy Hook Elementary School shooting in Newtown Connecticut, in which 20 young children (ages six and seven) were killed alongside a number of adults.

Table 1: Notable mass shootings in the US, 2009–2017.

Date	Location	Casualties
10 March 2009	Kinston and Samson, Alabama	10 killed, followed by suicide
3 April 2009	Binghamton, New York	13 killed, 4 injured followed by suicide
5 November 2009	Fort Hood, Texas	13 killed, 32 injured
19 January 2010	Appomattox, Virginia	8 killed
12 February 2010	Huntsville, Alabama	3 killed, 3 injured
3 August 2010	Manchester, Connecticut	8 killed, 2 injured followed by suicide
8 January 2011	Tucson, Arizona	6 killed, 11 injured
12 October 2011	Seal Beach, California	8 killed, 1 injured
2 April 2012	Oakland, California	7 killed, 3 injured
20 July 2012	Aurora, Colorado	12 killed, 58 injured
5 August 2012	Oak Creek, Wisconsin	6 killed, 3 injured
28 September 2012	Minneapolis, Minnesota	5 killed, 2 injured followed by suicide
21 October 2012	Brookfield, Wisconsin	3 dead, 4 injured followed by suicide
14 December 2012	Newtown, Connecticut	27 dead, 1 injured followed by suicide
7 June 2013	Santa Monica, California	5 killed, attacker then shot and killed by police
16 September 2013	Washington, DC	12 killed, 3 injured, attacker then shot and killed by authorities
2 April 2014	Fort Hood, Texas	3 killed, 16 injured, plus attacker found dead at scene
23 May 2014	Isla Vista, California	6 killed, 7 injured, followed by suicide
18 June 2015	Charleston, South Carolina	9 killed, 3 injured
16 July 2015	Chattanooga, Tennessee	4 killed, 3 wounded, attacker killed by authorities
1 October 2015	Roseburg, Oregon	9 killed, 9 injured followed by suicide
29 November 2015	Colorado Springs, Colorado	3 dead, 9 injured
2 December 2015	San Bernardino, California	14 killed, 22 injured, 2 attackers then shot and killed by authorities
12 June 2016	Orlando, Florida	49 killed, 53 injured, attacker then shot and killed by authorities

The contents of Table 1 alone would justify concerns over gun ownership in the US. However, it must be noted that these events are just a small fraction of the number of mass shootings in the US. There were 372 mass shootings in the US in 2015 alone, killing 475 people and wounding 1,870 (a mass shooting is defined as a single shooting incident, which kills or injures four or more people, including the assailant).[16] There were also 64 school shootings in the US in 2015.[16]

In 2015, 13,286 people were killed by firearms in the US, while another 26,819 were injured. This is almost 37 shot and killed per day. These figures exclude suicide.[16] The figures for suicide are even more dramatic. According to the Centers for Disease Control and Prevention in 2014, almost exactly one in two suicides in the US result from firearms. The figure for suicides involving firearms in 2014 was 21,334 out of a total of 42,773.[17]

The US is well known internationally for its gun culture. However, the actual extent of this obsession is staggering. It is estimated that the US population owns approximately 300,000,000 guns.[16] That is an average of almost one for every man, woman and child in the country. Arguments in support of firearms in the US based on a 'shooting, hunting and fishing' culture cannot defend mass ownership of weapons such as semi-automatic assault rifles, as used to deadly effect in the attack on an Orlando nightclub in June 2016, which left 49 victims dead.[14–15]

Other countries have responded to their firearm tragedies decisively. Australia dramatically restricted access to firearms following the mass shooting at Port Arthur in Tasmania. The UK did the same following such incidents in Cumbria and Hungerford. The US has yet to do so.[18]

Even by raising the issue of firearms as a public health issue, Vivek Murthy seriously endangered his career within the US Public Health Service. This kind of stand takes courage.[4] Daring to even raise the issue of gun control in the public sector in the US can result in dramatic censure. However, public health must continue to focus on this issue despite any inherent danger in doing so.[19–20]

It may be wise to remember Voltaire's sage advice: "To learn who rules over you, simply find out who you are not allowed to criticize". However, for public health it is essential to challenge the status quo and maintain both the courage and the independence necessary to speak out on important issues. Public health must resist censorship of its activities and avoid self-surveillance.

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Nil.

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Treatment of oligoarticular juvenile idiopathic arthritis

Intra-articular corticosteroids are widely used in the management of children with oligoarthritis. However, the joint symptoms recur requiring further injections. Methotrexate is a cornerstone treatment for rheumatoid arthritis and there is speculation that it would also be helpful in juvenile arthritis.

In this trial, 226 appropriate patients were randomly assigned to receive intra-articular steroids alone or in combination with oral methotrexate. Remission was achieved in 32% of the injection alone group and in 37% of the methotrexate group. Seventeen percent of the methotrexate-treated patients had recorded adverse events.

