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Public health interventions: the elephant in the room of the health system crisis

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Summaries

Use of healthcare resources and family planning methods 12 months after birth in women of South Auckland: the Healthy Mums and Babies (HUMBA) randomised trial

Rennae S Taylor, Jessica Wilson, Minglan Li, Katherine Anne Tyrrell Culliney, Megan McCowan, Christopher McKinlay, Lesley M E McCowan, Karaponi Okesene-Gafa

One hundred and twenty-seven (55.2%) mums who participated in Healthy Mums and Babies (HUMBA) study completed a survey at about 12 months after birth. All mums and babies in the study were: from South Auckland; of different ethnicities (Māori, Cook Island Māori, Samoan, Tongan, Other Pacific, European, Indian and Other); with obesity and 60% living in high deprivation. All babies and almost all mothers were enrolled in health care. Difficulties with attending ongoing health care appointments and family planning described by mothers were: being too busy with work, health carer not available for appointments or appointments cancelled; too busy with household duties and having to pay to see the GP. Most women reported that family planning was discussed before giving birth, but only half had family planning organised for them. Women advised that affordable after hour, weekend, community or mobile clinics and home visits will help them access health care and family planning services.

The economic cost of Indigenous child health inequities in Aotearoa New Zealand —an updated analysis for 2003–2014

Sarah-Jane Paine, Li Chao, Karen Wright, Ricci Harris, Belinda Loring, Papaarangi Reid

This study calculated the costs or savings that arise from Māori children having different rates of avoidable death, hospitalisation and use of healthcare services than non-Māori children. It found that health inequities for Māori children actually save the government health system money, yet are very expensive for society as a whole, especially Māori whānau. In addition to being a social justice and Indigenous rights concern, health inequities are costing New Zealand money.

The impact of pain on function after spinal cord injury

Jae Hong Ryu, Hannah Joyce, Christin Coomarasamy, Jessica Ozumba, Victoriya Semikina, Suresh Subramanian

Pain is a common complication for spinal cord injury patients that can affect them for a long time. From our study, we found that almost three-quarters of patients had pain by time of discharge from spinal cord injury rehabilitation units. However, most of these patients reported that they were satisfied with the management they received for their pain, and this did not severely affect their activities of daily living, mood, or sleep. Future focus will be to improve support for patients who do have pain that severely affects their day-to-day living and to also see if the effects of pain change over a long period of time.

Time for another review: following implementation of a new service model for Auckland sexual health service there has been an increase in referrals, case complexity and clinical workload but regional inequities in access remain

Sunita Azariah

A review of the Auckland sexual health regional service in 2014 did not respond appropriately to staff concerns and resulted in the unnecessary redundancy of two sexual health specialists. Auckland has disproportionate numbers of people considered to be sexual health priority populations including young people, men who have sex with men and people of Māori and Pacific ethnicities and therefore requires an appropriately resourced specialist sexual health service. There are continuing inequities in access to the sexual health service by people living in the Counties Manukau Region and this needs to be urgently addressed, particularly because syphilis is increasingly affecting women of child-bearing age in this region. There has been a rapidly increasing demand for gender affirming health care in recent years, however the sexual health service was never adequately resourced for this purpose and is currently struggling to meet the needs of this community.

A national audit of performance standards for blood cultures in Aotearoa New Zealand: opportunities for improvement

Juliet Elvy, Michael Addidle, Hanna-Sofia Andersson, Vivian Black, Dragana Drinković, Julia Howard, Michael O'Connor, Susan Taylor, Arthur J Morris

Blood cultures are performed for patients with suspected bloodstream infection to determine if any pathogens can be grown from the blood. Blood cultures can help identify the cause of the infection and ensure the best antibiotics are used for treatment. However, they need to be performed carefully to improve the chance of culturing the pathogen and reduce contamination. This audit looked at how well different regions were performing blood cultures by using laboratory data. The results demonstrated that there was variation in the performance of blood cultures across different regions.

HIV in women in Aotearoa New Zealand: 25 years of surveillance data

Ashleigh de Gouw, Susan McAllister, Jane Bruning, Judith Mukakayange, Jerram Bateman, Patricia Priest

From information received through routine reporting data over the past 25 years (1996 to 2020), a total of 634 women have been diagnosed with HIV in New Zealand, 180 of whom were reported to have acquired HIV in New Zealand. After a peak in 2006, the number of women diagnosed each year has remained steady at around 20 per year over the past 10 years. Amongst women who acquired HIV in New Zealand, almost half were diagnosed late—meaning they had been living with the virus for several years and not been tested for HIV. Early diagnosis is essential for successful treatment and reducing infectivity to sexual partners.

An investigation into the digitalisation of New Zealand general practice services during COVID-19

Nargis Mashal, Sussie C Morrish

Our paper summarises six key points in Enablers and Barriers of technological innovation adoption in GP medical centres in time of Covid-19 pandemic. These include enablers: 1) The availability of existing technology and devices within the GP medical centres; 2) The ease of use of the current technology to facilitate digitalisation combined with cost effectiveness and secure communication; and 3) Forced Information Communication Technology (ICT) adoption caused by Covid-19 induced business disruption, and social and physical distancing restrictions (a necessity-based enabler). These also include barriers: 4) The perception of risk and potential impact/utility of health interventions delivered via digital vs face to face means amongst primary care teams and patients; 5) Individual resistance to change amongst medical teams and patients; 6) Lack of knowledge and prior training in Information Technology (IT) systems for effective telehealth delivery amongst GPs and administrative staff.

Sleep-in to stay well: addressing school start times for the health and wellbeing of teens in Aotearoa

Charmaine Barber, Sarah Hetrick, Liza Edmonds, Rachael W Taylor, Mohamed Alansari, Leigh Signal, Jillian Haszard, Jacinta Oldehaver, Barbara Galland

Many teens in Aotearoa New Zealand do not get enough sleep, exacerbated by school start times that force them to wake earlier than they are programmed to. Adolescents' natural sleep-wake biology shifts at puberty to favour later bedtimes, meaning they naturally need to wake later in the morning, and it does not change again until approximately age 21. In this opinion piece, we argue that a later school start time (no earlier than 9:45 am) every day for senior secondary school students (years 12 and 13) is an attractive, non-stigmatising approach to address adolescent sleep issues, and is backed up by considerable published research on the issue from both here and overseas. Increased sleep also has the potential to favourably impact multiple areas of adolescents' health and wellbeing, as well as school success. However, the authors are acutely aware that later school start times for senior students would impact many people and organisations in a variety of ways, and therefore they also need to hear the opinions of many key stakeholders as to what might help or hinder schools considering shifting to later starts. Short surveys for parents of NZ high school-aged teens and NZ principals & teachers of high schools, can be accessed on our "Child and Teen Sleep Research Group" Facebook page. Additionally there is a longer survey for NZ High School teens (aged 16 and over) that asks for their opinion on later starts, and also asks about their current school start times, and own sleep and wellbeing.

Public health interventions: the elephant in the room of the health system crisis

Caroline Shaw, Christine Cleghorn

Since 2020, the "rules of engagement" for our health system, the expected and relatively predictable level of ill-health in the community, have changed.[1] COVID-19 has increased demand for healthcare through multiple pathways. Firstly, through managing those acutely unwell with COVID-19 infection, which during 2022 has been a significant source of hospitalisation over the three waves. Secondly, by creating a large burden of "catch up" care needed for those people whose care was delayed due to beds being occupied by those infected with COVID-19. Thirdly, as a result of long COVID, which, for some people, requires ongoing multidisciplinary specialist care. Fourthly, because of a deterioration in mental health associated with the pandemic and the public health measures to manage it.[2] Finally, due to the loss of children and young people from the education system or from lower educational attainment which has been caused by disrupted education—may also lead to poorer health later in life through altered life opportunities and trajectories.[3] So, even if COVID-19 disappeared tomorrow, the legacy of health impacts through other pathways will remain.

This increased demand for healthcare is being managed by a workforce experiencing illness itself, causing high levels of shortages. Long-standing health workforce shortages have been amplified by COVID-19, and burnout, exhaustion and distress amongst clinical staff are endemic and acute. We see this healthcare supply/demand mismatch playing out in the media, with multiple stories of long waits and delays in care in the emergency department (ED), sometimes with catastrophic results. There will also be disasters happening that are less visible but will ultimately lead to poorer health outcomes. For example, delays in diagnosis or initiation of care for cancer or heart disease, or poorer management of diabetes because of difficulty accessing primary care.

We also know that a stressed health system exacerbates inequities. For example, the drop off in childhood vaccinations for all children in recent years has been worse for Māori and Pacific children,[4] and lung cancer registrations and investigations seemed to reduce for Māori, but not for non-Māori/non-Pacific people, during the 2020 lockdown.[5] An under pressure health system is the type of setting in which healthcare provider implicit bias may be more likely to impact on healthcare decisions, potentially disadvantaging Māori further.[6]

There are no easy or quick fixes to increasing the capacity of the health system. Health professionals take many years to train and almost every high-income country is in the same situation as us,[7,8] fighting over the same international pool of health professionals.[9] Recruiting healthcare workers from low-income countries, with less resilient health systems, to plug gaps in our own workforce is ethically dubious.[10] Moreover, Aotearoa New Zealand is a signatory to a World Health Organization (WHO) Voluntary Code of Practice aimed at ensuring that low-income countries are not disadvantaged by this practice.[11]

This is a grim analysis, and it demands that we do things differently. And we can. Alongside training more health professionals and creating a healthy and safe work environment that allows for their sustainable long-term employment, we also need to focus on how we can reduce demand for healthcare.

We recently coordinated a series of blogs in which we asked topic experts to identify two to three evidence-based public health interventions that, if put in place, would rapidly reduce demand for healthcare in Aotearoa New Zealand. These covered topics such as child health, population mental health, injury, infectious diseases, housing, transport and food (the full blog series can be found here: https://blogs.otago.ac.nz/pubhealthexpert/).

While there is common perception that public health actions take decades to have impacts, the authors of these blogs identified a wide range of interventions that would have immediate and enduring impacts on health, and thus on our health system. These included interventions

such as vaccination, raising alcohol taxes, lowering drink driving levels, a health-based approach to drug harms, speed limit reductions, increasing benefit levels, alterations to streets to promote cycling and walking and reformulation of processed foods.[12–17] These interventions would impact on a wide range of health conditions, both physical and mental. Many would also have benefits to other sectors, for example through improved productivity or reduced greenhouse gas emissions.[18,19] Finally, many of them have already been recommended by reviews or are suggested actions in Government strategies.

As a detailed example, alterations to urban streets to promote cycling and walking through speed limit reductions, establishing car free areas, low traffic neighbourhoods and pop-up cycling infrastructure rapidly create measurable changes in injury risk, air and noise pollution exposure, crime, and physical activity.[20–24] These improvements in health risk factors have immediate as well as long-term effects on physical and mental health. For example, moderate or vigorous physical activity such as cycling is associated with reductions in anxiety and depression,[25–28] and air pollution improvements are associated with immediate reductions in asthma and respiratory admissions (and associated with long-term health improvements).[29,30] Temporary street furniture like planter boxes can be used to create networks of cycle lanes and eliminate through traffic on suburban streets—changes such as these can then be made permanent over time. These changes have been made rapidly and cheaply both in New Zealand during the 2020 lockdown and internationally over the same time period.[31] We also know that the Government actually wants to enable these types of changes, as they have recently finished consulting on a regulatory package that would make it easier for councils to take action.[32] However, if the Government is serious about delivering the health gains that are possible then it would be more proactive, rather than just enabling councils to do so if they chose to. This would include setting targets and funding delivery of the length of separated cycleways that evidence suggests is needed to maximise cycling uptake (around 150–200km/100,000 people[33]), and creating ambitious targets for low traffic neighbourhoods (such as in London where some local councils are planning to convert entire boroughs into low traffic neighbourhoods).

There is a wealth of resources to support the use of public health measures as a part of our solution to the health system crisis. We have a new Public Health Agency tasked with strengthening population and public health, ministers who support public health action, the re-formed Public Health Advisory Committee providing independent science-based advice to the Minister of Health, colleges and professional organisations with powerful voices when it comes to public health action,[34] as well as motivated and supportive professionals who are trusted by the community.

Putting in place public health interventions that reduce the need for healthcare should be an explicit part of our strategy to manage the health system crisis. There is a direct link between the speed limit or the level of alcohol tax, and the time people are waiting for care in ED or the length of surgical waitlists. The Government has shown that it can act quickly and decisively in a crisis, and policy that seemed impossible can be delivered rapidly. Now is the time for policymakers and the health sector to leverage all available solutions to our present crisis.

COMPETING INTERESTS
Nil.

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Use of healthcare resources and family planning methods 12 months after birth in women of South Auckland: The Healthy Mums and Babies (HUMBA) randomised trial

Rennae S Taylor, Jessica Wilson, Minglan Li, Katherine Anne Tyrrell Culliney, Megan McCowan, Christopher McKinlay, Lesley M E McCowan, Karaponi Okesene-Gafa

ABSTRACT

AIM: To report the utilisation of healthcare and family planning methods by participants in the Healthy Mums and Babies (HUMBA) trial at 12 months postpartum.

METHODS: Surveys on access to 1) healthcare, and 2) family planning methods were completed 1 year following birth by a sample of multi-ethnic women with obesity in South Auckland, New Zealand.

RESULTS: One hundred and twenty-seven out of two hundred and thirty (55.2%) HUMBA participants completed the surveys. All babies and 99% of the mothers were enrolled with a general practitioner (GP) and over 60% also accessed community or hospital emergency departments. One hundred and twelve (88.2%) used Plunket as their Well Child provider. A discussion on family planning/contraception during or after pregnancy occurred for 123/127 (96.9%) but only 74/127 (58.3%) had family planning/contraception provided after birth. Of the 53 who did not have a family planning/contraception method arranged, 20 (37.7%) did not believe in them. Factors that participants felt would assist access to family planning/contraception services included home visits, weekend or after-hour clinics and a local or mobile clinic.

CONCLUSIONS: In this South Auckland population, engagement with primary healthcare and Well Child health providers was almost universal. Family planning/contraception discussions during or after pregnancy were done well. However, provision of family planning/contraception services postpartum could be improved.

Te Whatu Ora Counties Manukau (CM) Health (the new name for the region after July 2022) provides health services to a population of approximately 560,000 in South Auckland, New Zealand. The vibrant community of CM is home to the largest population of Pacific people and also has the second largest population of Māori, compared to other regions in New Zealand.[1] Thirty-six percent of its residents live in areas of the highest socio-economic deprivation (decile 9 & 10) compared to a national average of 20%.[2] Over 123,000 children live in CM, with one in two living in areas of the highest socio-economic deprivation. Obesity increases health risks in the CM population, with over 66% of the women birthing in this region in 2015 having an overweight body mass index (BMI) (25%) and having obesity (41%). The ethnic distribution for women with an overweight BMI for Māori, Pacific, European, Indian, Chinese/Other Asian was 29%, 20%, 30%, 25% and 17% respectively. The obesity BMI for Māori, Pacific, European, Indian, and Chinese/Other Asian was 50%, 68%, 26%, 15% and 7% respectively.[1] In addition, disparities in services and health outcomes for Pacific and Māori peoples in New Zealand have been well documented.[3–6]

More than 7,000 babies are birthed in the Te Whatu Ora CM Health district each year and the perinatal mortality is higher than elsewhere in New Zealand.[7–8] In this community, postnatal access to and engagement with maternal and child health services is important to ensure the ongoing health and wellbeing of mothers and babies.

An external review of maternity care in the CM Health district in 2012[9] highlighted the contribution of maternal obesity to increased pregnancy complications in the region. The review reported high rates of unplanned pregnancy and many barriers to accessing contraception. A number

of recommendations were made, including that "*urgent work needs to be undertaken to develop culturally appropriate nutritional and lifestyle interventions to optimise weight gain during pregnancy*" and "*immediate consideration needs to be given to ways of making contraception much more accessible, affordable and available to women in CM Health region*".

The Healthy Mums and Babies (HUMBA) trial of nutritional interventions in pregnant women with obesity was developed in response to the recommendations.[10–11] Participants in the HUMBA trial were followed up at 12 months after birth. A survey was administered with the aim to assess access to early childhood health care services, (Well Child Tamariki Ora programme [which included Plunket]) and primary healthcare,[12] as well as access to and uptake of family planning/contraception.[13]

Methods

The HUMBA study recruited a multi-ethnic sample of pregnant women (n=230) with a body mass index of ≥30kg/m^2 (12^{+0} to 17^{+6} weeks pregnant) from the Te Whatu Ora CM Health area, who participated in a randomised controlled trial to investigate the effect of a dietary intervention vs routine dietary advice and a daily probiotic capsule vs placebo on maternal and offspring health outcomes. Women were enrolled in the study and recruitment commenced from April 2015 to June 2017. The last birth was in January 2018, with the last 1 year of birth follow-up in February 2019. Detailed methods for the trial are described in the HUMBA protocol.[14] Ethics approval was obtained from the Southern Health and Disability Ethics Committee, New Zealand (14/STH/205). The HUMBA trial was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12615000400561). The results of the HUMBA trial showed that although our interventions did not impact our primary outcomes of excessive weight gain and infant birth weight, we were encouraged by the dietary intervention resulting in participants gaining fewer than 1.8kgs in total.

As part of the 12-month postpartum follow-up in the HUMBA study, participants were asked to complete maternal and child health surveys, which consisted of questions about their access to and use of 1) local primary health and child wellness services, and 2) family planning services postpartum.

The survey was designed by the clinical investigators specifically for the Te Whatu Ora CM Health population, to be suitable for a multi-ethnic sample of New Zealand women. Four five-point Likert scales were utilised for different questions: 1=very easy to 5=very hard; 1=strongly disagree to 5=strongly agree; 1=very likely to 5=very unlikely; 1=never to 5=always. Prior to finalisation, the survey was piloted among community midwives and community health workers with multi-ethnic backgrounds to check the suitability, clarity of the questions and ease of administration.

Socio-economic status was determined using the NZ Deprivation Index (NZDep)[15] and scored from 1 to 10, with 10 being most deprived and 1 being the least deprived. NZDep was used because it combines several variables including communication, income and employment, and applies the score to a geocode representing a specific region. Primary home addresses provided by participants at the time of study enrolment were used to obtain a Meshblock code via a Classification Coding System (CCS) developed by Statistics NZ.[16] Once each address had its assigned code, these Meshblock codes were assigned a deprivation score, which were later grouped into quintiles.

Family planning/contraception was defined as use of methods to prevent conception (classified as permanent, hormonal and other) from birth until the 12-month visit. Permanent methods (tubal ligation, vasectomy) and hormonal were used: either long-acting reversible contraception (LARC) namely Jadelle (implant), Mirena (Levonogestrel intrauterine contraceptive device [LNG_IUCD]), copper intrauterine contraceptive device (Cu_IUCD); or depo-provera injection or oral contraceptive pill. Other methods included: condoms, withdrawal method and natural family planning.

Data and statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Demographic characteristics were compared between women who completed the maternal health surveys at 12 months and those who did not. Continuous variables were compared using t-Test, and categorical variables were compared using Chi-squared test. A p-value of <0.05 (two-tailed) was considered statistically significant. Utilisation of healthcare and family planning/contraception and data on the use of different family planning/contraception methods were evaluated using frequency tables for those who completed the 12-month healthcare survey.

Results

Of the 230 pregnant women who consented and were randomised into the HUMBA Trial, 127 (55.2%) mothers completed the health and family planning/contraception surveys at 12 months following the birth of their HUMBA baby (Figure 1).

The demographic details of those who did and did not complete the 12-month postpartum mother and baby surveys are outlined in Table 1. Those followed up at 12 months after birth were older, more likely to be European, had a planned pregnancy and were less likely to be in the highest New Zealand deprivation quintile. Allocation to the nutritional intervention, which included an additional four visits with a community health worker, did not differ between those who did and did not complete the survey.

The utilisation of healthcare services by the HUMBA mothers and babies is shown in Table 2**.** The mean (SD) age of the babies at the follow-up visit was 14.3 (1.9) months. All babies and 99% of the mothers were enrolled with a general practitioner (GP). Enrolment with the same GP as their babies was reported by 94% of the mothers. The GP practice was the preferred healthcare facility chosen if the baby was unwell (97%), although over 60% also used community and hospital emergency departments if needed.

Plunket was the main Well Child provider (88.2%). Only two babies were not enrolled with a Well Child provider. Most babies (88%) were seen in the previous 6 months with approximately half of the visits taking place in the home (Table 2).

Eight percent of the participants found it "hard or very hard" to see their Well Child provider. The three main barriers to accessing their provider were 1) too busy with work (23%), 2) provider was not available or appointments were cancelled (18%), and 3) too busy with household duties (14%). Specific feedback included the provider not keeping scheduled appointments or coming to the home without a booked appointment. Over 80% agreed that home visits would assist in accessing their provider and over two thirds agreed that after-hours/weekend clinics and having a clinic in their own community would also assist with access.

For the mothers, 7% found it "hard or very hard" to access their GP. The three main barriers were 1) the cost of GP visits (37%), 2) too busy with work (29%), and 3) too busy with household duties (24%). Women gave specific feedback on the unavailability of same-day appointments, the long waiting time at appointments, especially with a sick baby, and the higher cost for weekend appointments when it would be more convenient and less stressful for them to attend.

The family planning/contraception survey was completed by 127 women (Table 3).

A discussion on family planning/contraception, either during or after pregnancy occurred in 123/127 (96.9%) of the women (Table 3). Nearly 90% said they had this discussion with their lead maternity caregiver (LMC). Postpartum family planning/contraception was arranged for 74/127 (58.3%) of women and was most likely to be arranged by the LMC (42/74, 56.8%). Of the 74 women who had family planning/contraception arranged, the majority (61/74, 82%) did use it (Table 3).

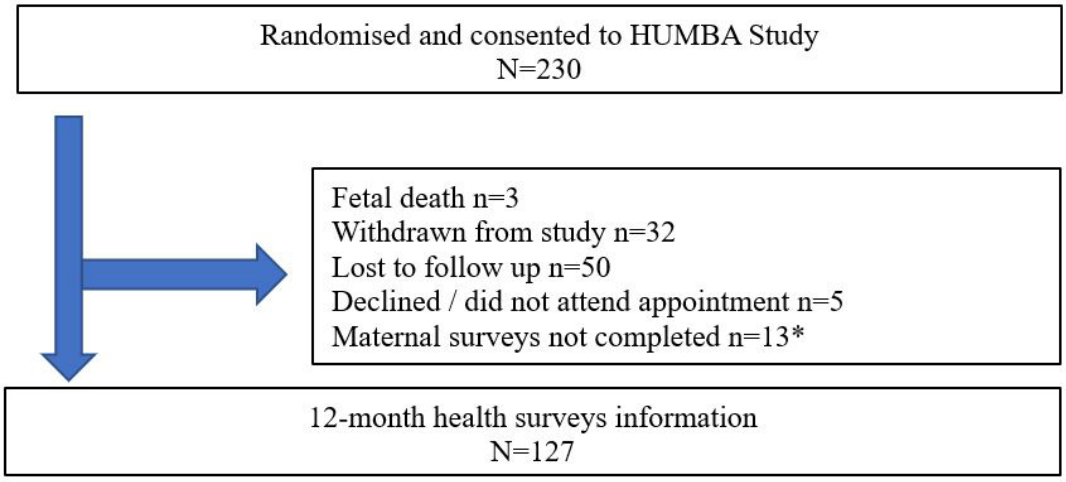
Of the women who had no family planning arranged, 37.7% (20/53) chose not to use any form of contraception.

Twelve (9.4%) women were pregnant at the time of the 12-month visit with an average interpregnancy interval for these women of 19.8 months (median 20 months, range 14.7 to 26.5 months); of these, six had used some form of contraception, three did not believe in using contraception and three chose not to answer.

If family planning/contraception decisions are needed in the future, participants said they would most likely see their GP (91/106, 86%), followed by the GP practice nurse (56/105, 53%), a nurse at a Family Planning Clinic (35/105, 33%), a doctor at a Family Planning Clinic (34/105, 32%) and 8% (8/105) said they would see a pharmacist. Women reported various factors that would assist them to access family planning/contraception in the future, including after-hours/weekend clinics (58%); community clinics (55%); home visits (50%) and mobile clinics (49%).

Methods of family planning used by the HUMBA mothers during the previous 12 months since the birth of their baby are outlined in Table 4.

Figure 1: HUMBA 12-month follow-up visit.



*Women did not always have time to complete all components of the 12-month follow-up appointment.

Table 1: Demographic details at HUMBA pregnancy booking visits.

Completed 12-month postpartum healthcare surveys	**Yes N=127 (55.2%)**	**No N=103 (44.8%)**	**P-value**
Maternal age, years	29.6 (5.5)	27.8 (5.7)	0.02
Body Mass Index, kg/m^2	39.0 (6.2)	38.0 (5.9)	0.24
Ethnicity, n (%)			**0.004**
New Zealand Māori	23 (18.1)	29 (28.2)	
Cook Island Māori	15 (11.8)	13 (12.6)	
Samoan	23 (18.1)	23 (22.3)	
Tongan	13 (10.2)	14 (13.6)	
Other Pacific Island	7 (5.5)	6 (5.8)	
Caucasian/European	36 (28.4)	6 (5.8)	
Indian	7 (5.5)	6 (5.8)	
Other	3 (2.4)	6 (5.8)	
Parity, n (%)			**0.20**
0	39 (30.7)	34 (33.0)	
1–3	78 (61.4)	54 (52.4)	
>4	10 (7.9)	15 (14.6)	
Highest deprivation quintile	74 (58.3)	74 (71.8)	0.03
Married/civil union/de facto relationship	113 (89.0)	88 (85.4)	0.43
Planned pregnancy	61 (48)	35 (34)	0.03
Nutritional intervention	66 (52.0)	50 (48.5)	0.61

Table 2: Utilisation of healthcare at 12-month HUMBA follow-up visits.

Utilisation of healthcare	**N=127**		
Enrolled with a general practice	**N (%)**		
Mother	126 (99.2)		
Baby	127 (100)		
Mother's healthcare	**N (%)**	**N (%)**	**N (%)**
Being able to visit GP	Hard/very hard	Neutral	Easy/very easy
	9 (7.1)	12 (9.4)	106 (83.5)
Factors affecting access to healthcare provider	**Disagree**	**Neutral**	**Agree**
The cost of GP visits	63 (49.6)	17 (13.4)	47 (37.0)
Too busy with work	73 (57.5)	17 (13.4)	37 (29.1)
Too busy with household duties	78 (61.4)	19 (15.0)	30 (23.6)
Childcare issues/no one to help with other children	90 (70.9)	20 (15.7)	17 (13.4)
Difficulties with transport to get to visits	102 (80.3)	15 (11.8)	10 (7.9)
Unpaid doctors' bills	110 (86.6)	7 (5.5)	10 (7.9)
Prefer alternative/traditional medicine	102 (80.3)	16 (12.6)	9 (7.1)
Move often and change addresses	116 (91.3)	7 (5.5)	4 (3.1)
Baby's healthcare			
Utilisation of healthcare if baby sick	Unlikely/very unlikely	Neutral	Likely/very likely
General practitioner	1 (1.0)	3 (2.4)	123 (96.9)
Community emergency department	31 (24.4)	12 (9.4)	84 (66.1)
Hospital emergency department	31 (24.4)	17 (13.4)	79 (62.2)
Traditional healer or massage	86 (67.7)	22 (17.3)	19 (15.0)
Enrolled with Well Child provider	**(N=127) N (%)**		
Plunket	112 (88.2)		
Other provider	13 (10.2)		
No provider	2 (1.6)		
Location of Well Child health visits	**(N=126) n (%)**		
Home	64 (50.8)		
Clinic	58 (46.0)		
Other (e.g., daycare centre)	4 (3.2)		

Table 2 (continued): Utilisation of healthcare at 12-month HUMBA follow-up visits.

Being able to see Well Child provider (n=125)	**N (%) Hard/very hard**	**N (%) Neutral**	**N (%) Easy/very easy**
	10 (8.0)	26 (20.8)	89 (71.2)
Factors affecting access to Well Child provider (n=127)	**Disagree**	**Neutral**	**Agree**
Too busy with work	82 (64.6)	16 (12.6)	29 (22.8)
Well Child provider not available/ appointments cancelled	93 (73.2)	11 (8.7)	23 (18.1)
Too busy with household duties	89 (70.1)	20 (15.7)	18 (14.2)
Childcare issues/no one to help with other children	99 (78.0)	16 (12.6)	12 (9.4)
Difficulties with transport to get to visits	101 (79.5)	16 (12.6)	10 (7.9)
Prefer alternative/traditional medicine	108 (85.0)	12 (9.4)	7 (5.5)
Move often and change addresses	117 (92.1)	7 (5.5)	3 (2.4)
Factors assisting access to Well Child provider	**Disagree/ strongly disagree**	**Neutral**	**Agree/ strongly agree**
Home visits	6 (4.7)	18 (14.2)	103 (81.1)
After-hours/weekend clinics	15 (11.8)	24 (18.9)	88 (69.3)
Clinic in my own community	11 (8.7)	32 (25.2)	84 (66.1)
Mobile clinic	19 (15.0)	33 (26.0)	75 (59.1)
Help with transport	55 (43.3)	40 (31.5)	32 (25.2)
Help with childcare	48 (37.8)	47 (37.0)	32 (25.2)

Table 3: Utilisation of family planning at 12-month HUMBA follow-up visits.

Family planning		
Was family planning discussed either during or after pregnancy?	**N=127**	**%**
Yes	123	96.9
No	4	3.1
Who discussed family planning "Once or More"?		
Lead maternity caregiver	112	88.2
Hospital midwife	71	55.9
Hospital doctor	63	49.6
GP	83	65.4
Not discussed	4	3.1
Was family planning/contraception arranged after birth of baby?		
Yes	74	58.3
No	53	41.7
If family planning/contraception was arranged and prescribed after the birth of your HUMBA baby, was it used?	**N=74†**	
Yes	53	71.6
Sometimes	8	10.8
No	13	17.6
Who arranged family planning after the birth of your HUMBA baby?	**N=74**	
Lead maternity caregiver	42	56.8
Hospital midwife	8	10.8
Hospital doctor	10	13.5
GP	11	14.9
New Zealand Family Planning Association	3	4.1
Some women choose never to use any form of family planning (including natural methods). Does this apply to you?	**N=53‡**	
Yes	20	37.7

†Women were only asked this question if family planning was arranged postpartum.
‡Only women who did not have family planning arranged were asked this question.

Table 4: Family planning methods used in 12 months after birth of HUMBA baby

Family planning methods used	N	%
Surgical (tubal ligation, vasectomy)	9	7.1
LARC (Jadelle, LNG_IUCD, Cu_IUCD)	20	15.8
Hormonal (Depo-provera, combined pill, minipill)	20	15.8
Other methods (condoms, withdrawal, natural family planning)	20	15.7
Combination of hormonal and other methods	23	18.1
None	29	22.8
Declined to answer	6	4.7

Discussion

This survey of mothers in the HUMBA randomised trial at 12 months after birth aimed to gain pertinent information on: enrolment in primary care and/or a Well Child health provider; utilisation of healthcare services; and discussions about access to family planning/contraception. The demographic characteristics of participants in this survey was broadly representative of the CM Health population in 2015.[7] In our sample, the highest quintile of deprivation was present in 58.3% of participants compared to 45.0% overall at CM Health, and Pacific people were over-represented (45.6% vs 30.2%) and Indian/Other Asian underrepresented (7.9% vs 16.9%) compared with the general birthing population. Our study population included whānau who face greater inequities in our health system, and it was therefore valuable to have their feedback.[3–6] Although our recruitment started in April 2015 and our last HUMBA baby 12-month follow-up was February 2019, our results are likely still relevant today.

1. Enrolment in primary care and Well Child health care provider.

In our sample of 127 participants in the HUMBA trial at 12 months postpartum, enrolment with a GP was reported for all the babies and all but one mother; 94% of the mother/baby pairs shared the same GP. New Zealand babies are recommended to enrol in with a GP soon after birth as per Ministry of Health (MoH) guidelines.[17] This policy was instituted in 2012, when it was realised that from October 2009 to September 2010 almost no new-borns in New Zealand were enrolled with a GP by 6 weeks and less than 50% were enrolled by 12 weeks of age. The move was to ensure that babies born in New Zealand were monitored to be safe, in good health and have immunisations up to date. The new-born GP registration can be activated through the National Immunisation registry notification process. GPs are also expected to develop their own inhouse guidelines to ensure that babies born to mothers in their practices are registered soon after birth.[17]

In this sample, 98% of babies were enrolled with a Well Child Tamariki Ora provider (mostly Plunket). The New Zealand Government is committed to supporting early childhood services to ensure optimal health of tamariki (children).[12] "Well Child/Tamariki Ora" is a comprehensive and well-funded programme to ensure that New Zealand children from birth to 5 years of age have an optimal start to life, to reach their full potential as adults. The *Lancet* series on "Advancing Early Childhood Development" reported that investing in the health of children resulted in improved intellectual abilities, better health and fewer psychological issues.[18] The Well Child/Tamariki Ora Programme Practitioners handbook is available for health professionals, as well as the Well Child Tamariki Ora My Health Book given to the mother at birth to record the child's first 5 years of growth, milestones, health checks and immunisations.[12] The programme was designed to be equitable, accessible and improve the long-term productivity of New Zealand children. The New Zealand Government is seeking further improvement to this programme.[19] Similar programmes are also in place in many developed countries with some doing better than others.[20–21]

Plunket services were received by 88% of mothers, which is very similar to the overall rate

in New Zealand.[22] Half of these Well Child Tamariki Ora visits took place in the home, which was identified as the strongest factor that assisted with accessing this service. HUMBA mothers were concerned (similar to a 2013 review), with appointments not being kept by the Well Child provider, and expressed a preference for home visits.[22]

Among the mothers, all but one was enrolled with a GP, usually the same one as their baby. The reported challenges in accessing primary care by the HUMBA participants are similar to those reported in a review of health equity for Pacific peoples in New Zealand around barriers to accessing primary care due to cost.[4] After-hours and weekend appointments were more costly, when it was more convenient for women to attend due to employment, childcare and transport issues. Their inability to get an appointment within 24 hours with an unwell baby was also concerning.

Although community and hospital emergency departments were used by 60% of the cohort when their babies became unwell, their preference was to use their GP. It is encouraging that this population was aware of the appropriate pathway to review their children to reduce pressure on emergency departments with already stretched services, as in a UK study.[23] The emergency department serving the CM region is often in crisis due to overcrowding, limited resources, short staffing and poor access to GP services.[24] Fortunately, New Zealand children have free healthcare, hence GP services are accessible.

2. Access to family planning/ contraception.

The 2014/2015 New Zealand Health Survey found that 80% of women (16 to 49 years) who were sexually active had used at least one form of family planning/contraception.[25] Our findings were very similar, with 72% (92/127) reporting some form of family planning/contraception use in the previous 12 months. A study in Eastern Australia in a sample of women aged 18–39 years reported that 43.2% (n=1814/2854) were using hormonal family planning/contraception methods. The most common form was the combined oral contraceptive (COC) pill, and long-acting reversable contraception (LARCs) or injectables.[26]

In November 2019, the LNG-IUS (Mirena) became fully funded in New Zealand.[27] It was an important equity issue in New Zealand, as the device cost $340 NZD and only those able to afford it could access it. Women in New Zealand not only benefit from LARCs as an excellent form of contraception, it also reverses abnormalities in the lining of the uterus in women with obesity,[28] who are more likely to be from low socio-economic regions with high fertility rates[2] and are at increased risk of endometrial cancer.[29] The Australian Government in February 2020 added the LNG_IUCD (Kyleena) as another form of contraceptive choice for Australian women in addition to the already funded Mirena.[30] Australia does not fund copper IUCDs. LARCs have reduced the rates of abortions in New Zealand and are the preferred choice for contraception due to their "fit and forget" capability, effectiveness and reversibility once removed.[31] Contraception allows spacing of pregnancies, improved maternal and perinatal outcomes and reduces the risks of unwanted pregnancies.[32] There is strong evidence that instituting contraception (LARCs or injectables) soon after birth is effective, convenient and avoids the inconvenience of booking an appointment to discuss and obtain contraception.[32]

A limitation was that information from postnatal women was not collected on whether the discussion regarding family planning/contraception offered was adequate and understandable. Also, whether the offered information enabled them to make the appropriate choice that suited their needs.

In conclusion, it is encouraging that in this sample of pregnant women who participated in the HUMBA trial in the Te Whatu Ora CM Health region, almost all of the women registered themselves and their baby with a GP and/or a Well Child health provider by 12 months postpartum. It is important to continue providing suitable and engaging family planning/contraception information antenatally and postpartum to women. More imperative is ensuring the information is fully understood and there is unimpeded postnatal access to family planning/contraception, as women are more likely to use them if arranged.

COMPETING INTERESTS
Nil.

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The economic cost of Indigenous child health inequities in Aotearoa New Zealand—an updated analysis for 2003–2014

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ABSTRACT

AIMS: This study estimates of the cost of Indigenous child health inequities in New Zealand.

METHODS: Standard quantitative epidemiological and cost of illness methodologies were used within a Kaupapa Māori framework. Data for 2003–2014 on children under 15 years were obtained from government datasets. Rates of potentially avoidable hospitalisations and mortality, as well as excess or under-utilisation were calculated. Publicly funded health sector costs, costs to families and costs of premature mortality were used to estimate the costs (or savings) of inequities.

RESULTS: Māori children had lower utilisation rates than non-Māori for primary healthcare, outpatient care, medicines, laboratory investigations and care after an accident/injury. Māori children had greater rates of avoidable hospitalisation (RR=1.36, 95% CI 1.35–1.37) and death (RR 1.98, 95% CI 1.84–2.13). Inequalities between Māori and non-Māori children cost in excess of $170 million NZD each year. This includes an annual net savings for the government health sector of $4 million NZD, with an annual cost to society of around $175 million NZD.

CONCLUSIONS: The under-serving of Māori children in the health sector saves the government health system money, yet imposes a huge cost on Māori families and society. In addition to avoiding considerable human suffering, reducing child health inequities would result in significant economic benefits.

Health inequities by ethnicity are unjust, preventable and amenable to intervention.[1] Indigenous peoples, where measured, are often the most marginalised. In Aotearoa New Zealand, Māori have a life expectancy 7.5 years fewer[2] than non-Māori, and experience higher rates of unmet health need and disease-specific mortality rates. Māori infants are almost twice as likely to die as non-Māori, non-Pacific infants while ambulatory sensitive hospitalisation (ASH) rates for Māori 0–4-year-olds are over one and a half times higher than non-Māori, non-Pacific ASH rates.[3]

There are strong social justice and human rights arguments for intervening in ethnic health inequities, and governments have made firm commitments to do so.[4,5] Yet inequities, and racist policies and healthcare systems, remain. In addition to the health, social and moral costs, health inequities have significant economic costs: on families, on communities, on health systems and on national economies.[6–11] This growing evidence base contradicts the misconception that eliminating health inequities is costly, but rather the cost of "doing nothing" to address inequity is itself significant.

Health equity, particularly for Māori, is an objective within key New Zealand health policy documents,[12–14] and New Zealand changed its position to endorse the UN Declaration on the Rights of Indigenous Peoples in 2010. New Zealand has also ratified the UN Convention on the Rights of the Child, which recognises the right of children to the highest attainable standard of health and healthcare, and to freedom from all forms of discrimination including on the basis of ethnicity.[15] Te Tiriti o Waitangi (the Treaty of Waitangi) provides an additional constitutional and legal obligation for the government to ensure equity for Māori. Despite this, very little is known about the costs associated with the disproportionate burden of illness and premature death experienced by Māori. An Indigenous-led New Zealand cost of illness (COI) study[7] using data from 2003–2007 found that inequities in illness, injury and potentially avoidable deaths between Māori and non-Māori children aged 0–14 years cost $62–200 million NZD per year in healthcare costs, years of life lost and lost caregiver wages. However, this included a net saving to the health sector of $24.7 million NZD

per annum, while costing Māori families $827,175 NZD per annum in lost caregiver wages alone. These findings suggest that under-serving Māori children is cost-saving to the health system, with the additional costs associated with these inequities being met by families, highlighting a lack of financial incentive for the health sector to redress inequitable care.

Our analysis builds upon the 2012 estimate of the cost of Māori child health inequities.[7] We applied a broadly similar method, with more recent data up to 2014, and updated costs and coding definitions to provide an updated estimate of the cost of child health inequities. This study aimed to: 1) investigate inequities in potentially avoidable illness, injury and death between Māori and non-Māori children, and 2) estimate "excess" or "under-utilisation" of healthcare associated with inequities in potentially avoidable illness, injury and death, and 3) quantify the costs associated with any "inequity excess" observed.

Methods

Kaupapa Māori methodology

This study is positioned within a Kaupapa Māori methodology, which is an approach to research driven by a Māori worldview, recognising the complexity of Māori historical and contemporary realities.[16] A Kaupapa Māori approach purposely acknowledges and challenges the power dynamics that have created and maintain the unequal position of Māori within society. In this study, quantitative epidemiological and health economic methods are used as tools for investigating questions,[7,17] while critiquing at the same time the limitations of these methods in terms of reinforcing ethnically biased power dynamics and scientific understandings.

Study design

Ethical approval was granted by The University of Auckland Human Participants Ethics Committee (UAHPEC ref: 018621). We analysed de-identified data on deaths, hospitalisations, primary care and public outpatient consultations, as well as government-subsidised pharmaceuticals, laboratory and accident/injury claims for New Zealand. These data were obtained from comprehensive national datasets held by government agencies, and data were analysed for the year ranges outlined in Table 1. We applied the New Zealand Ministry of Health (MoH) prioritised ethnicity protocols so that anyone who identified as Māori, either as a single ethnicity or as one of multiple ethnic groupings, was considered Māori, with everyone else categorised as non-Māori.[18]

Epidemiological methods

We obtained the number and crude rates of potentially avoidable hospitalisations (PAH) by ethnicity and age group (0–<1 year, 1–<5 years, 5–<15 years) from the national hospitalisation dataset (National Minimum Dataset). PAHs were defined using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10AM) codes for hospitalisations that are avoidable through access to timely, appropriate and affordable primary healthcare, population-based health promotion strategies and government policies to address social determinants of child health (e.g., income support, housing). We used the most recent ambulatory sensitive hospitalisation (ASH) codes available,[19,20] with the addition of broader codes for conditions amenable to interventions outside of primary care from Anderson et al.[21] Of note, this set of codes is restricted to those children aged 29 days and older, so our analysis of PAH was restricted to the 29 days–14 years age range. Estimates for the total Māori and non-Māori population for each year were extracted from Statistics NZ population estimates. We calculated the number of avoidable hospitalisations that would have occurred if Māori had the same rate as non-Māori in each age group. The difference between the actual and the estimated avoidable hospitalisations in each age group was summed to provide the total "excess" avoidable hospitalisations for Māori.

Similar methods were applied to estimate the total excess number of avoidable deaths, accidents/injury claims, pharmaceutical and laboratory claims, general and mental health outpatient consultations and general practitioner and nursing visits separately. Avoidable deaths were defined using a combination of the most recent amenable mortality ICD-10AM codes from the MoH[22] along with the avoidable mortality codes described by Walsh and Grey[23] and the MoH. A full list of the ICD-10AM codes used for both mortality and hospitalisations is included as Appendices.

Costing methods

To calculate the costs associated with avoid-

able death, the value of a statistical life (VoSL) was defined as the 2014 price of $3.95 million NZD.[24] The years of life lost (YLL) by Māori children were calculated assuming that all would have lived to the 2014 life expectancy of their non-Māori counterparts of the same gender.[25] The VoSL was divided by the male and female non-Māori life expectancies to produce an annual VoSL for each age group and gender. The annual VoSL was then multiplied by the YLL to calculate the annual costs of the inequity in avoidable death. In a sensitivity analysis using four scenarios for discounting, 0%, 3% (the "base case"), 5% and 8%, results were stable across all discount rates.

To calculate the direct costs associated with healthcare utilisation, the unit costs for each admission, claim, or consultation in each of the categories were defined, as shown in Table 4. The cost of hospital care was assessed from hospital reimbursements by the MoH. Because hospital services are provided publicly rather than patient charges, the costs are internal weighted estimates (based on Disease Related Groups and length of stay) of the cost of each type of care.

Hospital and outpatient care for children has associated costs to parents/caregivers. These include loss of wages during hospital caregiving and out of pocket fees for primary care visits. Given that there were no user fees for primary care for children under 6 years of age between 2008–2014, our model assumed out-of-pocket fees applied to less than half of child primary care visits. The costing analysis was unable to go into finer scale by age groups due to the difficulty in further defining the respective unit costs for age sub-groups.

Results

Inequities in healthcare utilisation

Table 2 summarises the differences in hospitalisations and healthcare utilisation between Māori and non-Māori children. Māori children had greater rates of avoidable hospitalisation (RR=1.36, 95% CI 1.35–1.37), with the disparity most marked for children aged under 1 year. This resulted in 3,987 extra hospitalisations of Māori children each year that would not have occurred if Māori had the same rates as non-Māori. The largest contributors to the excess hospitalisations for Māori were respiratory, digestive and skin diseases.

For most other types of healthcare, interactions measured that (with the exception of primary care nursing and mental health visits) Māori children were significantly less likely to receive services than non-Māori. Māori children received laboratory investigations at approximately half the rate (RR 0.59, 95% CI 0.59–0.59), resulting in over 80,000 fewer tests each year than if Māori had the same investigation rate as non-Māori. Māori children were less likely to receive prescription medications (RR 0.91, 95% CI 0.91–0.91). Accident and injury claims were lower for Māori (RR 0.75, 95% CI 0.75–0.75). Hospital outpatient appointments were also received far less by Māori (RR 0.78, 95% CI 0.78–0.78), and this difference was larger for Māori in younger age groups.

For primary care, Māori children were significantly less likely than non-Māori to see a doctor (RR 0.72, 95% CI 0.72–0.72). Māori children were more likely to see a primary care nurse, but the absolute number of nursing consultations was much smaller than doctor consultations.

Inequities in avoidable mortality

Of the 5,541 child deaths between 2003–2014, 54.2% were considered to be potentially avoidable using our classification. Māori children had higher avoidable death rates than non-Māori (RR 1.98, 95% CI 1.84–2.13), resulting in 594 extra avoidable Māori child deaths between 2003–2014 than would have occurred if Māori had the same avoidable mortality rate as non-Māori (Table 3). The biggest contributors to potentially avoidable mortality in Māori children were "external causes of morbidity and mortality" (including accidents and injuries), and "conditions originating in the perinatal period". Because avoidable child deaths are more common in the youngest age group, the greatest number of excess avoidable deaths for Māori occurred in children <1 year of age.