Concomitant administration of methotrexate did not augment the effectiveness of intra-articular corticosteroid therapy.

***Lancet* 2017; 389:909–16**

Risk of heart failure after community-acquired pneumonia

In this prospective controlled study, 4,988 adults with community-acquired pneumonia and no history of heart failure were recruited and matched on age, sex and treatment setting with up to five controls without heart failure or pneumonia (n=23,060).

The patients were followed for 10 years, and the risks of hospital admission for heart failure were compared. Twelve percent of the pneumonia cohort developed heart failure over the follow-up period. There was a greater than 50% relative increase in the incidence of heart failure in those who had suffered from pneumonia compared with the control group.

The researchers concluded that pneumonia is statistically significantly associated with an increased risk of heart failure across the range of ages and regardless of the severity of the pneumonia episode.

***BMJ* 2017; 356:j413**

Trial of pregabalin for acute and chronic sciatica

The antiepileptic drug pregabalin has been shown to be effective in reducing some types of neuropathic pain, including postherpetic neuralgia and diabetic peripheral neuropathy.

This report is of a randomised trial comparing pregabalin with a placebo in sciatica patients. The starting dose of pregabalin was 150mg, which was adjusted to a maximum dose of 600mg. Two hundred and nine patients were randomised to pregabalin or placebo. Leg pain intensity was reviewed at eight weeks.

The results were that treatment with pregabalin did not significantly reduce the intensity of leg pain associated with sciatica and did not significantly improve other outcomes, as compared with placebo, over the course of eight weeks. The incidence of adverse events was significantly higher in the pregabalin-treated subjects.

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Enlistment of Medical Officers in Australia

June 1917

New Zealand and Australian soliders landing at Anzac Cove, Gallipoli, Turkey, April 25, 1915. Photographer unidentified.

At a meeting of the Federal Committee, held in May, Dr. F.S. Hone moved:—"That the Federal Committee request that the Branches take a plebiscite of the medical profession in each State on the following question:—Are you in favour of the Federal Committee requesting the Federal Government to pass legislation to bring about compulsory enlistment of the medical profession in Australia for service in the Australian Imperial Force (including service overseas)?"

It was pointed out that a technical difficulty existed which would render the carrying out of this resolution difficult, if not impossible. The only lists of medical practitioners available were the Medical Registers, and it was recognised that the Registers were inaccurate. Many of the Registers included names of practitioners who had long since left Australia, or who had died, and there was considerable overlapping. It was therefore determined that the motion should apply to the members of the British Medical Association in Australia. It was carried in this form.

General Fetherston informed the Committee that General Sir Neville Howse had asked for 240 men for the year. He wanted as many young men as possible at once. There was some delay in getting the men off on account of the transport difficulty. He had to keep a certain number of men in readiness to accompany transports, but up to the present he was short of his requirements. When the next batch of students graduated he would be placed in a better position, but it would be necessary to enlist the services of a not inconsiderable number of practitioners, if he was to have the full number asked for.

Dr. D.H.E. Lines moved and Dr. W. Robertson seconded:—"That in the event of the voting being in favour by a three-quarters

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majority of those voting, and by a majority of the Branches, the Chairman be authorised to approach the Federal Government with a view to the introduction of a Bill for the compulsory enlistment of the medical profession for service in the Australian Imperial Force."

The motion was carried. It was further resolved that the honorary secretaries of the Branches be instructed to send in the returns of the voting not later than 16th July, 1917.

A discussion followed on the advisability of forming medical war committees in each State, for the purpose of undertaking the organisation of the profession for war purposes. The majority of the members considered that provision should be made for the eventuality that the Federal Government should decline to introduce a Bill for the compulsory enlistment of the medical profession. It was pointed out that the medical war committees, if formed under existing circumstances, would of necessity be voluntary organisations, and could not receive official recognition. In this way they would differ materially from the committees created after the proclamation.

General Fetherston promised that he and all the principal medical officers would welcome such a voluntary body, and would assist it in every way that lay in their power.

Dr. F.S. Hone moved and Dr. W.N. Robertson seconded:—"That the Federal Committee urges on the Branches the pressing necessity of securing all possible members for service abroad, and to that end requests them each to appoint a Medical War Committee in their State to work in conjunction with the Principal Medical Officer, for the purpose of (i.) securing entry of all members of the Branch into the Australian Army Medical Corps; (ii.) canvassing members of the Branch for service in the Australian Imperial Force; and (iii.) assisting arrangement of civil practice with the least possible disturbance."

The motion was carried.

Later on, the Committee considered the position of the practices of the men serving overseas. General Fetherston moved and Dr. D.H.E. Lines seconded:—"That the Federal Committee consider the question and formulate the principle to be followed by the members of each Branch towards the practice of members of the Australian Imperial Force and of the Naval and Military Expeditionary Forces."

The motion was carried.

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