Costs arising from inequities in healthcare utilisation and deaths

Table 4 shows the unit costs used for each variable, and the annual costs/savings to the government health sector for Māori:non-Māori inequities in utilisation. The higher rate of avoidable hospitalisation for Māori children cost the government health sector $9.2 million NZD each year. However, because the government health sector also received significant savings from the under-servicing of Māori children of other parts of the health system, there is a net annual saving of

over $4 million NZD to the government (Table 4). Estimates of direct costs to caregivers associated with child admissions or appointments are also shown in Table 4.

Costs associated with the excess years of life lost as a result of higher rates of avoidable mortality in Māori children (Table 5) were over $175 million NZD per year. Approximately 60% of these YLL came from deaths in the 0–<1year age group.

In putting all of these cost calculations together (Table 6), the inequities we found between Māori and non-Māori children in terms of healthcare utilisation and avoidable deaths cost in excess of $170 million NZD each year between 2003–2014. The burden of this cost was not shared equally—this total figure consists of annual savings of $4 million NZD to the health sector, while society (and disproportionately Māori communities) bore

Table 1: Databases and year ranges analysed.

Database name	Details	Source	Time period analysed
National Minimum Dataset (NMDS)	Public and (some) private hospital discharge information for inpatient and day stays.	NZ Health Information Service (NZHIS), Ministry of Health	2003–2014
Mortality Collection	Mortality and underlying causes of death.	NZHIS, Ministry of Health	2003–2014
National Non-Admitted Patients Collection	Non-admitted (hospital outpatient and emergency department) activity.	NZHIS, Ministry of Health	2006–2014
Accidents and injury claims	Injury claims for medical treatment, vocational rehabilitation and support for independence.	Accident Compensation Corporation (ACC)	2006–2014
Laboratory claims	Claims and payment information for laboratory testing.	NZHIS, Ministry of Health	2006–2014
Pharmaceutical Collections	Claims and payment information for subsidised dispensing.	NZHIS, Ministry of Health	2006–2014
Programme for the Integration of Mental Health Data database	Secondary mental health service use.	NZHIS, Ministry of Health	2009–2014
Primary care enrolments	Enrolments with Primary Health Organisations (PHOs).	NZHIS, Ministry of Health	2006–2014
Primary care utilisation	Primary care utilisation.	Primary Care team at Ministry of Health, via customised request	2008–2014
Fetal and infant deaths	Data on deaths that occurred before one completed year of life.	NZHIS, Ministry of Health	2003–2014
Live births		Statistics NZ	2003–2014

Table 2: Differences in hospitalisations and healthcare utilisation between Māori and non-Māori children, by age group, 2003–2014.

		Per 100,000		Ratio (95% CI)	Annual excess
	Period	Māori	Non-Māori	Māori:non-Māori	Interactions for Māori
All ages 0–<15 years)					
Avoidable hospital admissions	2003–2014	6,665	4,893	1.36 (1.35, 1.37)	3,987
Laboratory claims	2006–2014	52,348	88,060	0.59 (0.59, 0.59)	-81,126
Pharmaceutical claims	2006–2014	443,003	487,799	0.91 (0.91, 0.91)	-101,763
Mental health consultations	2009–2014	24,619	24,377	1.01 (1.01, 1.01)	558
Outpatient consultations	2006–2014	33,421	43,004	0.78 (0.78, 0.78)	-21,770
ACC claims	2003–2014	28,983	38,757	0.75 (0.75, 0.75)	-21,996
Primary care – GP consults	2008–2014	171,794	238,190	0.72 (0.72, 0.72)	-152,540
Primary care – nursing consults	2008–2014	30,666	25,018	1.23 (1.22, 1.23)	12,976
Age 0–<1 year					
Avoidable hospital admissions	2003–2014	23,093	15,888	1.45 (1.44, 1.47)	1,248
Laboratory claims	2006–2014	60,218	115,897	0.52 (0.52, 0.52)	-9,763
Pharmaceutical claims	2006–2014	771,750	971,359	0.79 (0.79, 0.80)	-34,999
Mental health consultations	2009–2014	291	581	0.50 (0.44, 0.57)	-49
Outpatient consultations	2006–2014	60,139	87,618	0.69 (0.68, 0.69)	-4,818
ACC claims	2003–2014	11,737	15,989	0.73 (0.72, 0.74)	-737
Age 1–<5 years					
Avoidable hospital admissions	2003–2014	10,435	8,876	1.18 (1.17, 1.19)	989
Laboratory claims	2006–2014	41,046	81,799	0.50 (0.50, 0.50)	-26,491

Table 2 (continued): Differences in hospitalisations and healthcare utilisation between Māori and non-Māori children, by age group, 2003–2014.

		Per 100,000		Ratio (95% CI)	Annual excess
	Period	Māori	Non-Māori	Māori:non-Māori	Interactions for Māori
Age 1–<5 years					
Pharmaceutical claims	2006–2014	673,331	743,656	0.91 (0.90, 0.91)	-45,713
Mental health consultations	2009–2014	2,451	2,805	0.87 (0.85, 0.89)	-240
Outpatient consultations	2006–2014	35,310	48,531	0.73 (0.72, 0.73)	-8,594
ACC claims	2003–2014	29,961	37,061	0.81 (0.81, 0.81)	-4,502
Primary care – GP consults (age 0–<5 years)*	2008–2014	267,654	399,184	0.67 (0.67, 0.67)	-110,888
Primary care – nursing consults (age 0–<5 years)*	2008–2014	46,081	38,451	1.20 (1.19, 1.20)	6,432
Age 5–<15 years					
Avoidable hospital admissions	2003–2014	3,037	2,309	1.31 (1.30, 1.33)	1,049
Laboratory claims	2006–2014	56,474	87,863	0.64 (0.64, 0.64)	-45,399
Pharmaceutical claims	2006–2014	299,632	339,746	0.88 (0.88, 0.88)	-58,018
Mental health consultations	2009–2014	37,730	35,430	1.06 (1.06, 1.07)	3,361
Outpatient consultations	2006–2014	29,333	36,516	0.80 (0.80, 0.81)	-10,389
ACC claims	2003–2014	30,623	41,567	0.74 (0.73, 0.74)	-15,794
Primary care – GP consults	2008–2014	116,227	157,696	0.74 (0.74, 0.74)	-60,312
Primary care – nursing consults	2008–2014	21,731	18,302	1.19 (1.18, 1.19)	4,987

Note: *The primary care data were only available for two age groups: under 5 years (including <1 year) and under 15 years.

Table 3: Differences in avoidable deaths between Māori and non-Māori children, by sex and age group, 2003–2014.

		Per 100,000		Ratio (95% CI)	Annual excess deaths in Māori
	Period	Māori	Non-Māori	Māori:non-Māori	
Age 0–<1 year					
Female	2003–2014	359.16	222.44	1.61 (1.41, 1.84)	11.10
Male	2003–2014	452.43	271.34	1.67 (1.49, 1.87)	15.58
Age 1–<5 years					
Female	2003–2014	18.66	9.29	2.01 (1.47, 2.74)	2.89
Male	2003–2014	25.05	10.06	2.49 (1.90, 3.27)	4.89
Age 5–<15 years					
Female	2003–2014	10.44	4.28	2.44 (1.85, 3.22)	4.33
Male	2003–2014	14.06	6.51	2.16 (1.72, 2.71)	5.60
Total (0–<15 years)	2003–2014	44.32	22.34	1.98 (1.84, 2.13)	49.47

Table 4: Cost estimates for the inequity in healthcare utilisation between Māori and non-Māori children, 2003–2014.

	Annual excess for Māori	Unit cost	Source for cost	Annual cost
Costs to government health sector				
Avoidable hospital admissions	3,987	$2,314.29	NMDS 2003–2014, mean non-Māori cost weight 0.48, and Ministry of Health national hospital admission mean price 2016/2017 $4824.67 NZD	$9,227,420
Laboratory claims	-81,126	$11.34	NZHIS 2006–2014, weighted mean non-Māori claim cost	-$920,268
Pharmaceutical claims	-101,763	$11.91	NZHIS 2006–2014, weighted mean non-Māori claim cost	-$1,212,206
Mental health consultations	558	$168.43	Ministry of Health (2016), population-based funding formula for community mental health residential	$94,053
Outpatient consultations	-21,770	$192.42	Auckland DHB and Waikato DHB, hospital outpatient per day	-$4,189,047
ACC claims	-21,996	$263.11	ACC data 2003–2014, weighted mean non-Māori claim cost	-$5,787,358
Primary care – GP consults	-152,540	$10.54	MoH data 2008–2014, non-Māori GP utilisation weights by age groups, and Ministry of Health national average GP fees 2008–2014	-$1,608,424
Primary care – nursing consults	12,976	$30.00	Mills et al (2012), assumed amount per consult	$389,290
Subtotal				-$4,006,540
Direct costs to Māori families				
Parental loss of wages (hospital caregiving)	3,987	$274.00	Assumed amount, 2 days, one caregiver, Statistics NZ median weekly wage in 2017 $959 NZD	$1,092,479
Parental out of pocket (GP consults)	-65,592	$25.00	Assumed amount, for 43% of GP visits	-$1,639,804
Parental out of pocket (nursing consults)	5,839	$15.00	Assumed amount, for 45% of nursing visits	$87,590
Subtotal				-$459,734

Table 5: Cost estimates for the inequity in avoidable deaths between Māori and non-Māori children, by sex and age group, 2003–2014.

	Annual excess Māori deaths	VoSL	Non-Māori life expectancy	Annual VoSL	Annual YLL	Annual cost
Age 0–<1 year						
Female	11.10	$3,950,000	83.92	$47,066	931.81	$43,856,283
Male	15.58	$3,950,000	80.31	$49,186	1,250.95	$61,529,002
Age 1–<5 years						
Female	2.89	$3,950,000	81.75	$48,319	236.02	$11,404,218
Male	4.89	$3,950,000	78.19	$50,519	382.11	$19,303,476
Age 5–<15 years						
Female	4.33	$3,950,000	74.81	$52,800	323.66	$17,089,232
Male	5.60	$3,950,000	71.26	$55,432	398.77	$22,104,896
Total						$175,287,107

Table 6: Estimates of total costs of health inequity between Māori and non-Māori children, 2003–2014.

	Annual cost	
Costs to government health sector		
Avoidable hospital admissions		$9,227,420
Laboratory claims		-$920,268
Pharmaceutical claims		-$1,212,206
Mental health consultations		$94,053
Outpatient consultations		-$4,189,047
ACC claims		-$5,787,358
Primary care – GP and nursing consults		-$1,219,134
	Subtotal	-$4,006,540
Costs to society		
Caregiver loss of wages (hospital caregiving)		$1,092,479
Caregiver out of pocket (GP consults)		-$1,639,804
Caregiver out of pocket (nursing consults)		$87,590
Avoidable deaths		$175,287,107
	Subtotal	$174,827,373
	Total	$170,820,834

an annual cost of around $175 million NZD.

Discussion

Our attempt to quantify the economic costs of Indigenous child health inequities in New Zealand recognises it is impossible and undesirable to reduce the value of a healthy life to monetary terms. However, we are able to demonstrate that there are economic consequences of Indigenous health inequities, and that these costs are borne disproportionately by Māori families while the government benefits from cost savings. In addition to being in contravention of Indigenous rights, child rights, Te Tiriti o Waitangi and social justice, the inequitable status quo is financially costly.

The pattern of health inequities and costs/savings are broadly consistent with Mills et al,[7] even though there were some differences in methods: we used more recent data from a wider year range; we used a different (although overlapping) subset of ICD-10AM codes; and we used a single method for calculating the VoSL, which we considered to be more stable. Our cost estimates must be taken as highly conservative. Not all potentially avoidable causes of hospitalisation or death were included—in particular, injury hospitalisations and sudden unexplained deaths in infancy deaths were not included. Our consideration of out-of-pocket costs is an underestimate—for example, we did not include lost caregiver income for outpatient appointments, recovery at home or transport costs. We have not been able to do justice to nor quantify the costs of pain, suffering, trauma, missed educational and employment opportunities and other important consequences of health inequities for Māori children and their families. Our study uses non-Māori children as the comparator group, which includes children of other marginalised ethnic minorities. For example, 14% of children in New Zealand are of Pacific ethnicity.[26] The disparity between Māori children and NZ European will be much wider than the disparity between Māori and non-Māori children.

Considerable efforts have been made over recent years to improve the quality and completeness of ethnicity data recording in New Zealand health datasets, however, weaknesses remain that result in a net under-counting of Māori healthcare interactions.[27,28] Between 2000–2005, while no Māori under-counting was found in the mortality database, the national hospitalisation database under-counted Māori by 5–15%, and in 2009 28% of Māori who identified as Māori in the New Zealand Health Survey were not recorded as Māori in primary care enrolment data.[27] Ethnicity data for pharmaceutical and laboratory claims and mental health consultations come from the National Health Index (NHI) number, and while efforts have been made to improve NHI ethnicity data, Māori are still under-counted.[29] This under-counting of Māori children could partially contribute to the lower utilisation we found for primary care, and underestimate hospitalisations.

We compared Māori utilisation to that of non-Māori children, but this does not mean that if Māori utilisation equated to non-Māori this would be an equitable/appropriate distribution of care. If adjusted for current levels of higher health need,[3,30] Māori children should expect much higher rates of utilisation than non-Māori children for all dimensions of healthcare measured in this study, just to deliver an equal healthcare response to the same health conditions. For example, our analysis found that Māori children were 0.75 times as likely to receive care or compensation for an injury through ACC. This is despite evidence that injury rates are higher in Māori children—Māori aged 0–14 years are 5 times more likely to experience a fatal injury and 1.5–2 times more likely to be hospitalised from a non-fatal injury than children of any other ethnic group in New Zealand.[31] The lower rate of medicines claims for Māori children is alarming given they need more medicines than non-Māori based on burden of disease. This is consistent with previous findings that, adjusted for need, Māori receipt of prescription medicines is lower than non-Māori for all age groups.[32]

By any measure, the health system is clearly failing to serve Māori children. It is beyond this study to interrogate the reasons for this, but there are multiple complex factors that drive Indigenous health inequities including unfair historical and contemporary power imbalances, differential exposure to the social determinants of health[28 33] and racist health policies, organisations and models of care. Health professionals and healthcare organisations are important contributors to inequities in health care[28,34] and there is growing recognition of the importance of the need to improve cultural safety at both individual health practitioner and organisational levels to achieve equitable health care.[35] Unlike many countries, New Zealand's healthcare system is free at the point of care (including free primary care for children under 6 years of age between 2008–2014, a policy which has since been extended up to 14 years of age). This further demonstrates that even in

a “free” healthcare system, inequities in access exist. Māori families are highly over-represented in the poorest socio-economic deciles and even small incidental costs such as transport, parking and subsidised prescription charges can make healthcare unaffordable.

The healthcare utilisation picture in our study is one of a failure to deliver care for Māori children upstream via primary care, resulting in the need for more downstream and serious intervention in the form of hospitalisations. However, like Mills et al. found in 2012,[7] this does not result in higher net cost overall to the government health sector. It actually costs the government less to admit Māori children to hospital for ambulatory sensitive conditions than it would to prevent or treat them early in primary care. This means the government health sector does not have a financial imperative to do things better.

Even as a highly conservative estimate, at $170 million NZD each year, the cost of the current Māori child health inequities is clearly significant. But what our study demonstrates is that the cost burden is not shared equally—the savings from these inequities benefit the government health sector, while the bulk of the costs are borne by Māori families. From a whole-of-government perspective, the costs of lost productivity and income to non-health sectors is likely considerable but outside the scope of this study. The distribution of costs is a clear breach of Te Tiriti o Waitangi and contributes to the further exacerbation of poverty and economic drivers of health inequities for Māori in New Zealand.

Conclusions

There are economic consequences of the health inequities experienced by Māori children in New Zealand. The costs ($175 million NZD per year) are borne disproportionately by Māori families while the government health sector benefits from net cost savings ($4 million NZD per year). This study highlights: 1) that delaying healthcare for Māori children through under-provision of primary care resulting in higher rates of hospitalisations is cheaper for the government health sector, and 2) that there is no financial incentive for the government health sector to intervene to reduce health inequities for Māori children, and 3) that “doing nothing” to change the current child health inequities has a high economic cost to Māori families and society.

COMPETING INTERESTS
The authors declare that they have no competing interests.

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Appendices: Full list of ICD-10AM codes used for potentially avoidable hospitalisations and avoidable mortality

Appendix 1: Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Cardiovascular				
Rheumatic fever/ heart disease	I00	Rheumatic fever without mention of heart involvement	All	No
	I01	Rheumatic fever with heart involvement	All	No
	I02	Rheumatic chorea	All	No
	I05	Rheumatic mitral valve diseases	All	No
	I06	Rheumatic aortic valve diseases	All	No
	I07	Rheumatic tricuspid valve diseases	All	No
	I08	Multiple valve diseases	All	No
	I09	Other rheumatic heart diseases	All	No
Dental				
Dental conditions	K02	Dental caries	All	Yes
	K04	Diseases of pulp and periapical tissues	All	Yes
	K05	Gingivitis and periodontal diseases	All	Yes
Dermatological				
Cellulitis	L01	Impetigo	All	No
	L02	Cutaneous abscess, furuncle and carbuncle	All	No
	L03	Cellulitis	All	No
	L04	Acute lymphadenitis	All	No
	L08	Other local infections of skin and subcutaneous tissue	All	No
	H00.0	Hordeolum and other deep inflammation of eyelid	All	No
	H01.0	Blepharitis	All	No
	J34.0	Abscess, furuncle and carbuncle of nose	All	No
	L98.0	Pyogenic granuloma	All	No

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Dermatological				
Dermatitis and eczema	L20	Atopic dermatitis	All	No
	L21	Seborrhoeic dermatitis	All	No
	L22	Diaper [napkin] dermatitis	All	No
	L23	Allergic contact dermatitis	All	No
	L24	Irritant contact dermatitis	All	No
	L25	Unspecified contact dermatitis	All	No
	L26	Exfoliative dermatitis	All	No
	L27	Dermatitis due to substances taken internally	All	No
	L28	Lichen simplex chronicus and prurigo	All	No
	L29	Pruritus	All	No
	L30	Other dermatitis	All	No
Gastrointestinal				
Constipation	K59.0	Constipation	All	No
Gastroenteritis/ dehydration	A02	Other salmonella infections	All	No
	A03	Shigellosis	All	No
	A04	Other bacterial intestinal infections	All	No
	A05	Other bacterial food-borne intoxications, not elsewhere classified	All	No
	A06	Amoebiasis	All	No
	A07	Other protozoal intestinal diseases	All	No
	A08	Viral and other specified intestinal infections	All	No
	A09	Other gastroenteritis and colitis of infectious and unspecified origin	All	No
	R11	Nausea and vomiting	All	No
	K52.9	Noninfective gastroenteritis and colitis, unspecified	All	No

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
GORD (gastro-oesphageal reflux disease)	K21	Gastro-oesophageal reflux disease	All	No
Nutrition deficiency and anaemia	D50	Iron deficiency anaemia	All	No
	D51	Vitamin B12 deficiency anaemia	All	No
	D52	Folate deficiency anaemia	All	No
	D53	Other nutritional anaemias	All	No
	E40	Kwashiorkor	All	No
	E41	Nutritional marasmus	All	No
	E42	Marasmic kwashiorkor	All	No
	E43	Unspecified severe protein-energy malnutrition	All	No
	E44	Protein-energy malnutrition of moderate and mild degree	All	No
	E45	Retarded development following protein-energy malnutrition	All	No
	E46	Unspecified protein-energy malnutrition	All	No
	E50	Vitamin A deficiency	All	No
	E51	Thiamine deficiency	All	No
	E52	Niacin deficiency [pellagra]	All	No
Nutrition deficiency and anaemia (continued)	E53	Deficiency of other B group vitamins	All	No
	E54	Ascorbic acid deficiency	All	No
	E55	Vitamin D deficiency	All	No
	E56	Other vitamin deficiencies	All	No
	E58	Dietary calcium deficiency	All	No
	E59	Dietary selenium deficiency	All	No
	E60	Dietary zinc deficiency	All	No
	E61	Deficiency of other nutrient elements	All	No
	E63	Other nutritional deficiencies	All	No

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Respiratory				
Asthma	J45	Asthma	All	No
	J46	Status asthmaticus	All	No
	R06.2*	Wheeze	0 to 4 years	No
Lower respiratory infections	J22*	Unspecified acute lower respiratory infection	0 to 4 years	No
Pneumonia	J13	Pneumonia due to Streptococcus pneumoniae	All	No
	J14	Pneumonia due to Haemophilus influenzae	All	No
	J15	Bacterial pneumonia, not elsewhere classified	All	No
	J16	Pneumonia due to other infectious organisms, not elsewhere classified	All	No
	J18	Pneumonia, organism unspecified	All	No
Upper and ENT respiratory infections	J00	Acute nasopharyngitis [common cold]	All	No
	J01	Acute sinusitis	All	No
	J02	Acute pharyngitis	All	No
	J03	Acute tonsillitis	All	No
	J04*	Acute laryngitis and tracheitis	All	No
	J06	Acute upper respiratory infections of multiple and unspecified sites	All	No
	H65	Nonsuppurative otitis media	All	No
	H66	Suppurative and unspecified otitis media	All	No
	H67	Otitis media in diseases classified elsewhere	All	No

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Vaccine-preventable disease				
Vaccine-preventable MMR	B05	Measles	15 months to 14 years	No
	B06	Rubella [German measles]	15 months to 14 years	No
	B26	Mumps	15 months to 14 years	No
	P35.0	Congenital rubella syndrome	15 months to 14 years	No
Other vaccine-preventable disease	A33	Tetanus neonatorum	6 months to 14 years	No
	A34	Obstetrical tetanus	6 months to 14 years	No
	A35	Other tetanus	6 months to 14 years	No
	A36	Diphtheria	6 months to 14 years	No
	A37	Whooping cough	6 months to 14 years	No
	A80	Acute poliomyelitis	6 months to 14 years	No
	B16	Acute hepatitis B	6 months to 14 years	No
	B18*	Chronic viral hepatitis	6 months to 14 years	No
	A40.3*	Sepsis due to Streptococcus pneumoniae	6 months to 14 years	No
Other				
Kidney/urinary infection	N10	Acute tubulo-interstitial nephritis	5+	No
	N12	Tubulo-interstitial nephritis, not specified as acute or chronic	5+	No
	N13.6	Pyonephrosis	5+	No
	N30.9	Cystitis, unspecified	5+	No
	N39.0	Urinary tract infection, site not specified	5+	No

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Potentially avoidable hospitalisations (not in ASH) from Anderson et al[2]				
Condition	Diagnosis code ICD-10-AM	Diagnosis description	Applicable ages	Includes elective events
Respiratory				
	J05.0	Croup		
	J10.0, J11.0	Influenza with pneumonia		
Viral pneumonia	J12			
Other LRTI	J21	Acute bronchiolitis	29d-14yr	
Nervous system				
	G00, G01	Bacterial meningitis		
Infections and parasitic disease				
Infections	A00, A01	Cholera, Typhoid, Paratyphoid		
	A15-A19	Tuberculosis		
	A39	Meningococcal disease		
Endocrine, nutritional, metabolic				
Nutritional deficiency	E64	Sequalae of nutritional deficiency		
Musculoskeletal				
Osteomyelitis	M86	Osteomyelitis		
Infections of joints	M01.4	Rubella arthritis		
Skin				
	L00	Staph scolded skin syndrome		
Genitourinary				
	N30.0	Acute cystitis		

Appendix 1 (continued): Potentially avoidable hospitalisations, ICD-10AM codes for use in the child cost of illness (COI) study. Based on Ministry of Health Wai 2575 Māori Health Trends Report[1] for ambulatory sensitive hospitalisation (ASH) codes and broader potentially avoidable hospitalisation codes from Anderson et al.[2]

ASH codes from the Ministry of Health Wai 2575 Māori Health Trends Report1				
ASH condition	**Diagnosis code**	**Diagnosis description**	**Applicable ages**	**Includes elective events**
Other				
	A87, G02, G03	Viral/other/unspecified meningitis		
	B34	Viral infection of unspecified site		

Notes: for ASH codes, age is calculated at admission.
Exclusions: non-casemix events, neonates (i.e., patients less than 29 days old at admission), events with an overseas or unknow DHB domicile (as per MoH 2019).
ASH codes in Anderson et al. (2012) but not MoH, 2019 include skin infection (L00), some vaccine preventable diseases (M01.4), urinary infection (N30.0). These have been included in overall potentially avoidable hospitalisations.
*Additional ASH codes not in Anderson et al. 2012. Note that Anderson et al. only includes B18.0 and B18.1 instead of all B18. Codes for MMR vaccine preventable diseases are greater than 16 months in Anderson et al. 2012.

Appendix 2: Avoidable mortality ICD-10AM codes for use in the Child COI study. Based on Ministry of Health A Guide to Using Amendable Mortality as a System Level Measure[3] and additional codes from Walsh & Grey[4] for preventable mortality.

Group	Condition	ICD-10-AM-VI amenable mortality list3	Additional preventable mortality codes4
Infections	Pulmonary tuberculosis	A15–A16	A17, A18, A19, B90
	Meningococcal disease	A39	
	Pneumococcal disease	A40.3, G00.1, J13	
	Hepatitis C (HCV)	B17.1, B18.2	
	HIV/AIDS	B20–B24	
Cancers	Lip, oral cavity, pharynx		C00–C14
	Oesophagus		C15
	Stomach cancer	C16	
	Colon cancer		C18
	Rectal cancer	C19–C21	
	Trachea, bronchus, lung		C33–C34
	Bone and cartilage cancer	C40–C41	
	Melanoma of skin	C43	
	Mesothelioma		C45
	Female breast cancer	C50	
	Cervical cancer	C53	
	Uterine cancer	C54, C55	
	Prostate cancer	C61	
	Testis cancer	C62	
	Thyroid cancer	C73	
	Hodgkin lymphoma	C81	
	Acute lymphoblastic leukaemia (For ages 0–44 only)	C91.0	
Maternal and infant disorders	Complications of pregnancy	O00–O96, O98–O99	
	Complications of perinatal period	P01–P03, P05–P94	
	Cardiac septal defect	Q21	

Appendix 2: Avoidable mortality ICD-10AM codes for use in the Child COI study. Based on Ministry of Health A Guide to Using Amendable Mortality as a System Level Measure[3] and additional codes from Walsh & Grey[4] for preventable mortality.

Group	Condition	ICD-10-AM-VI amenable mortality list3	Additional preventable mortality codes4
Cardiovascular disorders and diabetes	Diabetes	E10–E14	
	Valvular heart disease	I01, I05–I09, I33–I37	
	Hypertensive diseases	I10–I13	
	Coronary heart disease	I20–I25	
	Pulmonary embolism	I26	
	Atrial fibrillation & flutter	I48	
	Heart failure	I50	
	Cerebrovascular diseases	I60–I69	
	Aotic aneurysm		I71
Other chronic disorders	Influenza		J09–J11
	Chronic obstructive pulmonary disease (COPD)	J40–J44	
	Asthma	J45–J46	
	Cholelithiasis	K80	
	Renal failure	N17–N19	
	Peptic ulcer disease	K25–K27	
Avoidable substance use	Alcohol		F10, G31.2, G62.1, I42.6, K29.2, K70, K73, K74.1, K74.2, K74.6, K74.7, K74.8, K74.9, K86.0
	Illicit drug use		F11, F12, F13, F14, F15, F16, F18, F19

Appendix 2: Avoidable mortality ICD-10AM codes for use in the Child COI study. Based on Ministry of Health A Guide to Using Amendable Mortality as a System Level Measure[3] and additional codes from Walsh & Grey[4] for preventable mortality.

Group	Condition	ICD-10-AM-VI amenable mortality list3	Additional preventable mortality codes4
Injuries	Land transport accidents excluding trains	V00–V04, V06–V14, V16–V24, V26–V34, V36–V44, V46–V54, V56–V64, V66–V74, V76–V79, V80.0–V80.5, V80.7–V80.9, V82–V86, V87.0–V87.5, V87.7–V87.9, V88.0–V88.5, V88.7–V88.9, V89, V98–V99	
	Accidental falls on same level	W00–W08, W18	W00–X59 (excluding W00–W08, W18)
	Fire (burns)	X00–X09	
	Suicide	X60–X84	
	Homicide and assault		X85–Y09
	Treatment injury		Y60–Y82

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3. Ministry of Health. A Guide to Using Amenable Mortality as a System Level Measure Wellington: Ministry of Health. 2018.
4. Walsh M, Grey C. The contribution of avoidable mortality to the life expectancy gap in Māori and Pacific populations in New Zealand—a decomposition analysis. N Z Med J. 2019;132(1492):46-60.

The impact of pain on function after spinal cord injury

Jae Hong Ryu, Hannah Joyce, Christin Coomarasamy, Jessica Ozumba, Victoriya Semikina, Suresh Subramanian

ABSTRACT:

AIM: Pain is a common complication of spinal cord injuries (SCI). Our objective was to quantify those who had pain on discharge from rehabilitation, and the level of interference it had on their functionality.

METHOD: This study used data collected prospectively from 2018 to 2019 via the New Zealand Spinal Cord Injury Registry (NZSCIR). Questionnaires completed by patients on discharge provided the necessary data. Primary outcomes were the number of patients reporting pain, and the level of interference with their activities of daily living (ADLs), mood and sleep. Level of interference was quantified via a score from zero to 10. Scores of seven and above were considered "severe" interference.

RESULTS: Seventy-six-point six percent of patients in this study group reported having pain on discharge. The median scores for interference with functionality were all three out of 10. Twenty-three-point eight percent of patients reported severe interference with sleep, 16.7% with ADLs and 16.2% with mood.

CONCLUSION: The number of patients being discharged with pain from SCI rehabilitation units in New Zealand is similar to figures from other literature. Although significant functional impairments were not found overall, focus remains to optimise management for patients who do report "severe" interference.

In New Zealand, the most recent figures for the mean annual incidence of traumatic spinal cord injuries (TSCI) over a 10-year period has been found to be 22 per million people.[1] This has decreased from the previously estimated rate of 49 per million from 1998; however, it is difficult to gauge where this new estimate lies in the global context, given the wide variability of figures.[2,3] From the New Zealand Spinal Cord Injury Registry (NZSCIR) Annual Report in 2020, it was reported that the incidence rate of TSCI and non-traumatic SCI (NTSCI) combined was 44 per million. Local studies have also shown disparities in the incidence of TSCI in New Zealand, with more people of Māori and Pacific Island ethnicities having higher rates of injuries compared to others.[1,4]

Among patients with spinal cord injuries (SCI), one of the most prevalent chronic complications is pain.[5–7] A systematic review and meta-analysis by Hunt et al. classified chronic pain post-SCI using the International Spinal Cord Injury Pain (ISCIP) classification, and reported neuropathic pain in 79% of patients, musculoskeletal pain in 58% and visceral pain in 3%.[8] Fifty four percent reported two or more types of pain. The pooled prevalence in this meta-analysis was 68%. Consequently, pain can hinder patients' rehabilitation and their transition into community as it affects quality of sleep, ability to return to paid employment, mood and anxiety levels and social connectedness.[9–12]

Our study's primary objective was to determine the proportion of patients who reported pain on discharge, with a particular focus on how pain impacted their activities of daily living (ADLs), mood and sleep. The secondary objectives were to assess their satisfaction with pain management, and the relationship between pain and patient demographics such as ethnicity, age, level of injury, severity of injury (The American Spinal Injury Association (ASIA) Impairment Scale) and type of SCI (TSCI vs NTSCI).

The outcomes of this study hope to guide future decisions in community programmes and rehabilitation systems that can be established to support patients with a SCI after discharge. It will also contribute to the way that pain is discussed prior to discharge so that patients and their whānau feel more equipped for the transition.

Method

This was a retrospective study that used data collected prospectively of patients who sustained either a TSCI or a NTSCI and were admitted to one of the two spinal rehabilitation units in New Zealand. The rehabilitation units in New Zealand are the Auckland Spinal Rehabilitation Unit (ASRU) and the Burwood Spinal Unit (BSU). The ASRU admits

patients with SCI from approximately the upper half of the North Island, whereas the BSU admits patients from the region below. The data for this study was collated from the years 2018 to 2019 and obtained through the New Zealand Spinal Cord Injury Registry (NZSCIR) with access granted by the NZSCIR Data Access Group. The data received did not include any identifiable information. Ethics approval was obtained via the Auckland Health Research Ethics Committee (AHREC) (Reference number: AH23267). The study's inclusion criteria focussed on adult patients above the age of 16 with a TSCI or a NTSCI who consented for a discharge interview at the time of their discharge from ASRU/BSU. The study's exclusion criteria consisted of patients with incomplete data and/or those who declined consent to participate in the NZSCIR.

The data stored in the NZSCIR were obtained from discharge interviews with patients that were typically conducted prior to transition from their respective spinal rehabilitation unit to their discharge destination. The discharge interview is a questionnaire that asked patients to give a score from zero to 10 for questions relating to pain, its interference with ADLs, mood and sleep and their satisfaction with management for pain. Demographic characteristics including age, gender and ethnicity, as defined by the New Zealand Ministry of Health, were gathered on every participant in the NZSCIR as part of standard data collection. Ethnicity was classed as NZ European, Māori, Pasifika, and Others. Others included Asian, Middle Eastern, Latin American and African ethnicities. Information on neurological level of injury and completeness of injury were collected. The level of injury and severity noted were those recorded on discharge from the rehabilitation units. Where level of injury on discharge was not available, the level noted on admission to rehabilitation was used. The level of neurological injury was grouped into either tetraplegia/paraplegia/intact. The American Spinal Injury Association Impairment Scale (AIS) was used to describe the completeness of spinal cord injury. This ranges from "A", representing a complete injury (no sensation or motor activity below the level of injury), to "E" (normal sensory and motor function).[13]

Questions in the discharge interview related to pain were:

Numerical Rating Scale (NRS) was used as the self-reported measure for the questions relating to pain management satisfaction and the level of interference with functionality. Numbers from zero to 10 were presented and answers recorded by coordinators interviewing the patients on discharge. A score of 10 was considered optimal pain management, a score between seven to nine was considered satisfactory management, and a score of zero was considered completely dissatisfied with management. A score of seven and above for the questions relating to functionality was considered "severe" interference, based on a study by Boonstra et al., who investigated the cut-off points for "severe" interference with chronic musculoskeletal pain.[14] A score of zero for the functionality questions thus indicated no interference. The scores provided by patients for each individual question were collated and a median score was found.

1. *"Have you had any pain in the last 7 days, including today?"*
2. *"Are you receiving treatment for a pain problem?"*
3. *"If yes (to above), what treatments do you use to manage your pain?"*
4. *"Overall, how satisfied are you with the management of your pain?"*
5. *"In general, how much has pain interfered with your day-to-day activities in the last week?"*
6. *"In general, how much has pain interfered with your overall mood in the last week?"*
7. *"In general, how much has pain interfered with your ability to get a good night's sleep?"*

Based on the answers given for pain on discharge: "Yes" or "No", the patients in each demographic/SCI characteristic group were stratified according to the answers given. The patients who answered "Yes" to pain on discharge were of focus to our study. Data were reported as frequency and proportions for patient characteristics and pain on discharge. Two by two contingency tables and Chi-squared or Fisher's exact test were used to assess potential associations of pain on discharge rates by demographics/SCI characteristics. P-values of less than 5% were considered as statistically significant. All statistical analyses were carried out using OpenEpi and SAS version 9.4.

Results

In the years 2018 and 2019, 435 patients sustained a SCI in New Zealand (Figure 1). Three hundred and seventy-two of these patients were admitted to ASRU or BSU for rehabilitation. Two hundred ad seventy-four patients consented to discharge interviews being completed for the NZSCIR. Ninety-eight out of 372 eligible patients did not participate in this

study, producing an attrition rate of 26.3%. Out of the 274 patients, 210 answered "Yes" to pain on discharge and 64 answered "No" (Table 1). The proportion of patients who reported pain on discharge from this study population was 76.6%.

The age group with the highest proportion of reported pain on discharge was the 46–60 years category (84%). One hundred and twenty-eight patients identified as NZ European, 47 as Māori, 23 as Pacific Island, and 12 as Others. Despite making up only 19% of the patients who consented for the discharge questionnaire, Māori patients had the most pain reported on discharge, with 88.7% reporting "Yes". The Pacific Island group were second, with 76.7% reporting "Yes". One hundred and forty-six were male and 64 were female, with more females reporting pain in proportion (82.1%). For those reporting pain on discharge, 145 patients sustained a TSCI and 65 sustained a NTSCI. 111 patients were tetraplegic, 96 were paraplegic and 3 were intact. AIS A was the level at which there were the greatest proportion of patients with pain on discharge (83.6%).

Overall, the median score for satisfaction of pain management in the total population was eight (Figure 2). Out of the 210 patients, 60 patients (28.6%) scored their satisfaction as optimal pain management with 10 out of 10. One hundred and three patients (49.0%) scored within the range of seven to nine, as satisfactory pain management. The median scores for effect of pain on interference with ADLs, mood, and sleep were all three out of 10 (Figures 3–5). With ADLs, 35/210 patients (16.7%) reported "severe" interference due to pain, whereas 55 (26.2%) reported no interference. Thirty-four out of two hundred and ten patients (16.2%) reported "severe" interference with their mood, and 64 (30.5%) denied any interference. Sleep was the functional task that showed the greatest number of patients reporting "severe" interference, with

Figure 1: Study population with inclusion and exclusion criteria.

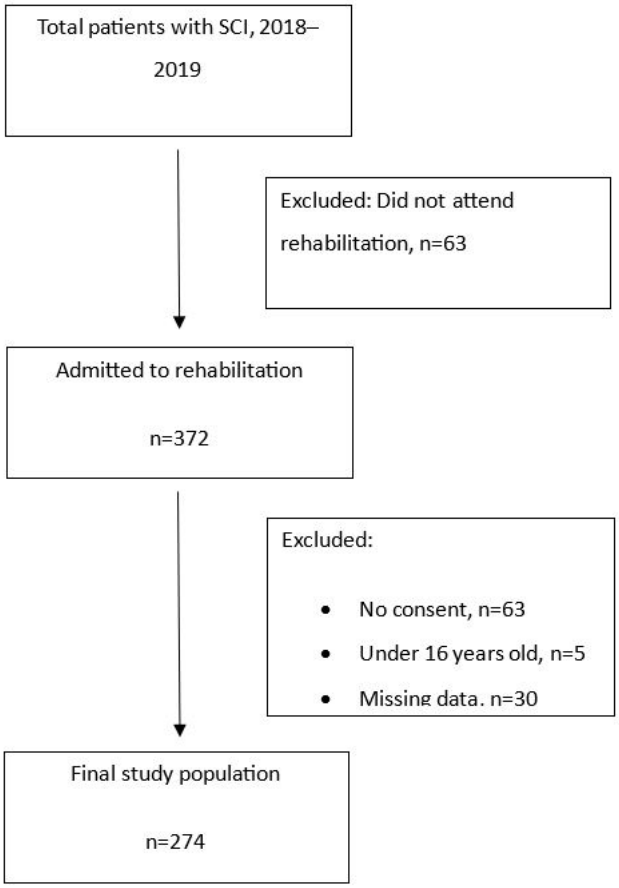


Table 1: Patient demographics/characteristics grouped by pain on discharge.

	Pain on discharge			
Patient demographics/ characteristics	**Yes (n=210)**	**No (n=64)**	**Total (n=274)**	**P-value**
Ethnicity				
European (includes NZ European)	128 (73.6%)	46 (26.4%)	174	0.135
Māori	47 (88.7%)	6 (11.3%)	53	
Other	12 (70.6%)	5 (29.4%)	17	
Pacific Island	23 (76.7%)	7 (23.3%)	30	
Age group				
0–30	44 (78.6%)	12 (21.4%)	56	0.205
31–45	27 (69.2%)	12 (30.8%)	39	
46–60	68 (84.0%)	13 (16.0%)	81	
61–75	57 (75%)	19 (25%)	76	
76+	14 (63.6%)	8 (36.4%)	22	
Gender				
Male	146 (74.5%)	50 (25.5%)	196	0.24
Female	64 (82.1%)	14 (17.9%)	78	
Type of SCI				
Traumatic	145 (79.7%)	37 (20.3%)	182	0.129
Non-traumatic	65 (70.7%)	27 (29.3%)	92	
Level of injury				
Tetraplegia	111 (73.0%)	41 (27.0%)	152	0.187*
Paraplegia	96 (81.4%)	22 (18.6%)	118	
Intact	3 (75%)	1 (25%)	4	
Severity of injury				
A	46 (83.6%)	9 (16.4%)	55	0.217*
B	17 (77.3%)	5 (22.7%)	22	
C	20 (62.5%)	12 (37.5%)	32	
D	125 (77.2%)	37 (22.8%)	162	
E	2 (66.7%)	1 (33.3%)	3	

*Fisher's exact test or Chi-squared test used.

Table 2: Patient reported scores of interference with ADLs, mood and sleep.

	Score ≥7/10	Score <7/10
Interference with ADLs	35/210 (16.7%)	175/210 (83.3%)
Interference with mood	34/210 (16.2%)	176/210 (83.8%)
Interference with sleep	50/210 (23.8%)	160/210 (76.2%)

Figure 2: Scores given for satisfaction with pain management.

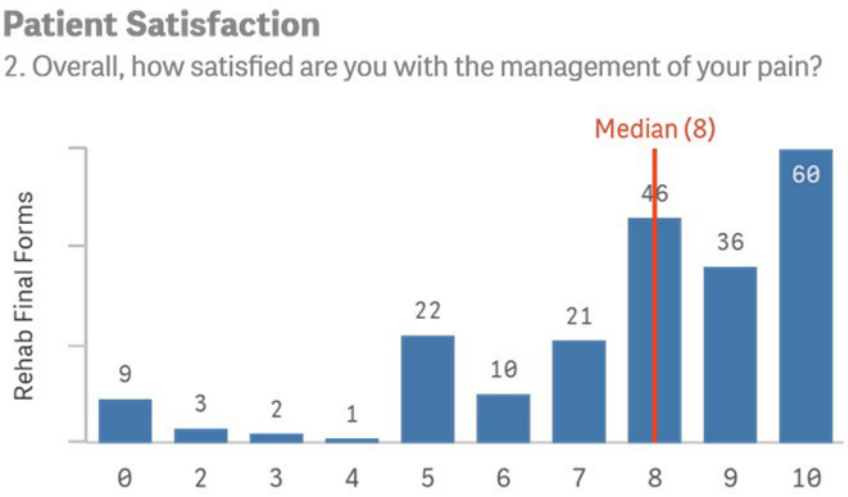


Figure 3: Scores given for level of interference with daily activities.

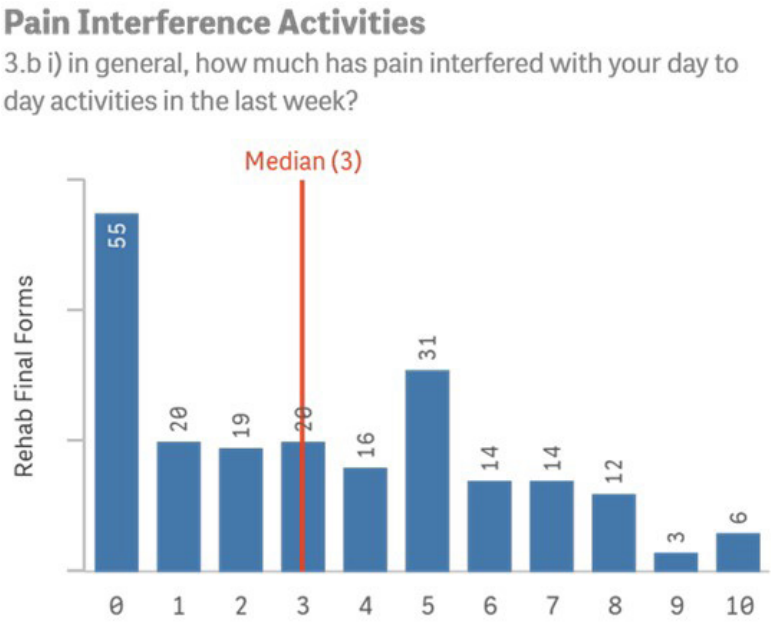


Figure 4: Scores given for level of interference with mood.

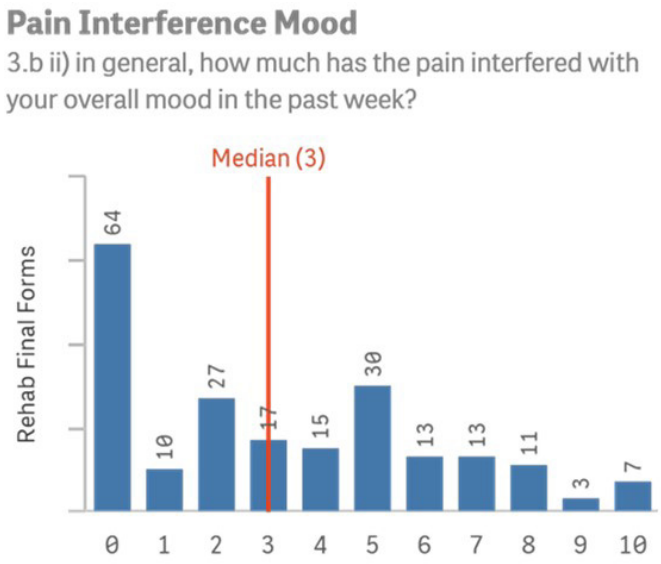


Figure 5: Scores given for level of interference with sleep.

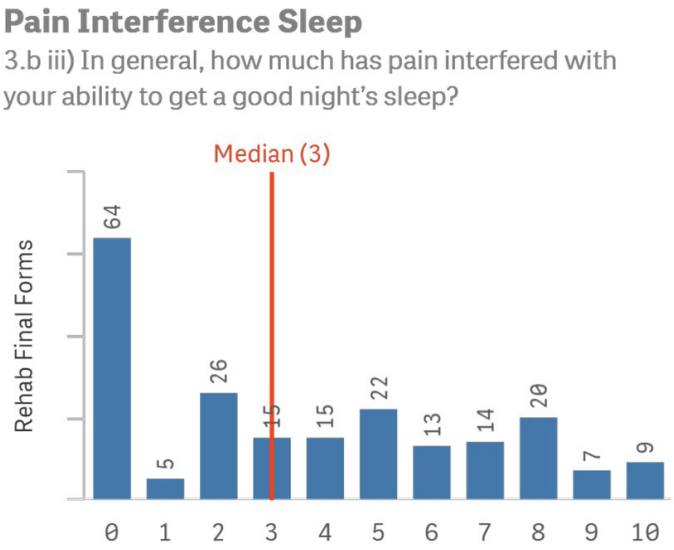


Figure 6: Modes of management options for pain in TSCI patients.

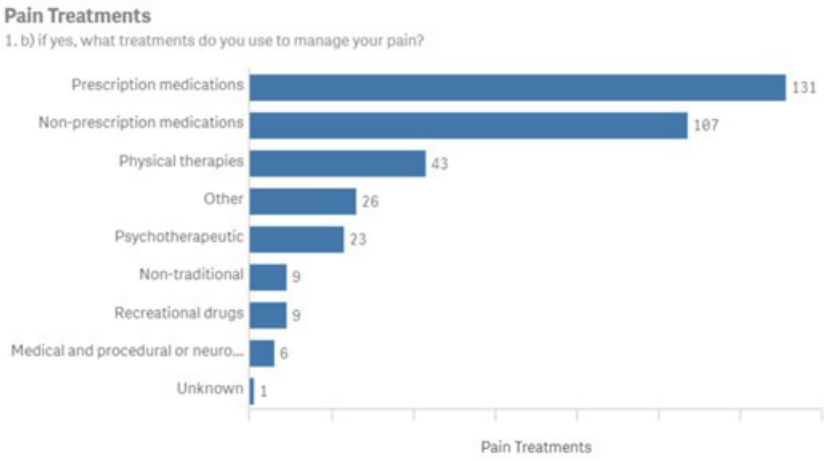
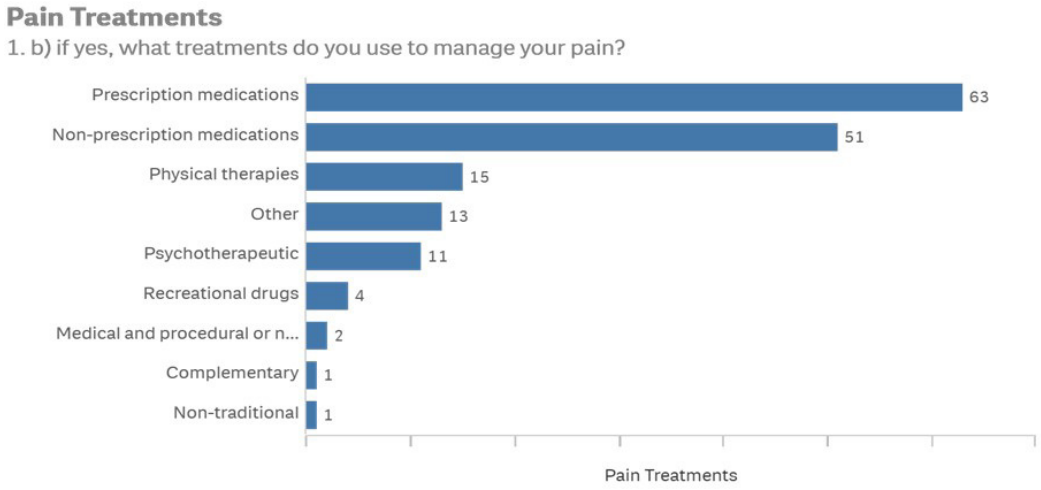


Figure 7: Modes of management options for pain in NTSCI patients.



50/210 patients (23.8%). However, 64 patients (30.5%) reported no interference with sleep. On further questioning, the mode of treatment for pain was largely dominated by pharmacological means (both prescription and non-prescription) in both the TSCI and NTSCI groups (Figures 6—7).

Discussion

The purpose of this study was to investigate the prevalence of pain and its impact on functionality (ADLs, mood and sleep) for patients with a SCI near their time of discharge. Pain after sustaining a SCI, whether traumatic or non-traumatic, is a common complication and the interference with ADLs, sleep, and mood are also well documented.[5–12] In our study, it was found that 210/274 patients (76.6%) reported having pain at time of discharge. This is consistent with other literatures' statistics.[6,7,15] Despite the number of patients reporting pain being high, our study shows that the management for pain is still satisfactory for most, and interferences with ADLs, mood and sleep are low overall. The median scores for the level of interference with ADLs, mood and sleep were all three out of 10, implying that pain plays a small part in affecting the lives of majority of our patients. Almost 78% of patients reported at least a satisfactory management of their pain, with 28.6% reporting completely optimal management. This is a reassuring sign that current modalities for pain management are effective for most SCI patients in New Zealand at the time of discharge. However, further focus can be made to assess if pain management is maintained in the community with longer follow-up, considering that the ramifications of pain can change over time post-discharge.

In Norrbrink Budh's study, pain was the major factor interfering with sleep quality, showing patients with continuous pain had poorer sleep than those with nil or intermittent pain.[9] They also noted that mood and sleep were interlinked, as patients with lower mood tended to have poorer sleep. Low mood was not reported to have improved significantly over the course of 10 years after sustaining a SCI; hence, Cruz-Almeida theorised that this long-term low mood also contributes to the chronic pain experienced by patients.[16] This bidirectional relationship between pain and mood also exists with pain and sleep as well, with pregabalin providing significant improvement in reducing pain-related interference with sleep.[17–19] In a study from 2001, approximately 40% of patients were found to have difficulty falling asleep or staying asleep due to pain,[20] whereas our study indicates that approximately a quarter of the patients report being severely affected (23.8%). Out of the 3 facets of functionality that were measured in our study, more patients reported "severe" interference with sleep, compared to interference with ADLs (16.7%) or mood (16.2%). However, it is reassuring to see that in our study there is consistently a greater proportion of patients reporting no interference for all ADLs, mood and sleep.

The principles of Te Tiriti o Waitangi stress the importance of upholding certain values for the healthcare of Māori: tino rangatiratanga, equity, active protection, options and partnership.[21] This should be held with high regard in SCI management based on the results seen from our study. Incidence rates of SCI were higher for Māori

compared to other ethnic groups, which has not changed since the last study conducted on SCI in New Zealand.[1] In addition, our data implies Māori had the largest proportion of patients having pain on discharge compared to non-Māori. However, it should be noted that due to the limitation of this study having no individual data available through the Registry, we were unable to perform multi-variate analysis to deduce that ethnicity was a single contributing factor. Other studies have also shown that racial and ethnic minorities with SCI are more likely to have more health complications, low mood and poorer quality of life.[22–24]

There were limitations to our study. Firstly, the attrition rate of data loss was approximately 26% from the SCI patients who were admitted for rehabilitation. This was due to variety of reasons, including age (under 16 years), no consent for the full data set (e.g., non-residents, comorbidities preventing interviews or declining participation), or incomplete discharge interviews (due to death, transition to palliative care or transfer to another facility before completion of interview). The data in our study were all self-reported by the patients, which can allow the definition of "pain" being interpreted in different ways depending on the patient's values, culture and life experience. This is seen in certain meta-analyses, where high heterogeneity has been reported across various studies that were used.[6,7] Hence, the prevalence reported in our study may not be entirely accurate. A cumulative dataset was provided by the Registry as opposed to individual patient information; hence, no further univariate or multivariate analyses could be performed to investigate significant factors for pain and interference with functionality. The questionnaire also did not include a question that quantified the actual severity of pain; hence analysis of this could not be attained.

Furthermore, our study has shown that while there are a significant proportion of patients with SCI leaving rehabilitation units with pain, there is high satisfaction with the management for this pain and low interference with functionality in day-to-day activities. Future focus will be to investigate ways of providing better community support for the small percentage of patients experiencing pain that interferes with their functionality. It is also crucial to further evaluate and mitigate the inequities seen in ethnic differences of pain prevalence.

COMPETING INTERESTS:
No competing interests were involved in this study

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Time for another review: following implementation of a new service model for Auckland Sexual Health service there has been an increase in referrals, case complexity and clinical workload but regional inequities in access remain

Sunita Azariah

ABSTRACT

AIMS: A review of the Auckland Sexual Health regional service in 2014 resulted in new criteria for access, and redundancy of two sexual health physicians. The aim of this audit was to review the impact of the review on operating volumes, referrals and case complexity.

METHODS: Secondary care referrals to the service were audited over three 12-month periods and were compared to the total volumes of first specialist assessments during the same periods following implementation of the new service model.

RESULTS: Numbers of secondary referrals nearly doubled from 1,218 referrals in 2017 to 2,036 in 2021. Auckland (40%) and Waitematā (31%) District Health Boards accounted for a much greater proportion of secondary referrals than Counties Manukau (22%). This was similar for self-referrals, with only 17% coming from Counties Manukau. The biggest increases in secondary referrals were for virtual specialist advice (500%) and for gender-affirming treatment (220%).

DISCUSSION: The Auckland sexual health review has resulted in an increase in case complexity and in workload of all staff, including specialists, but has not addressed regional inequities in service access or provision. Provision of gender-affirming care has resulted in greatly increased demand for service. Service delivery and workforce require a review to guide commissioning of sexual health and gender-affirming healthcare in the region.

The Auckland Sexual Health Service (ASHS) is New Zealand's largest sexual health service, and prior to the establishment of Te Whatu Ora – Health New Zealand it was contracted to provide primary- and secondary-level specialist sexual health care to three regional district health boards (DHBs): Auckland, Counties Manukau and Waitematā. Auckland has a large, culturally diverse population of around 1.7 million people, which is younger on average than the rest of New Zealand. It is estimated that around 30% (500,000) of the population live within the former Auckland DHB catchment area, 34% (580,000) in Counties Manukau and 37% (630,000) in the Waitematā DHB area.[1] ASHS provides access through a number of clinic locations in Auckland: Greenlane Clinical Centre (Auckland DHB), Glenfield, Henderson (Waitematā DHB), and Māngere (Counties Manukau DHB). There are also two weekly outreach clinics; one operating in the Aotearoa New Zealand Sex Workers' Collective (formerly New Zealand Prostitutes' Collective) premises in the city centre and the other at Body Positive, a community non-governmental organisation (NGO). A further outreach clinic located at the New Zealand AIDS Foundation was closed in late 2021. All clinics can be accessed by anyone in the Auckland region no matter where they normally reside.

Background to review of regional sexual health service

Prior to the establishment of The Auckland DHB funding and planning department has held the contract for provision of sexual healthcare to the Auckland region for the last three decades or more. All of the three regional DHBs contributed to the sexual health operating budget, which is volume-based. In 2014, ASHS staff were directed by Auckland DHB senior management to internally review the service with the aim of transitioning it to a more specialised secondary-level service

accessible only by referral, and with the thought that there would need to be a 30% reduction in operating volumes. No formal documentation was provided to support the rationale for the review or for the reduction in operating volumes. (The proposed changes would have resulted in a radical change in service delivery as at that time there were no restrictions on access and most patients were self-referred.) Staff were directed to develop new service specifications to inform referral criteria for a more specialised secondary-level service and to advise which patients should be referred back to primary care services for management. Although the funders and planners envisaged that primary care would pick up the 30% of people no longer eligible to access the service, there was no robust parallel consultation process with primary care or with consumers of the service to determine whether this would be acceptable or appropriate. The commissioners of the review appeared to have little understanding of the nature or scope of sexual health medicine as a speciality or the importance of maintaining primary level access to sexual health services, as many people affected by sexually transmitted infections experience significant barriers in accessing healthcare. For this reason, the current Ministry of Health service specifications for specialist medical and surgical services state that, "*Hospital-based sexual health services operate mainly as a multi-disciplinary outpatient service with patients attending on a self-referred basis. Referrals also come from general practitioners, the New Zealand Family Planning Association, Māori providers such as marae health clinics, and the New Zealand AIDS Foundation clinics, for example*".

The review was conducted by a committee of medical and nursing staff from the service, and they strongly advocated that primary-level access to the service should be maintained; this was supported by evidence that outlined the epidemiological rationale for maintaining primary access for key priority populations who would be able to self-refer. These were to be people aged under 30 years, Māori and Pasifika, men who have sex with men, people living with HIV, sex workers, people who inject drugs and transgender people. Those people designated as non-priority populations would require a referral in order to access the service. It should be noted that the specifications were not intended to address workforce requirements and did not refer to any reduction in FTE (full-time equivalent) for either medical or nursing staff. There were already challenges involved in staffing the multiple clinic locations and difficulties providing adequate levels of clinical supervision for registrars and support for nursing staff. Further, it was envisaged that the workload for the service would actually increase for a number of reasons, including a projected increased growth in the population of the Auckland region, a poorly controlled syphilis outbreak, a projected increase in demand for HIV pre-exposure prophylaxis (PrEP), an increase in complex cases and that additional nursing staff would be required to staff the new telephone triage system. (It should be noted that at the time of the review there were only 19.3 total FTE clinical and allied health professional staff employed at the service.)

The new service model and specifications were accepted by the funding and planning unit in late 2014 and there followed a 12- month trial period of implementing the new service model to assess the effect on patient volumes. Following this, a workforce consultation process was conducted in 2016 by Auckland DHB management that recommended an immediate reduction of senior medical staff from 4.8 FTE to 3.2 FTE despite feedback from medical staff and the Association of Salaried Medical Specialists that this would result in insufficient capacity to cover leave or to manage the anticipated increased workload and greater clinical acuity of cases. The Māngere clinic was also reduced in operating hours from 4 to 3 days per week, against advice from sexual health staff.

Following the sexual health review, a parallel review of gender-affirming services in the region led to ASHS being designated the regional provider of this completely new service, in addition to being the regional provider of secondary sexual health services. In 2017, despite written submissions by medical staff and ASMS advising against such a move, Auckland DHB management made the decision to make 1.6 FTE of the senior medical staff redundant with no additional nursing, medical or psychology FTE created to provide the new gender-affirming service.

Aim

The aim of this audit was to analyse the impact of the review on operating volumes, referrals, case complexity and specialist clinical workload.

Method

A search was conducted of the ASHS electronic medical record system (HCC) for all secondary care referrals to the service over 3 years following imple-

mentation of the new service model. Three 12-month periods in 2017, 2018 and 2021 were audited in order to track the evolution of service delivery and access. Secondary care referrals to the service are mainly by e-referral. ASHS accepts referrals for a range of conditions including genital dermatology opinions, management of complex STIs such as syphilis and HIV, vulvovaginal conditions including recurrent candidiasis and recurrent bacterial vaginosis, chronic genital pain and people wishing to start gender-affirming hormones. All secondary care referrals to the service are triaged by sexual health specialists to determine if the referral is appropriate and to grade priority.

The search included data on NHI, encounter date, name of triaging clinician and demographic information (age and ethnicity) of patients referred to the service. Ethnicity categories were condensed as follows into: New Zealand European/European, Māori, Pacific, Chinese, Indian, other Asian, other (African, Latin American/Hispanic, Middle Eastern) and not stated or specified. Information was also collected on which DHB the person resided in, the referral source (general practitioners (GP), secondary health care service, NGO etc.) and the clinical indication for referral. The majority of referrals are triaged into appointments for medical staff, but the service's two nurse practitioners also provide gender-affirming care and some complex STI management. Most people self-refer and data on total first visit volumes (FSA) for the same three time periods were collected from routine business intelligence reports.

Results

Volumes

The total numbers of first specialist assessments (FSAs) were 12,465 in 2017, 12,789 in 2018 and 11,181 in 2021. There was a 12% reduction in FSA volumes in 2021 compared to the other time periods that was due to the two COVID-19 related lockdowns that occurred in Auckland in February 2021 and August 2021 (Figure 1).

The majority of FSAs seen in all three periods were from the Auckland DHB area followed by Waitematā and Counties Manukau. Counties Manukau DHB accounted for only 17% of FSAs in 2021 with Auckland and Waitemata DHBs having 37% and 28% respectively. The other 19% of FSAs in 2021 were from DHBs outside Auckland.

Although total FSAs remained similar or lower over the three periods, the number of secondary referrals increased 200% over time, from 1,218 referrals in 2017 to 2,036 in 2021. Therefore, the proportion of secondary care referrals to total FSAs increased from 9.7% in 2017 to 18.2% in 2021. The largest numbers of referrals in all audited years were from Auckland DHB, averaging 40% over the three periods, followed by Waitematā with an average of 31% of referrals and Counties Manukau with the smallest proportion at an average of 22%, demonstrating inequities in access between the three DHBs (Figure 2).

Ethnicity of referrals

The ethnic breakdown of referrals remained similar across the years with NZ and other Europeans making up the biggest proportion; averaging 56% of total referrals over the three periods, followed by Māori and Pasifika who accounted for 11% and 9% of referrals. The 2018 Census figures for Auckland reported the ethnic breakdown as 53.5% European, 11.5% Māori, 15.5% Pasifika, 28.2 % Asian, 2.3 % Middle Eastern/Latin America/African and 1.1% as other, so it would appear that Pasifika were under-represented for referrals (Figure 3). When comparing ethnicities of referrals across the three DHBs in 2021, Counties Manukau DHB had a lower proportion of referrals of people of NZ European/European ethnicity (40%) and a much higher proportion of referrals for people of Māori ethnicity (26%) than the other two DHBs. Waitematā DHB had a higher proportion of referrals of people of NZ European/European ethnicity (68%) and a lower proportion of referrals of people of Pacific ethnicity (6%) than the other two DHBs. Counties Manukau DHB has a higher proportion of Pasifika people, a similar proportion of people of Māori ethnicity and a lower proportion of people of other ethnicities compared to the national average. Auckland DHB has a higher proportion of people of Pacific and other ethnicities and a lower proportion of people of Māori ethnicity than the national average. Waitematā DHB has a lower proportion of Māori and a higher proportion of people of other ethnicities than the national average.

Referral source and type

The biggest source of referrals was from GPs, (75% in 2017, 70% in 2018 and 75% in 2021) followed by secondary care services, which ranged between 7% and 12% of referrals. The remaining referrals were from a range of services including family planning clinics, lead maternity carers, corrections services and non-governmental agencies such as Body Positive and the New Zealand AIDS Foundation (now Burnett Foundation Aotearoa).

Figure 1: Total FSA volumes 2021 by DHB.

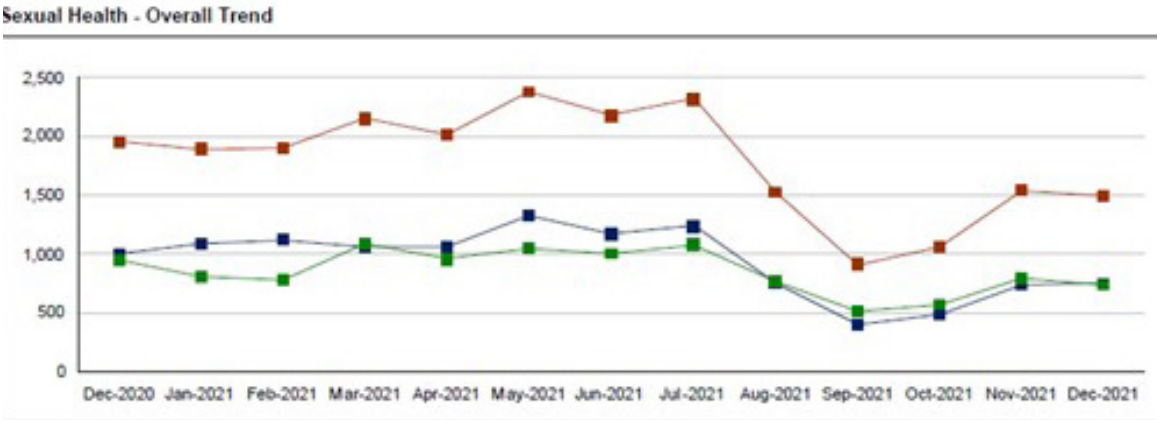


Figure 2: Secondary care referrals by DHB.

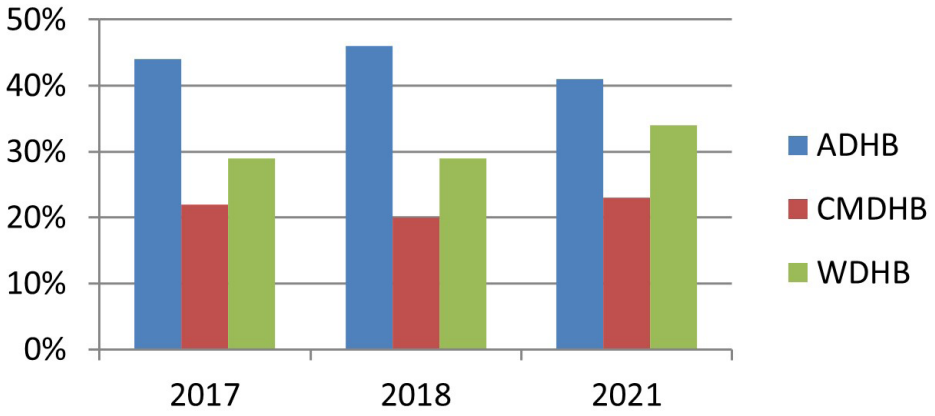


Figure 3: Ethnicity of referrals by DHB compared to 2018 Census data.

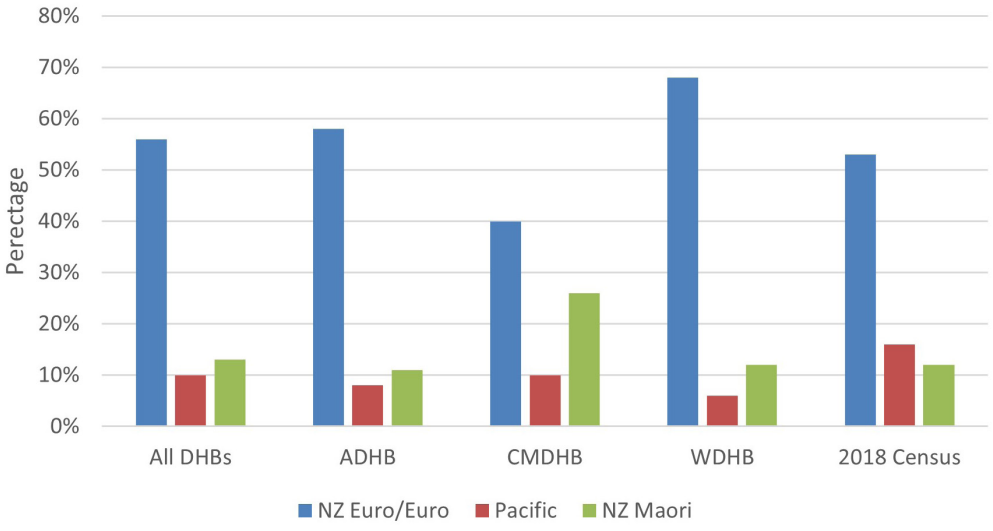


Figure 4: Referral categories.

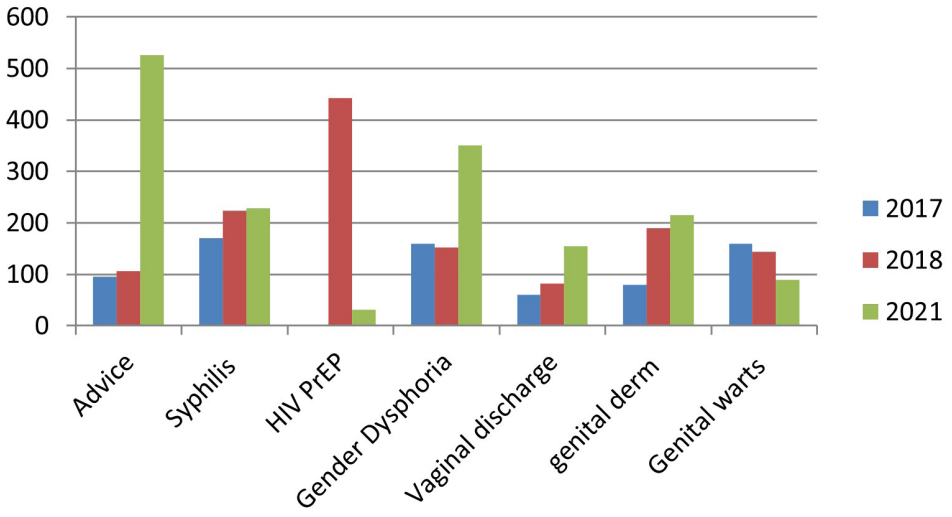
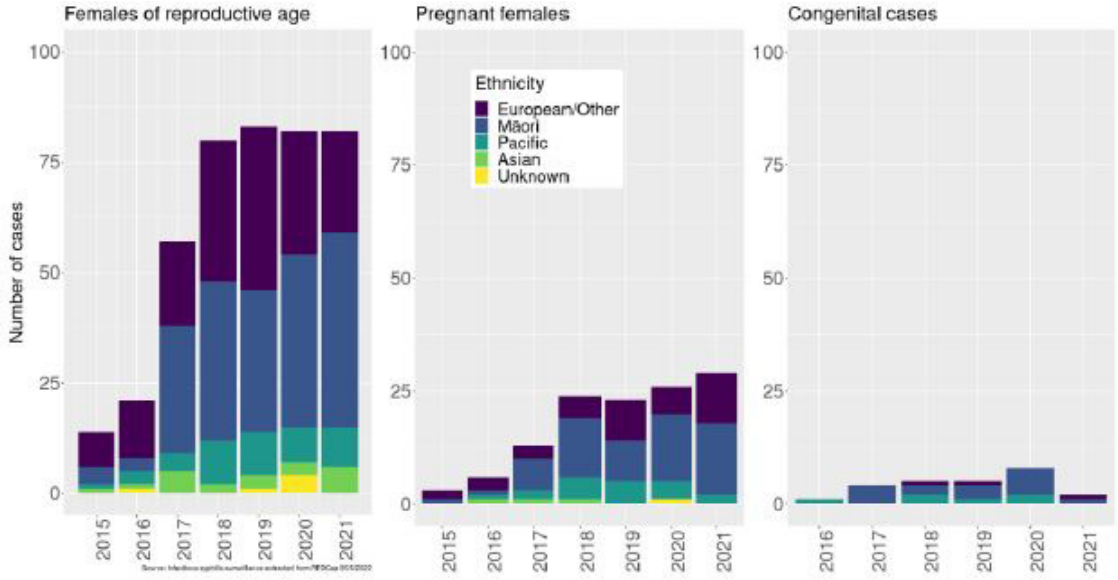


Figure 5: Syphilis cases in females of reproductive age, 2015 to 2021.*



*It should be noted that syphilis cases may be under-reported by clinicians, and therefore ESR surveillance data may not be representative of all cases treated. Also that in 2020 and 2021, there were substantial changes to behaviour, healthcare interactions and testing related to COVID-19 alert changes and therefore these data should be interpreted with caution.

The reasons for referral were categorised as follows: specialist advice, genital ulceration, chronic vaginal discharge, chronic urethritis, HIV PrEP, HIV management, HIV post-exposure prophylaxis (PEP), syphilis management, gender dysphoria, genital dermatology opinion, recurrent candidiasis, genital warts management, chronic genital pain, complex genital herpes, STI treatment, unspecified, other and declined (Figure 4). HIV PrEP was funded by PHARMAC for the first time in 2018 and initially all applications for special authority had to be approved by an HIV prescriber. The number of referrals for this increased rapidly in 2018 (23% of all referrals), however, this requirement for specialist consultation was later removed and in 2021 only 1% of referrals were for management of HIV PrEP.

Over time the number of referrals requesting or being managed as virtual specialist advice increased over 500% from 96 in 2017 to 517 in 2021. Numbers of referrals for gender-affirming treatment more than doubled from 159 referrals in 2017 to 351 in 2021. Genital dermatology opinions, syphilis management, genital warts management and chronic vaginal discharge were the next most common reasons for referral (Figure 4). Referrals for genital dermatology opinions and management of chronic vaginal discharge have increased over time, while referrals for genital warts management have declined. In 2021, management of gender-affirming healthcare accounted for 42% (217) of referrals managed as virtual advice and the next most frequent categories were advice for reactive syphilis serology 18% (92), HIV PrEP 6% (31), genital herpes 5% (26), STI management 5% (26) and genital dermatology 4% (21).

Discussion

The sexual health review has achieved its aim of transitioning ASHS to a more specialised secondary level service. This is evidenced by the fact that the numbers of secondary care referrals have increased since the new model was implemented, while overall FSA volumes have remained static. The audit has also highlighted large inequities in access between the three DHBs in terms of both primary- and secondary-level access to care. Auckland and Waitematā DHBs accounted for 80% of Auckland region FSAs despite Counties Manukau DHB having a similar population. The disparity was similar for secondary care referrals and is striking given that the population of Counties Manukau does have significant numbers of people who are regarded as priority populations by ASHS, including young people and Pasifika. Also, Counties Manukau has a greater proportion of people living with social deprivation who face significant barriers and challenges in terms of access to health services. Contributing factors to poor access in Counties Manukau are likely to be the limited days of operation, the current clinic location and challenges for people accessing primary care services in south Auckland, given that the majority of secondary care referrals are from GPs. Interestingly this audit has also highlighted that nearly 20% of FSAs resided outside the Auckland region.

A compelling equity argument can be made for improving access to sexual health services in Counties Manukau. Syphilis is a serious sexually transmitted infection that has been highly endemic in the Auckland region since the early 2000's, with a rapid increase in cases since 2015.[3] ASHS data have highlighted grave inequities and a rapidly evolving change in the epidemiology of syphilis infections in the Auckland region since then. Formerly, this disease was predominantly diagnosed in men who have sex with men (MSM), however, Environmental Science and Research (ESR) STI surveillance data shows that the proportion of people infected through heterosexual transmission has steadily increased over time (data provided by Putu Duff on behalf of ESR Sexually Transmitted Infections Surveillance team).[3] In 2015, 73% of cases were diagnosed in MSM but by 2021 they only made up 56% of cases. In 2015, 25% of cases were diagnosed in heterosexual men (MSW) and women (WSM) but by 2021 that had increased to 57%. There has also been a change in the ethnicity distribution of cases over time. In 2015, individuals of Māori and Pacific ethnicities accounted for 20% of cases notified in Auckland region, but by 2021 this had increased to 41.3%. Even more concerning is the continued rise in numbers of women of reproductive age and pregnant women being diagnosed with syphilis, many of whom reside in Counties Manukau DHB. This ethnic disparity is also noted in national ESR data for syphilis cases in women of reproductive age, in pregnant women and in congenital cases (Figure 5). There have been 23 congenital syphilis cases reported in New Zealand from 2016 to 2020, including eight fetal and one peri-natal death[4] (this is likely under-reported as not all cases of fetal loss are investigated); all potentially pre-

ventable by early diagnosis and treatment during pregnancy. The syphilis data highlight that Counties Manukau is a region of high need that should be given urgent priority. This could include better targeting of resources, better collaboration with Māori and Pasifika healthcare providers and more innovative approaches to service provision.

It should be noted that the general increase in case complexity since the implementation of the new model cannot be completely captured in this audit of secondary care referrals, and the overall workforce impact of the transition has not been properly reviewed since 2016. The Ministry of Health service specifications are cognisant of the fact that sexual health services need to provide "*access to free confidential consultation for prevention, counselling, diagnosis, treatment, follow-up and partner notification (contact tracing). Hospital-based clinics will be part of a network of service providing multiple entry points to the system.*" There is no doubt that the new model has resulted in a much bigger workload for a relatively small workforce in terms of triage and management of these patients. The large volume of self-referrals requires an adequately staffed roster of experienced nurses for effective triage. The telephone consultations are often time consuming and difficult as many involve distressed and anxious people discussing sensitive information. Further, people who self-refer often have similar clinical complexity to those who are referred by other services, so secondary care referrals do not present a complete picture of the change in workload. The increased syphilis cases have also increased nursing workload for contact tracing and follow-up and have increased specialist workload in terms of triage, case management and clinical oversight. Many cases are complex and require case discussion to determine a consensus on management and will sometimes require referral to other secondary services such as infectious diseases, dermatology or ophthalmology.

ASHS has also taken on a new role as regional provider of gender-affirming healthcare for adults following the review, and since 2017 there has been a corresponding 220% increase in referrals for gender-affirming healthcare. This has resulted in increased demand for clinical case management by doctors and nurse practitioners and also for psychology appointments. There has also been a big increase in requests for virtual advice for GPs managing gender-affirming healthcare as the service's visibility has increased. Many gender-diverse people require a lot of clinical and psychological support due to a greater prevalence of mental health and social issues, which has resource implications.[5] The appointment of a transgender key worker has helped considerably with patient liaison and support, but this has not addressed increased demand for appointments and provision of case management advice.

Demand for HIV PrEP increased substantially following the decision by PHARMAC in 2018 to fund PrEP for MSM and transgender people at high risk of HIV acquisition. Since then, an internal ASHS audit found that 1,100 patients had been commenced on PrEP over a 2-year period from March 2018 to February 2020. The demand steadily increased from 179 visits for PrEP in the first quarter of 2018 to 637 visits in the last quarter of 2020. People on PrEP require regular testing and follow-up, so many of these patients have had multiple visits to the service for testing, STI treatment and repeat prescriptions. The increasing PrEP workload for medical and nursing staff was resulting in significant capacity issues and wait times, so in early 2020 a decision was made to refer many of these patients back to primary care for follow-up once treatment was initiated. The service continues to provide PrEP for people who are considered to have greater barriers to accessing primary care including those aged under 25, those of Māori and Pacific ethnicity, those with sexualised drug use, sex workers and transgender people. Although the majority of follow-up PrEP consults are now managed by nurses via telehealth, this still requires as much clinical resource as provision of face-to-face appointments, and there is still a requirement for some oversight by medical staff or nurse practitioners for the prescribing and management of abnormal test results. Equity of access to the service also may need addressing as MSM accounted for 42% of clinical encounters between January 2021 and January 2022, which may be affecting access for other priority populations. The recent decision by PHARMAC to widen access criteria for PrEP will also increase pressure for service access.

All these factors have inevitably resulted in medical staff experiencing an overall increased clinical administration workload in order to manage telephone and email consultations, clinic letters, virtual consults with GPs and other referrers, arrange prescriptions for chronic care patients and attendance at multi-disciplinary meetings to discuss complex patients. There is also a requirement for clinical oversight of two training registrars and to provide teaching for other health

professionals. An appropriately skilled workforce is critical to the delivery of high-quality health services, but unfortunately New Zealand does not have any national standards for the management of STIs or a workforce strategy for sexual health. The Ministry of Health tier two specifications, which have not been reviewed since 2001, do refer to service components required for a hospital-level sexual health service but do not have any criteria for workforce requirements. The United Kingdom developed standards for the management of STIs in 2013, which were intended to be a guide to commissioners of sexual health services, and they refer to three levels of care (Level 3 being complex/specialist). The standards state that, "*Only a service led by a consultant on the specialist register of the General Medical Council (GMC) for Genitourinary Medicine (GUM) and offering a comprehensive range of services spanning all three levels, can be defined as being a specialist GUM service (Level 3) for the management of STIs. Specialist GUM services should provide clinical leadership, including training, clinical expertise and clinical governance in the management of STIs, within local health economies*". Translating this to the New Zealand context, a secondary-level specialist sexual health service should require the leadership of vocationally trained sexual health specialists in order to be designated a true specialist-level service. It is unfortunate to say the least that the 2016 workforce development consultation completely disregarded the important role that sexual health specialists have to play in the leadership and governance of a secondary-level specialist service. A national survey of DHB- provided sexual health services in 2021 (Personal communication Anne Robertson, Mid central health, unpublished data) noted that there is wide inter-DHB variation in the size and level of service provision and in the range of services offered. It was also noted that when DHBs sub-contract sexual health services to other DHBs, the "home DHB" has a higher level of service provision. (This is certainly the case in the Auckland region when the volumes data for the three DHBs are compared). The survey also noted that some services have no capacity to provide cover for annual and sick leave with reduction of service access when staff are away, and that there is a need for a more critical mass for services in order to provide more sustainable support to primary care and other providers. Since the review was implemented, there has been a small increase in specialist FTE, but it is still below the staffing levels prior to the review. There are currently only 2.9 FTE specialist sexual health consultants, resulting in a reduction in clinical expertise for an already challenged region and a ratio of only 0.17 sexual health specialists per 100,000 head of population. Disestablishment of the DHBs and the creation of Te Whatu Ora offer opportunities for reducing regional inequities and improving access to hospital services, however, the concern is that sexual health will be overlooked yet again as a poorly understood specialty by health policy makers and funders.

To conclude, implementation of a new service model has been successful in transitioning the ASHS to a more specialist secondary-level service. The increased case complexity has placed increased demands on the nursing, medical and psychology workforces, and although there has been a small increase in nursing FTE there has been no increase in medical FTE. It is recommended that the workforce requirements be reviewed, in particular specialist FTE, and that consideration be given to commissioning a specific separate service for the provision of gender-affirming healthcare. Implementation of the new model has not addressed regional inequities in service access or provision and has not been responsive to the increased workload or the changing workforce requirements of the service. Current marked regional inequities in access need to be urgently addressed and consideration should be given to the wider geographic role of the service, as 20% of FSAs are from outside the Auckland region.

COMPETING INTERESTS
Nil.

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A national audit of performance standards for blood cultures in Aotearoa New Zealand: opportunities for improvement

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ABSTRACT

AIMS: To audit key quality indicators for blood culture (BC) practices across Aotearoa New Zealand to facilitate national BC practice peer review and promote BC quality improvement interventions.

METHOD: Microbiology laboratories providing diagnostic services to district health board (DHB) hospitals were invited to participate. Practice was compared against published BC recommendations. Laboratories were required to submit data for BC positivity and contamination rates, BC bottle fill volume and the proportion of BC received as a single set.

RESULTS: Laboratories serving 15 of the 20 DHBs participated in the audit. Nine DHBs (60%) demonstrated a positivity rate within the target range of 8% to 15%. Eight DHBs (53%) reported a contamination rate lower than the accepted 3%, but seven (47%) DHBs exceeded this target and two reported a contamination rate greater than 5%. Mean BC bottle fill volumes were generally greater than the target of 8mL, but this volume was not reached by three DHBs and a further three were unable to provide fill volume data. No DHB met the audit standard for single-set BCs representing <20%, and for six DHBs single-set BC comprised more than half of all samples. No DHB failed all audit targets.

CONCLUSION: This audit demonstrates wide variation in BC performance across New Zealand. In most instances an inadequate volume of blood is being collected, lowering the chance of culturing a pathogen. A significant opportunity for improvement exists; clinical services and laboratories are encouraged to work together to implement targeted quality improvement processes to correct deficiencies in practice.

Blood cultures (BC) are among the most important samples processed in the clinical microbiology laboratory. They remain the gold standard investigation for bloodstream infections, and an essential diagnostic tool for severe infections such as infective endocarditis, bone and joint infections and meningitis.[1] Optimising BC practices can improve pathogen recovery and optimise infection management with targeted antimicrobial therapy, improved patient outcomes and support of antimicrobial stewardship efforts.[2–4]

Many factors influence BC quality, including BC collection technique, BC bottle volume of fill, and the number of BC bottles obtained. While there are several published BC best practice guidelines,[5–9] national compliance with such performance criteria has never been reported and many of these key steps are not measured.[10] We therefore sought to audit the key quality indicators for district health board (DHB) BC practices across microbiology laboratories around the country. The overall purpose of the study was to facilitate national peer review of BC practices, provide benchmarking and promote quality improvement interventions. This was an initiative undertaken, and supported, by the New Zealand Microbiology Network (NZMN), a national group consisting of clinical microbiologists, representatives from the Ministries of Health and Primary Industries, Medical Officers of Health and the Institute of Environmental Science and Research (ESR).

Method

This audit was carried out before the transition to the new health system Te Whatu Ora – Health New Zealand. Microbiology laboratories providing diagnostic services to DHB hospitals were all invited to take part. Participating laboratories were required to interrogate their own laboratory information systems pertaining to adult BC practices (age ≥18 years) to provide audit data for

the period 1 July to 31 July 2021. Paediatric blood cultures were excluded.

Data required were:

1. The total number of BC sets submitted to the laboratory during the month of July 2021.
2. The number and proportion of BC sets that yielded a pathogen.
3. The number and proportion of BC sets that yielded a contaminant.
4. The mean BC bottle fill volume (in mL) and the number and proportion of bottles received with less than 50% of the recommended fill volume.
5. The number and proportion of BCs received as a single set (consisting of just one aerobic and one aerobic bottle).

A pathogen was defined as *Staphylococcus aureus*, *Streptococcus pneumoniae*, beta-haemolytic streptococci, *Listeria monocytogenes*, *Escherichia coli* and other members of the *Enterobacterales*, *Pseudomonas aeruginosa*, *Neisseria meningitidis*, *Haemophilus influenzae*, anaerobic Gram-negative bacteria (such as *Bacteroides* species and *Fusobacterium* species) and *Candida* species, or where the clinical microbiologist or treating physician deemed the cultured organism to be clinically significant.

A contaminant was defined as a single blood culture positive for coagulase-negative staphylococci, *Corynebacterium* species, *Micrococcus* species, *Cutibacterium acnes*, *Bacillus* species (not *B. anthracis*), alpha-haemolytic streptococci or where the clinical microbiologist or treating physician deemed the cultured organism to be a contaminant. Where an organism commonly considered to be a contaminant was present in more than one set, the responsible microbiologist categorised the isolate as either a pathogen or contaminant after clinical review.

BC bottle fill volumes were required to be measured for a minimum of 7 days during the audit period. Where fill volume was measured manually, participating laboratories determined this by weighing each bottle and comparing it to the average weight of an empty (unfilled) bottle as follows: (weight of bottle in grams – average weight of empty bottle in grams)/1.06.

Laboratories with automated capability for fill volume measurement, for example by using the BacT/ALERT Virtuo (Biomérieux) or BacTec EpiCenter/Synapsys (Becton Dickinson) automated systems, reported fill volumes utilising this method.

All data was reported to, and collated by, the first author on behalf of the NZMN and assessed for compliance with the following audit standards:[5–9]

1. Proportion of BC positive for a pathogen, or positivity rate, 8 to 15%.
2. BC contamination rate less than 3%.
3. Mean BC bottle fill volume 8 to 10mL.
4. Less than 20% of bottles with a fill volume of less than 4mL.
5. Less than 20% of BC series as a single set.

Laboratories were also asked to provide, where possible, data for two additional quality measures:

1. The average time taken for BC bottles to reach the laboratory after collection.
2. The average time from receipt in the laboratory to loading onto the BC analyser.

Results

The performance of the 15 participating DHBs across Aotearoa New Zealand against the five audit standards is presented in Table 1. Nine DHBs (60%) demonstrated a positivity rate within the target range of 8% to 15%. Eight DHBs (53%) reported a contamination rate lower than the accepted target of 3% but seven DHBs (47%) exceeded this target and two reported a contamination rate greater than 5%. Mean BC bottle fill volumes were generally greater than 8mL, but this target was not reached by three DHBs (20%) and a further three were unable to provide any fill volume data. Approximately 12% of sets contained <4mL of blood per bottle (Table 1). Where fill volume data was able to be reported, all DHBs met the target for less than 20% with a fill volume lower than 4mL. Conversely, no DHB met the audit standard for single-set BCs comprising less than 20% of samples, and for six DHBs single-set BC comprised more than half of all samples. Overall, 5,398 (44%) of 12,306 sets were single sets. No DHB failed to meet all audit targets.

Voluntary additional data pertaining to time from BC collection to receipt in the laboratory, and time from receipt to incubation, were provided by only a minority of laboratories (n=5). Furthermore, the accuracy of this data, where reported, was questionable, e.g., implausibly long delays were reported for some individual BC samples. This data has therefore been excluded from analysis.

Table 1: Audit results for participating DHBs for each of the quality measures.

District health board	Number of BC sets	Positivity rate, % (n)	Contamination rate, % (n)	Mean fill volume in mL	% with fill volume <4mL	Single set BC, % (n)
Bay of Plenty	1,121	11.0 (123)	1.7 (19)	**7.9**	11.8*	**46.5 (521)**
Capital and Coast	1,595	8.7 (138)	2.0 (32)	9.5	14.8*	**59.4 (947)**
Canterbury	1,920	**6.4 (123)**	1.8 (34)	8	15–20*	**37.5 (720)**
Counties Manukau	1,917	10.5 (201)	2.3 (45)	Not provided	Not provided	**37.8 (725)**
Hutt Valley	508	**6.9 (35)**	**3.9 (20)**	10.2	4	**76.2 (387)**
Lakes	444	13.1 (58)	2.3 (10)	Not provided	Not provided	**35.8 (159)**
MidCentral	372	**7.5 (28)**	**6.2 (23)**	8.5#	14.8#	**60.0 (315/526)**
Nelson Marlborough	397	11.3 (45)	**3.8 (15)**	9.1	10.2	**36.2 (144)**
South Canterbury	154	**15.6 (24)**	**4.5 (7)**	8.4	18.8	**25.3 (39)**
Southern	1,101	9.6 (106)	2.6 (29)	8.3	8*	**48.7 (537)**
Tairāwhiti	215	12.0 (26)	**3.7 (8)**	Not provided	Not provided	**56.0 (120)**
Taranaki	413	8.3 (34)	**4.4 (18)**	**7.5**	18.8	**66.2 (274)**
Wairarapa	245	**5.3 (13)**	2.4 (6)	**7.8**	34	**44.1 (108)**
Waitematā	1,771	**5.6 (99)**	1.0 (17)	10	5.6	**22.0 (389)**
Whanganui	133	12.0 (16)	**6.0 (8)**	8.5#	14.8#	**78.0 (137/176)**
Target audit standard	**-**	**8–15%**	**<3%**	**≥8mL**	**<20%**	**<20%**

Red shading denotes audit target not met.
*Data obtained by automated method.
#MidCentral and Whanganui DHBs fill volumes are presented as a combined value by a single laboratory provider.

Discussion

The importance of BCs cannot be underestimated as they remain the gold standard diagnostic tool for sepsis and severe infections, such as infective endocarditis and meningitis. Optimal management relies on an accurate and timely microbiological diagnosis, but this is achieved in only 30–40% of sepsis cases.[2–4] Accordingly, microbiology laboratories, together with frontline clinical services, have an important role to play in efforts to optimise BC sampling.

There are a number of well-established BC consensus guidelines which outline the recommended BC practices and quality standards.[5–9] However, there is no mandatory requirement to comply with these standards, and this audit demonstrates that there is wide variation in BC performance across most of the parameters measured.

Five DHBs demonstrated a positivity rate below 8%. A low positivity rate may reflect lower test sensitivity due to inadequate sample volumes or an over-representation of BC from patients with a low pre-test probability of bacteraemia. Conversely, too high a positivity rate may reflect too few BC being performed and bacteraemias going undetected. DHBs are encouraged to review their current practice to avoid performing BC for low-yield conditions such as mild cellulitis, non-severe pneumonia, cystitis or transient post-operative fever. Targeting patient selection to conditions with a high (e.g., sepsis, endovascular infections, septic arthritis, meningitis) or moderate (e.g., severe cellulitis, severe community-acquired pneumonia, cholangitis) likelihood of infection is recommended.[1]

Seven DHBs demonstrated a contamination rate greater than 3%, with two DHBs exceeding 5%. BC contamination is common, and to some extent unavoidable, but potentially leads to unnecessary use of antibiotics, increased length of stay, unwarranted investigations and missed diagnosis.[11–15] The true impact of BC contamination at a given institution will depend on a variety of local factors,[16] but it is discouraging that seven DHBs did not meet the audit target for this parameter. Setting a target rate, introducing BC collection bundles, using sample diversion devices, ongoing education and feedback have all been shown to progressively lower contamination rates over time.[17–22] Arguably, a contamination rate target of less than 1% may be more clinically appropriate[23] but BC practices in New Zealand would require further quality improvements to achieve this. BC collection by phlebotomists has consistently been shown to reduce the risk of contamination[24] but this is not usually available nor is it routine practice for BC in most centres.

Under-filling of individual BC bottles was not a common problem in this audit, with most DHBs compliant with a mean fill volume of more than the recommended 8mL. However, three participant sites were not able to provide fill volume information for the given audit period. In a recent survey of Australasian laboratories, only two out of 93 laboratories (2%) indicated that they regularly monitored the BC volume of fill,[10] despite all BC standards recommending this be done.[5–9] While this audit didn't explore the barriers to fill volume measurement, such data often relies on manual inspection or weighing of bottles, which is time consuming and laborious. Newer BC analysers include automated functionality for fill-volume measurement (for example, using photometric technology)[25–28] but this capability is not yet available for many laboratories that rely on older analysers until upgrades or replacements are due.

All DHBs missed the target for single-set BC draws, which compromises test sensitivity [29–32] and can make accurate interpretation of positive cultures more challenging. Adequate blood volume has repeatedly been shown to be the single most important factor affecting BC sensitivity because there is usually a very low concentration of circulating micro-organisms. Accordingly, the likelihood of pathogen recovery is directly proportional to the volume of blood collected.[29–32] For this data set only 50% of collects were ≥16mL where 40mL–60mL was recommended. This implies an approximately 25%–45% lower yield for these BCs than expected with the recommended blood volume. If a pathogen is not detected because it was not included in the sample, possible clues to the origin of infection may be missed along with the ability to rationalise patient treatment based on susceptibility results.

Blood volume is a function of both the individual bottle fill volume and the number of BC bottles obtained; laboratory standards and sepsis guidelines all recommend collection of 2 to 4 sets, 8–10 mL per bottle, before starting antimicrobials.[2,3,5–9] Even with modern BC analysers, the test sensitivity expected from 20mL, 40mL, and 60mL BC collects is 65%–75%, 80%–90%, and 96%–98% respectively, i.e., approximately 1% increase in pathogen yield per mL of blood cultured.[29–32] Hence, performing single-set draws (consisting of just one aerobic and one anaerobic bottle) or

under-filling BC bottles significantly reduces test sensitivity and limits the chance of identifying the pathogen. While it is disappointing to find single-set draws being commonly performed in the majority of DHB hospitals, this could be addressed with regular education, monitoring and feedback to frontline clinical and phlebotomy teams to emphasise the importance of optimising sample volume, which has been shown to be highly effective to improve practice in this regard.[33,34] This audit did not explore the barriers to obtaining more BC sets, but the traditional requirement for separate venepunctures is a major inconvenience and is likely to have an impact. More recent evidence suggests that obtaining multiple BC sets via a single venepuncture can successfully reduce the proportion of single sets while also reducing contamination, and this approach should be considered.[35,36]

Very few laboratories in our audit were able to provide the additional voluntary data regarding timings from BC collection to arrival into the laboratory and onward loading on to the BC analyser. These variables were therefore not able to be reported. Delays in BC loading can prolong the turnaround time and BC standards recommend loading within 2 to 4 hours of collection.[5–7] Lack of access to accurate data of this sort is commonplace but problematic, and resolution of this issue would require changes to laboratory information systems.

There are several limitations to our study. Not every DHB was able to participate, and we did not explore the reasons why some DHBs failed to meet certain BC quality standards. An audit period of 1 month is a short snapshot period and may not provide an accurate reflection of practices. This may disadvantage smaller DHBs with fewer numbers of BC samples where a single contaminant will skew results to a greater extent than for larger DHBs performing more BC. We excluded paediatric BC in recognition of the difficulties faced for paediatric sample collection and the lack of consensus for the required fill volumes. However, BC optimisation is as relevant for children as it is for adults, since contamination rates may be high, sample volumes low and overall fewer BC bottles per patient episode;[37,38] it is therefore advisable for services to include paediatric samples in BC quality improvement activities wherever possible.

We did not ask whether laboratories had already in place any regular audit feedback cycle for BC quality measures. Improvements in pre-analytical processes, such as sampling technique and patient selection, are outside the direct control of the laboratory, require ongoing training, education, audit and feedback to clinical teams,[5–9] and can be difficult and time-consuming to maintain. While the laboratory is well placed to drive improvement in BC standards, clinical services must also play their part. The NZMN recommends that regular monitoring and feedback processes be implemented to review ongoing performance.

To conclude, this audit demonstrates a wide variation in BC performance across New Zealand and has identified many opportunities for improvement. Laboratories, hospitals and Te Whatu Ora – Health New Zealand are encouraged to work together to review and implement targeted BC quality improvement processes where deficiencies in practice exist. Laboratory and hospital accreditation agencies would do well to ensure BC quality assurance activity is implemented and regularly reviewed. Such improvements would aim to optimise management of patients with bloodstream infections, which disproportionately affects Māori and those of lower socio-economic status.[39] Ultimately improved BC quality performance will help improve antimicrobial stewardship efforts and will be of direct benefit to patients and their whānau.

COMPETING INTERESTS
Nil.

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HIV in women in Aotearoa New Zealand: 25 years of surveillance data

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ABSTRACT

AIM: We describe the characteristics of women diagnosed with HIV and AIDS in Aotearoa New Zealand over the last 25 years, and of women living with HIV in New Zealand in order to guide the response for HIV prevention and care.

METHODS: Data on women diagnosed with HIV and AIDS in New Zealand (1996–2020) were collected through routine surveillance case reports from healthcare providers. CD4 cell count <350 cells/mm^3 was considered a late diagnosis. Women living with HIV by 31 December 2020 included those first diagnosed in New Zealand and those previously diagnosed overseas.

RESULTS: A total of 634 women have been diagnosed with HIV (18% of all diagnoses in this time): most cases were acquired through heterosexual contact (82%). Twenty-eight percent (n=180/634) acquired HIV in New Zealand, of whom 43% were diagnosed late. AIDS was diagnosed in 128 women (72% within three months of HIV diagnosis). An estimated 570 women (77% aged ≥40 years) were living with diagnosed HIV at the end of 2020.

CONCLUSION: The number of women diagnosed with HIV each year in New Zealand has remained steady over recent years. More timely testing and diagnosis is essential to ensure women with HIV have access to appropriate treatment and support.

The United Nations has a goal to end AIDS by 2030 with targets of 95% of all people with HIV diagnosed, 95% on treatment and 95% having a suppressed viral load—and for these targets to be achieved within all sub-populations and groups.[1] This is particularly challenging in countries with a concentrated epidemic, such as among gay and bisexual men (GBM), who are often the priority group for reaching the goal. Other groups affected by HIV, who sometimes constitute small numbers of people, also require attention.

Aotearoa New Zealand is a low HIV prevalence country, with the epidemic largely concentrated in GBM.[2] Women in low-prevalence countries are often perceived as being at low risk for HIV infection by both themselves and medical professionals,[3] which results in less testing, late diagnosis[4,5] and barriers to treatment and support services.[3,6] Each of these are contributing factors towards the increased risk of HIV progressing to an AIDS diagnosis and poorer long-term outcomes.[5,7] Stigma and discrimination can also lead to hesitancy to test.[6,8] Once diagnosed, women can feel socially isolated particularly if HIV support services are mostly designed for gay men.[6]

Women living with HIV also have particular needs in the areas of sexual and reproductive health, clinical management and emotional wellbeing.[3,9,10] New Zealand has a network of Infectious Disease Specialists, based mostly in the large urban centres, where people diagnosed with HIV are referred to for treatment. Some of these centres also have a team of HIV nurse specialists, social workers and access to other allied health professionals for the care and support of patients. Positive Women Incorporated was established in 1990 to support and empower women and their families living with or affected by HIV and to provide services unique to women. More recently, Toitū te Ao was established as a Kaupapa Māori organisation to support and uphold the mana of Māori women living with HIV.

New Zealand aims to eliminate local transmission of HIV.[11] The total number of people diagnosed with HIV each year has been declining since 2016,[12] but to reach the goal it is important to tailor HIV testing, treatment and support services to those who need them most. To date there is a lack of published data on women diagnosed and living with HIV to guide the response. We therefore describe the characteristics of women diagnosed with HIV and AIDS over the last 25 years and women thought to be living with HIV in New Zealand at the end of 2020.

Methods

Data sources

Since 1996, the AIDS Epidemiology Group (AEG) at the University of Otago has undertaken

enhanced surveillance of HIV, whereby anonymous information on individuals newly diagnosed with HIV in New Zealand has been sought from the clinician who requested the HIV confirmatory test. From 2002, data have also been received from laboratories performing HIV viral load (VL) testing in order to capture information on people living with HIV in New Zealand who had their initial HIV diagnosis overseas. From 2017, HIV became notifiable under the Health (Protection) Amendment Act 2016.

In New Zealand, an individual with HIV infection is defined as having AIDS when they first develop one of a number of specific AIDS-defining conditions.[13] Clinicians diagnosing AIDS are required to notify the case using unnamed coded information, and to complete a case report.

Information on women known to be infected with HIV who give birth has been collected by the AEG via the New Zealand Paediatric Surveillance Unit since 1998.

Definitions

Women diagnosed with HIV include all women (including transgender) diagnosed in New Zealand since the beginning of 1996 to the end of 2020. This excludes women who were previously diagnosed overseas.

The estimated number of women living with diagnosed HIV in New Zealand at the end of 2020 includes women first diagnosed in New Zealand between the years 1996 and 2020, as well as those previously diagnosed overseas and notified to the AEG through VL testing, for whom no information has been received to say they had died or gone overseas.

Variables and analysis

From the AEG database, demographic data for women include age and place of residence at the time of diagnosis, current age (calculated as at the end of December 2020), and prioritised ethnicity.[14] Mode of acquisition was categorised into heterosexual contact, injecting drug use (IDU) (including women for whom both IDU and heterosexual contact were reported as possible modes of acquisition), mother-to-child transmission and other or not reported. Place of likely acquisition was categorised as New Zealand, overseas or unknown. Clinical data included the site of, and reason for testing, sexual partner's risk status, previous negative HIV test, and CD4 cell count (available since 2005) categorised to <350 cells/mm^3 and 350+ with a CD4 cell count of less than 350 considered a late diagnosis.[15] The characteristics of women diagnosed in New Zealand are presented in two time periods (1996–2010 and 2011–2020) to identify and describe any change over these years. Descriptive analysis was undertaken using Stata SE Version 17. Denominator data for the rate of women diagnosed with HIV was the estimated resident all-female population as in December each year, and for women living with diagnosed HIV the denominator was the estimated resident female population aged 15 and over as in December 2020.[16]

Results

Women diagnosed in New Zealand

A total of 634 women (18 of whom were transgender) were newly diagnosed with HIV in New Zealand over the 25 years from 1996 to the end of December 2020—18% of all diagnoses in this time. The main mode of acquisition was heterosexual contact (82%). Most women (76%) were aged less than 40 years at the time of diagnosis, however, in the past 10 years the proportion of women aged ≥40 years at the time of diagnosis has increased (37% compared to 19% between 1996 and 2010) (Table 1).

Almost half of the women (42%) were residing in the Northern region (wider Auckland and Northland District Health Board areas) at the time of diagnosis. The main site of HIV testing was at a general practice (40%) and the main reasons for testing were because of symptoms (19%), or a history of risk (14%). Overall, 13% tested as part of immigration screening and 14% refugee screening. The latter declined from 17% in 1996–2010 to 7% in 2011–2020. Forty three (7%) women were diagnosed through antenatal testing —32 after the introduction of routine antenatal screening in 2006.

The majority (73%) of women diagnosed in the earlier years had acquired HIV overseas (Figure 1) and were mostly of African (52%) or Asian (19%) ethnicity (Table 1). The 3-year average shows a sharp rise to 2005–2007 followed by a rapid decline. In the last 10 years (2011–2020), there has been a similar number of women acquiring HIV overseas and in New Zealand (Figure 1) with wider representation from different ethnic groups (Table 1). The average annual rate of all women diagnosed in the 15 years from 1996 to 2010 was 1.43 per 100,000 females and in the past 10 years almost halved to 0.80 per 100,000.

Table 1: Characteristics of women diagnosed with HIV in New Zealand from 1996 to 2020.

Characteristics	Year of diagnosis		
	1996–2010 n (%) (n=445)	2011–2020 n (%) (n=189)	Total n (%) (n=634)
Age at diagnosis (years)			
<30	182 (40.9)	63 (33.3)	245 (38.6)
30–39	180 (40.4)	57 (30.2)	237 (37.4)
40–49	61 (13.7)	36 (19.0)	97 (15.3)
50+	22 (4.9)	33 (17.5)	55 (8.7)
Ethnicity			
Māori	18 (4.0)	21 (11.1)	39 (6.2)
Pasifika	22 (4.9)	13 (6.9)	35 (5.5)
African	231 (51.9)	40 (21.2)	271 (42.7)
Asian	86 (19.3)	52 (27.5)	138 (21.8)
European	74 (16.6)	50 (26.5)	124 (19.5)
Other/not reported	14 (3.1)	13 (6.9)	27 (4.3)
Usual residence at time of diagnosis[a]			
Northern	204 (45.8)	65 (34.4)	269 (42.4)
Midland	55 (12.4)	26 (13.8)	81 (12.8)
Central	89 (20.0)	29 (15.3)	118 (18.6)
Southern	59 (13.3)	22 (11.6)	81 (12.8)
Overseas	29 (6.5)	25 (13.2)	54 (8.5)
Not reported	9 (2.0)	22 (11.6)	31 (4.9)
Likely mode of acquisition			
Heterosexual contact	375 (84.3)	142 (75.1)	517 (81.5)
Injecting drug use (IDU)[b]	3 (0.7)	5 (2.6)	8 (1.3)
Mother-to-child transmission	18 (4.0)	1 (0.5)	19 (3.0)
Other[c]/Not reported	49 (11.0)	41 (21.7)	90 (14.2)
Site of testing			
General practice	180 (40.4)	71 (37.5)	251 (39.6)
Infectious disease/other hospital clinician	104 (23.4)	33 (17.5)	137 (21.6)
Refugee centre	76 (17.1)	13 (6.9)	89 (14.0)

Table 1 continued: Characteristics of women diagnosed with HIV in New Zealand from 1996 to 2020.

Characteristics	Year of diagnosis		
	1996–2010 n (%) (n=445)	2011–2020 n (%) (n=189)	Total n (%) (n=634)
Site of testing			
Sexual health clinic	41 (9.2)	9 (4.7)	50 (7.9)
Other[d]	27 (6.1)	23 (12.2)	50 (7.9)
Not reported	17 (3.8)	40 (21.2)	58 (9.0)
Reason for testing			
History of risk[e]	72 (16.2)	19 (10.1)	91 (14.4)
Symptoms	91 (20.4)	30 (15.9)	121 (19.1)
History of risk and symptoms	13 (2.9)	4 (2.1)	17 (2.7)
Antenatal screening[f]	28 (6.3)	15 (7.9)	43 (6.8)
Immigration screening	52 (11.7)	33 (17.5)	85 (13.4)
Refugee screening	76 (17.1)	13 (6.9)	89 (14.0)
Contact tracing	37 (8.3)	11 (5.8)	48 (7.6)
Other[g]	53 (11.9)	22 (11.6)	75 (11.8)
Not reported	23 (5.2)	42 (22.2)	65 (10.3)

[a] Regions of usual residence are made up of the following district health board areas:
Northern: Northland, Waitematā, Auckland, Counties Manukau
Midland: Waikato, Lakes District, Bay of Plenty, Tairāwhiti
Central: Taranaki, Hawkes Bay, MidCentral, Hutt District, Capital and Coast, Wairarapa
Southern: Nelson Marlborough, West Coast, Canterbury, South Canterbury, Southern
[b] Injecting drug use also includes those reported as heterosexual and injecting drug use.
[c] Includes, but not limited to, blood transfusion, occupational exposure, and transgender women.
[d] Includes family planning, fertility, and antenatal clinics, blood service, immigration or insurance clinic, NZ AIDS Foundation or Body Positive Clinic.
[e] Includes contact with a bisexual man, sex work or contact with a sex worker, or history of injecting drug use.
[f] Routine HIV antenatal screening commenced 2006. [g] Includes, but not limited to, immigration test for entry to another country, insurance application, blood donation screening, routine sexual health screening

Figure 1: Three-yearly average of women first diagnosed with HIV in New Zealand by place of acquisition.

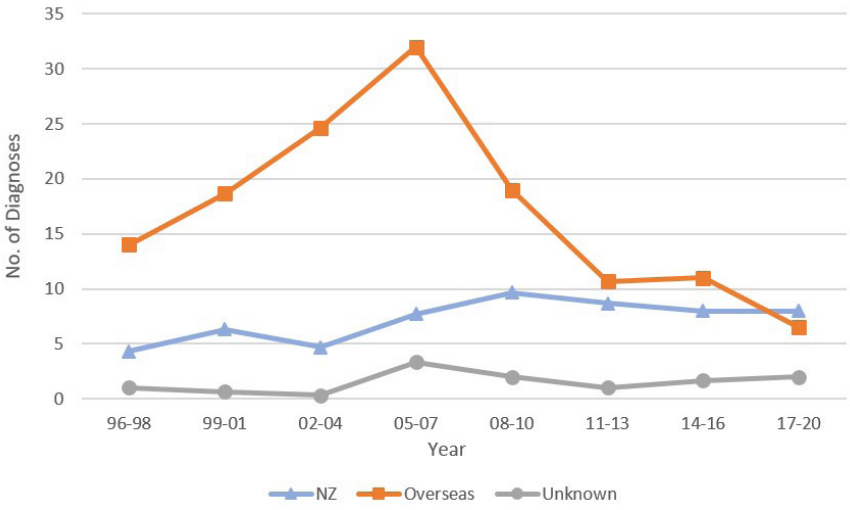

Table 2: Characteristics of women diagnosed with HIV (1996 to 2020) with HIV acquired in New Zealand.

Characteristics	Total n (%) (n=180)
Age at diagnosis (years)	
<30	72 (40.0)
30–39	56 (31.1)
40–49	30 (16.7)
50+	22 (12.2)
Ethnicity	
Māori	36 (20.0)
Pasifika	21 (11.7)
Asian	23 (12.8)
MELAA[a]	27 (15.0)
European	73 (40.5)
Likely mode of acquisition	
Heterosexual contact	152 (84.5)
Injecting drug use (IDU)	4 (2.2)
Mother-to-child transmission	4 (2.2)
Other[b]/not reported	20 (11.1)

Table 2 (continued): Characteristics of women diagnosed with HIV (1996 to 2020) with HIV acquired in New Zealand.

Characteristics	Total n (%) (n=180)
Risk status of the sexual partner	
High risk[c]	99 (55.0)
No known risk group	5 (2.8)
Unknown or not reported	76 (42.2)
Previous negative test	
Within past 2 years	20 (11.1)
>2 years or time unknown	32 (17.8)
No	92 (51.1)
Not reported	36 (20.0)
Initial CD4 count[d]	**(n=134)**
<350	57 (42.5)
350+	65 (48.5)
Not reported	12 (9.0)

[a] MELAA: Middle Eastern, Latin American, African
[b] Includes, but not limited to, blood transfusion, occupational exposure, and transgender women
[c] Sexual partner a bisexual man, a person from a high HIV prevalence country or an injecting drug user
[d] CD4 count data is since 2005

Figure 2: Annual number of women diagnosed with AIDS and deaths among women who were notified with AIDS.

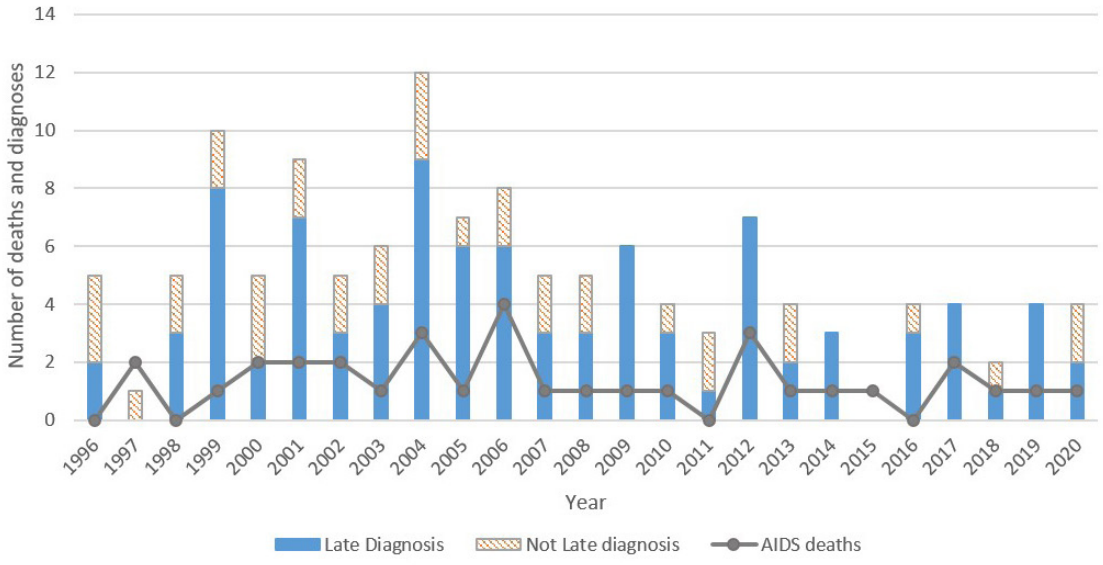

Table 3: Women diagnosed with AIDS from 1996 to 2020.

Characteristics	Total n (%) (n=128)
Age at AIDS diagnosis (years)	
<30	31 (24.2)
30–39	49 (38.3)
40–49	32 (25.0)
50+	16 (12.5)
Ethnicity	
Māori	14 (10.9)
Pasifika	7 (5.5)
Asian	35 (27.3)
MELAA[a]	45 (35.2)
European	27 (21.1)
Clinical indicator[b]	
Opportunistic infection	86 (67.2)
HIV wasting syndrome	9 (7.0)
Tuberculosis	30 (23.4)
Other clinical condition	11 (8.6)
Late diagnosis[c]	
Yes	92 (71.9)
No	36 (28.1)

[a] MELAA: Middle Eastern, Latin American, African
[b] More than one condition could be indicated
[c] AIDS diagnosis within 3 months of HIV diagnosis

Women with HIV acquired in New Zealand

Table 2 shows the age, ethnicity, sexual partner's risk status, previous negative test, and CD4 count information of the 180 women (including 14 transgender) who were reported to have acquired HIV in New Zealand between 1996 and 2020 (10% of all locally acquired HIV diagnoses in this time). The ethnicity of these women differs from that of the overall group diagnosed in New Zealand, with a greater proportion being Māori (20%) or of European (41%) ethnicity. The age is similar to the overall group diagnosed in New Zealand, and there was a greater proportion of older women diagnosed in 2011–2020 (33/82; 40%) than in 1996–2010 (19/98; 19%). Since 2005 (when CD4+ count information was first collected), 43% had a CD4 count less than 350 cells/mm³ at the time of diagnosis and were therefore considered a late diagnosis. Only a third had ever had a previous HIV test. Of the 14 transgender people, 5 were Māori, 4 European and 5 Pasifika or other ethnicity. Two had a CD4 count less than 350 cells/mm³ at the time of diagnosis, and 4 had had a previous negative HIV test.

Women diagnosed with AIDS

A total of 128 women were diagnosed with AIDS (Table 3), an average of 6.2 women per year in the years 1996 to 2010, and 3.5 women per year

between 2011 and 2020 (Figure 2). Māori women made up 11% of women diagnosed with AIDS, 27% Asian, 35% Middle Eastern, Latin American or African, 21% European, and 6% Pasifika. The most common clinical indicator of AIDS was an opportunistic infection (67%) such as pneumocystis pneumonia, oesophageal candidiasis and cerebral toxoplasmosis. Tuberculosis was frequently reported in the earlier years between 1996 and 2010 (n=27/93; 29%) but has reduced considerably since then (n=3/35; 9%). The mean age at the time of an AIDS diagnosis was 40 years (standard deviation 12.85 years). Seventy-two percent (n=92) had an AIDS diagnosis within three months of their HIV diagnosis and were therefore considered a late diagnosis of HIV (Table 3). A total of 33 women have died from AIDS over the 25 years (Figure 2).

Women living with diagnosed HIV

Of the women who had been notified with HIV between 1996 and 2020 (either diagnosed in New Zealand or previously diagnosed overseas), 184 had died (n=42) or gone overseas (n=142), leaving an estimated 570 living with diagnosed HIV in New Zealand at the end of 2020 (27.3 per 100,000 females aged 15 and over). Three quarters (77%) are aged 40 or more, and over a third (38%) are aged over 50 years. African (39%), European (22%) and Asian (20%) women make up the greatest proportion, followed by Māori (6%) and Pasifika (6%). The main mode of acquisition was heterosexual contact (78%), mother-to-child transmission (3%), injecting drug use (2%) and for the remainder the mode was unknown or not reported. Nineteen are transgender women.

Births to women with diagnosed HIV

Between 1998 and 2020, 192 children were born in New Zealand to women with diagnosed HIV. None of these children have been infected with HIV. The majority of women (82%) were diagnosed before their pregnancy, and 34 (18%) diagnosed during their pregnancy. Almost all of the women received antiretroviral treatment (97%). Delivery was by caesarean section for 53% and vaginal delivery for 46%. The majority of women did not breastfeed their children (95%).

Discussion

From routine surveillance data we have shown that the number of women diagnosed with HIV in New Zealand has remained low over the past 25 years, particularly women who acquired HIV in this country. Of concern, however, is the high proportion of women who were diagnosed late. Women living with diagnosed HIV in New Zealand are predominantly older and ethnically diverse.

A strength of our study is the use of national surveillance data collected consistently over a long period of time. Overall, there has been a high return of case report forms from clinicians in this time (89%), however, data are incomplete for some specific questions such as assessment of risk history. Information was obtained from clinicians at the time of diagnosis therefore some data such as the place of residence and whether women are still living in New Zealand may have subsequently changed.

The number of women diagnosed in New Zealand in the earlier years was mostly women who acquired HIV overseas—largely from high HIV prevalence countries in sub-Saharan Africa. Changes to the immigration policy in 2005[17] included introducing HIV testing as part of the visa requirements and is the likely reason for the subsequent decline. The average annual rate of all women diagnosed with HIV in the past 10 years (0.80 per 100,000 female population) has remained steady and is similar to Australia (0.83).[18] However, most Western European countries, for example the United Kingdom (4.49), Denmark (2.04) and Germany (1.42),[19] reported higher rates most likely due to a high proportion of people originating from a country outside of where they were diagnosed. The New Zealand visa requirements were recently reviewed in October 2021 and HIV was removed from the list of medical conditions deemed likely to impose considerable costs to the health system.[20] HIV testing remains a requirement for visa applicants intending to stay for more than 12 months, with applications from people with HIV to be considered on a case-by-case basis. Continued surveillance is essential to show how these changes in immigration might impact on the overall number of people notified with HIV in New Zealand and whether there is any increase in women first diagnosed overseas but requiring care in New Zealand.

The HIV epidemic in New Zealand has been concentrated in GBM,[2] with women making up only 10% of locally acquired infection. About half of these infections have been from sexual contact with a partner traditionally considered to be at high risk such as a bisexual man, a person from a high prevalence country or a person who injects drugs. Such high risk is potentially reduced in the

current era of prevention referred to as "Undetectable=Untransmissable" (U=U)[21] whereby the risk of transmitting HIV sexually from a person living with HIV who has an undetectable viral load is negligible.[22] To be undetectable, however, depends on a high level of people testing for HIV and adherence to HIV treatment in those who are diagnosed. Prevention of HIV in women therefore depends on overall national prevention and control strategies.

Of some initial concern was that 20% of women with locally acquired HIV were Māori, which is higher than the 16% of Māori women aged 15–64 years in the population. However, after removing the five Māori transgender women from this group, the proportion is reduced to 17%. This constitutes 31 women over a 25-year period—approximately one Māori woman per year. To reach the goal of elimination of transmission of HIV in Māori women, and to support Māori women living with HIV in New Zealand, the articles of Te Tiriti o Waitangi need to be upheld, including kāwanatanga (ensuring meaningful representation and participation at all levels), tino rangatiratanga (self-determination), and ōritetanga (ensuring equity between Māori and other citizens of New Zealand).[23]

Almost half of the women who acquired HIV in New Zealand were diagnosed late. Similar rates of late diagnosis amongst women have also been reported in Australia (24% in Australian born; 51% in overseas born women),[6] Western Europe (54%),[5] and the United Kingdom (51%).[24] An analysis of late diagnosis of people diagnosed with HIV in New Zealand from 2011–2020 showed minimal reduction in the proportion of late diagnosis in women from the previous period of 2005–2010. The main risk factors for late diagnosis in both heterosexual women and men were older age (40+) and being of an ethnic group other than European (unpublished data). New Zealand has no specific guidelines for HIV testing in women—apart from the universal offer of testing for all pregnant women, through which 32 women have been diagnosed since its introduction in 2006. Instead, women are included in the overall recommendations for testing that are in accordance with the 2006 US Centers for Disease Control.[25] These aim to promote more frequent testing and to "normalise" testing but still recommend testing for persons who are considered high risk and those seeking assessment for sexually transmitted infections (STIs).[26,27] For almost half of the women in our database, however, the risk status of their partner was unknown or not reported, which has been a reason for late diagnosis in other studies.[28,29] The number of women diagnosed late, and the small proportion who had a recent previous HIV test, indicates that more needs to be done to raise awareness of HIV testing among healthcare providers and among women themselves. Moreover, increasing age at the time of diagnosis, as seen in our data, has been reported in other countries. Reasons for this are varied, such as change in risk behaviour patterns, health-seeking behaviour, testing programmes and patterns, levels of stigma and low perceptions of risk by healthcare providers, particularly for older women.[5,8,30] Further research is required to understand testing rates and patterns in New Zealand that could guide further testing policies and other possible testing options and sites; for example, opportunistic testing in different types of healthcare settings such as gynaecology clinics, emergency departments, or primary care, and greater access to free HIV and other testing for sexually transmitted infections.

The number of women diagnosed with AIDS has been consistently low and declined even further in the past 10 years—a trend also seen in other high-income countries.[19] While this is encouraging, it would be possible to see no AIDS diagnoses in New Zealand if women are tested and diagnosed early.

Women currently living with diagnosed HIV in New Zealand are of diverse ethnicities and are mostly aged over 40. PHARMAC (the Pharmaceutical Management Agency responsible for government subsidised medications including ART) reported 453 women on subsidised ART in mid-June 2020. Our estimated number of 570 women currently living with HIV is likely to be an overestimate as those who have moved overseas since diagnosis cannot be completely ascertained, but could also reflect barriers to access to treatment for some women, especially non-European.[23,29,31] To uphold tino rangatiratanga for Māori women and provide culturally appropriate services to women of diverse ethnic backgrounds is essential for overcoming such barriers. Meeting the changing needs of women as they age is also important.[10] Further research is needed to assess how these needs are being met in New Zealand.

The risk of mother-to-child transmission of HIV is markedly reduced by antiretroviral treatment (ART) and having a suppressed viral load.[32] HIV antenatal screening is therefore vital for ensuring women know their status and have the

opportunity to receive ART. A total of 192 women diagnosed with HIV have given birth in New Zealand since the beginning of routine surveillance in 1998, 34 of whom were diagnosed during their pregnancy, and none of these children have been infected with HIV. Implementation of universal, opt-out antenatal testing of HIV began in 2006 and since 2007 there have been no children with perinatally acquired HIV born in New Zealand, giving testament to the importance of ensuring this screening is maintained to a high standard and is accessible to all women.

In conclusion, it is to be acknowledged that the number of women diagnosed in New Zealand has remained low. More work, however, is required to prevent late diagnosis by ensuring timely and accessible testing, diagnosis and access to treatment that aligns and partners with Māori women and women of other key affected ethnic groups, as well as transgender women.

COMPETING INTERESTS
Nil.

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An investigation into the digitalisation of New Zealand general practice services during COVID-19

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ABSTRACT

AIM: This study investigates the digital transition initiated by the onset of the COVID-19 pandemic and the factors that enabled the digitalisation of general practices (GPs) in New Zealand.

METHOD: Using a multiple case study design, we conducted 86 in-depth interviews with staff from 16 GP centres in New Zealand.

RESULTS: The critical enablers of digital transition in response to the pandemic were support from the community, agility and adaptability of GP medical centres and the ability to pragmatically create external operational processes to ensure business continuity and to meet patient expectations. Major barriers to digitalisation at the early stage of the COVID-19 pandemic (28 February to 30 August 2020) included lack of organisational leadership, financial support availability, systems management collaboration, and patient and staff knowledge and preferences. Digitalisation was characterised by the GP centre's ability to provide telehealth services using existing systems and technology, embracing e-prescription, e-referrals, e-lab and video-only consults.

CONCLUSION: The decision to adopt digitalisation had a significant impact on GP centres, disrupting the norm but also allowing continued access to health services to patients who were the most vulnerable during the pandemic. The pandemic forced GP medical centres to change to digitalisation and led to significant changes in GP medical centres' business models. However, it remains to be seen how the rapid change effected at this time correlates with patient satisfaction and how the digitalisation capabilities that have been built impact on future primary care services. This study suggests that changes brought about by COVID-19 may pave the way to an expansion of GP telehealth services, which has the potential to permanently change the primary care landscape.

In February and March 2020, most of the general practice (GP) centres across New Zealand started the year with business as usual. Few anticipated the extent of disruption and the pace of change that the unfolding COVID-19 (SARS-CoV-2) global pandemic would impose upon all primary healthcare providers' services, particularly GP medical centres. The first COVID-19 case was reported in New Zealand on 28 February 2020.[1] On Saturday 21 March 2020, in response to the COVID-19 pandemic in New Zealand and restrictions announced by the New Zealand Government, the Royal New Zealand College of General Practitioners (RNZCGP) requested all GP medical centres in the country immediately adopt virtual triage for all patient contacts and aim to provide 70% of consultations by virtual means, commencing Monday 23 March 2020.[1–2]

In New Zealand, technology-integrated learning has been embedded in medicine and allied health programs for some time.[1–5] Information Communication Technology (ICT) specialists in healthcare have been actively involved in the development of digital solutions and process reform.[6–10] However, primary care, particularly GP services, had never been delivered over 70% remotely in New Zealand.[2] Subsequently, GP medical providers had to reorganise their medical centres within 48 hours to accommodate 1½ meter social distancing requirements and to enforce separation between everyday patients and potential COVID-19 patients. Among other measures, most practices had to remove chairs from waiting rooms, put up plexiglass screens at the reception, wear personal protective equipment (PPE) and follow physical distancing rules set by the Ministry of Health (MoH).[11–13]

GP medical centres drew on the experience and expertise of their business managers and staff and acted quickly to source equipment, manage logistics and provide in-time assistance to support their centre's continued operations. There was a need to actively repurpose and redeploy resources, upskill staff digital competencies and develop new processes and systems to transition traditionally face-to-face consults to remote or online health service support/telehealth.[14]

Telehealth or telecare is defined by Sikka et al.

(2019) as "*the use of telecommunication technologies to communicate and facilitate health-related services between two remote parties and typically used in health care between provider and patient or between two healthcare providers.*"[15]

Even though most of primary care adopted digital technology and increased telehealth as a temporary measure, it became evident that GP medical centre digitalisation in the use of telehealth may become permanent.[16–17] By the end of March 2020, the extent of COVID-19 disruption was demonstrated via the restrictions on face-to-face doctor appointments and significant lockdown restrictions, resulting in reductions in GP face-to-face visits and significant financial loss to medical centres in New Zealand.[18]

In general, the core operation of GP medical centres appeared to continue. At the beginning of the pandemic, most GP medical centres waited on direction from the MoH and their primary health organisations (PHOs). PHO leaders were carefully monitoring the situation, including the need to transition to telemedicine and remote healthcare support services for patients.[12,19–21] Following its guidance to transition to remote consults via telemedicine, the RNZCGP acted quickly and decisively to enable rapid GP services transformation by announcing a broad reduction to the regulatory burden for GP medical centres managing COVID-19 pandemic challenges.[12] This deregulation provided PHOs and GP medical centres with approval to effect changes to the modes of delivery of health services, as well as to provide remote medicine services to patients during the lockdown. The RNZCGP caveat, however, was that GP medical centres using telehealth and telemedicine must maintain quality standards as face-to-face consults.[21]

The RNZCGP-guided deregulation resulted in high satisfaction with telehealth in GP medical centres during the lockdown.[12] In 2020, approximately 4.7 million of the 5 million population of New Zealand was enrolled with a primary care organisation.[22] The conversion to teleconsult (telephone consult) and video consult was critical to GP medical centres as they continued as the first point of contact in most situations for most people seeking medical care.[18] There were significant obstacles to digitalisation. The initial stage of transition to telehealth can be particularly challenging to GP medical centres in rural areas with limited hardware technology and numerous enrolled patients with limited access to a network connection. It is worth considering that there are also lower-income patients with no access to smartphones or other devices to facilitate telehealth access in all environments, from urban to rural.[19] New Zealand studies suggested that transition into telehealth was gradual for many practices.[21] Adopting multiple methods of GP service provision such as teleconsult, video consult, in-person (face-to-face), text or email allowed GP medical centres to meet the patient healthcare service demands.[20] Telehealth became the most practical option for GP medical centres during the lockdown, which caused significant changes to their internal and external processes and practices.[23] It was proposed that a digitalised health service response to COVID-19 could result in some patients being placed at increased risk of a missed or incorrect diagnosis due to the limitations of telehealth. However, there is evidence that some services suffer no deterioration from being delivered remotely; for instance, anticoagulation services delivered solely by teleconsult or video consult have been shown to create no statistically significant difference in the risk of extreme supratherapeutic INR, major bleeding, minor bleeding or thromboembolic events.[24] However, in November, Wilson et al. (2021) proposed that the threat of COVID-19 infection, combined with patient and health system factors (including telehealth adaptation), were elements that contributed to delayed patient care in the early pandemic period and may have caused harm.[20] More research is required in this area.

While teleconsult and video consults can have great potential for patients seeking access to GP services as well as specialist services in rural and urban areas,[25] there is a need to work hard to safely connect patients to primary care services within the digital realm and in the absence of face-to-face, in-person interaction.[18]

This study does not focus on the limitations of telehealth or its safety but centres on the enablers and barriers to the forced digitalisation process as experienced by GP medical centres in New Zealand during the early stages of the COVID-19 pandemic, which enabled it. This study also examines the shared experiences of GP staff during this process and extracts lessons that could be employed in future pandemic scenarios. This aspect is of relevance as there is evidence that in post-COVID pandemic conditions GP practices are already starting to retreat from elements of digitalisation, creating the risk that lessons learnt may well be lost.

Method

The purpose of this research was to investigate digitalisation in GP medical services during a pandemic in order to understand and add new knowledge to both academic and practitioner understanding of digitalisation by capturing some of the adoption processes used during the time of COVID-19. The study adopted a qualitative approach with an embedded multiple-case study design and a phenomenological approach as an initial point. The case study research involved the examination of the COVID-enabled digitalisation phenomenon in GP medical centres.

A mix of GP medical centres were selected based on their performance in maintaining levels of patient service during the COVID-19 pandemic and maintenance of revenue stream. A total of 16 GP medical centres participated in the study. They were selected via purposeful sampling combined with a snowballing method to identify suitable cases. The practices included in the study were then selected based on geographical location, size, the number of employees and years the practices had spent operating in their specific locations. The intention of the selection process was to identify best practice from medical centres covering diverse demographic, socio-economic and geographic areas.

The majority of the practices selected during this study were the lead COVID-19 test centres during the first New Zealand lockdown.

Each GP practice was treated as an individual case. The selected GP medical centres encompassed urban, rural and suburban practices from different decile areas of New Zealand.

The analysis generated themes from the interview data. The multiple case studies did not require control of the behavioural event/elements and focussed specifically on the COVID-19 pandemic. Primary data were collected through interviews with doctors, nurses and the GP centre's management and support staff teams.

The New Zealand MoH report into COVID-induced disruption to hospital and GP activity was used as secondary data to triangulate the findings from primary data by comparing overall hospital and GP activities data from March to June 2020 with the same months in 2018 and 2019.[18]

The individual interviewees within each case were selected based on their experience and involvement in the centre's COVID-19 pandemic-driven digitalisation process.

The analysis was performed using a combination of qualitative analysis software (N-Vivo) and visual and hand-coding. The transcripts from interviews were reviewed and coded. All comments that mentioned digitalisation adoption processes were highlighted and collected on a summary sheet. The summary sheets from each participating practice were then compared to the aggregated data, and comparisons and contrasts were drawn from the process.

Ethical approval

This study was approved by the University of Canterbury Human Ethics Review Board and Research Ethics Committee. The reference number for ethics approval is #09032021.

Results

This study took place from February to April 2021. However, the interview questions were focussed on the first six months of the COVID-19 outbreak in New Zealand (February to August 2020). During the initial pandemic period, all 16 GP medical centres in the study confirmed converting to telehealth within 48 hours of the lockdown announcement. All 86 research participants acknowledged the significant work required by staff to implement digitalisation within a very limited time frame and gave credit to the ubiquitous messaging that the health and wellbeing of patients were of primary importance in the process. Telehealth was utilised to triage patients, provide GP consult services and mitigate the loss of revenue. Each interviewed staff member's reflection tended to identify temporary solutions using existing practice systems and hardware being utilised initially, as well as personal smartphones.

The practice managers moved to incorporate temporary solutions but also planned for future telehealth sustainability during the pandemic amid an anticipated need for a balanced healthcare service approach. Patient and staff adaptability and support were discussed in nearly all interviews. Some staff found the experience of accelerated change into the digitalisation of general practice very exciting and fruitful, while others found the experience daunting and highly unsettling. In general, there were shared concerns about the radical change in practice operation, especially combined with the extraordinary workloads the COVID-19 pandemic -fuelled digitalisation transition required. Notably, nearly all 16 GP medical centres already had digitalisation systems identified in their strategic

plan for the next two to three years (2020–2023). COVID-19 led to instantaneous implementation. The systems that facilitated fast transition to digitalisation were electronic-prescription, electronic-referrals, electronic-lab and patient administration systems (e.g., MedTech/Indici).

Table 1 shows the digital systems used in telehealth to support GP medical centres during the early stages of the COVID-19 pandemic.

The interviews were undertaken during 2021 when lockdowns were still common, and COVID-19 vaccines were not yet available; most of the participants reported that GP services were likely to change permanently given the scale of change during the pandemic, with some concerned that this change would call into question the traditional face-to-face approach to practice. Senior GPs were more likely to comment on concerns that physical distancing and digital change had been implemented at the expense of quality of care, and as a rapid response to an unprecedented situation. Furthermore, this group was concerned that the speed of the digitalisation transition allowed little time for reflection and evidence-based refinement. However, it is notable that despite these concerns, none of the GP medical centres reported incorrect diagnoses, late diagnoses or missed diagnoses resulting from patients using telehealth services. Most GPs reported being more cautious during telehealth consults and advised patients to come in for a face-to-face consult if it was felt further examination was needed.

Table 2 and Table 3 show enablers and barriers to the digitalisation of general practice in the initial six months of the COVID-19 pandemic.

Discussion

Enablers to digitalisation

The last pandemic of the same scale as COVID-19 was the Spanish influenza in 1918, in the pre-digital age. Adapting health infrastructure and administrations to a pandemic via digital means was a new experience in New Zealand and globally.

A dynamic balance between the identified enablers and barriers to digitalisation of New Zealand GP services during COVID-19 determined the rate of digitalisation in this environment.

Enablers were perceived differently depending on the size of GP centres. The availability of existing technology and devices within the GP medical centres was found to be the primary enabler for provision of telehealth services and establishing digital solutions in a short time. Often, digitalised options had been available using pre-existing IT but not utilised as there had been limited perceived "market demand"; during COVID-19, GP surgeries activated this latent IT functionality. During interviews, 88% of participants confirmed that they used existing systems and hardware to support patients and provide GP services.

Training and staffing levels had a large impact on this enabler. In larger GP centres, digital solutions tended to be adopted more rapidly, mainly due to there being more fully trained personnel available to implement change than in the small- and mid-size GP medical centres.

Research conducted during the same time in eight European countries confirmed a similar primary enabler for fast digitalisation of primary care during the initial phases of the COVID-19 pandemic.[26] In the U.K., a telemedicine programme was created "overnight", which allowed the primary care provider to reduce the number of face-to-face consults via pre-screening and prioritisation.[27] The second enabler identified was the integrability—the ease of use of the current technology to facilitate digitalisation, combined with cost effectiveness and secure communication. It was vital that sufficient communication capabilities were available at a low operational cost to establish secure communication structures on both a short- and long-term basis. Key factors included remote-access availability, access to the patient information management system and transmission of prescriptions to pharmacies.

The third enabler consisted of forced Information Communication Technology (ICT) adaptation caused by COVID-induced business disruption and social and physical distancing restrictions—COVID-19 acted as an accelerator of change, as change was essential to facilitate the continuation of the business. The COVID-19 crisis forced GP medical centres to adapt rapidly to new realities, enabling new ways to work with patients and colleagues remotely. In doing so, GP medical centres arguably demonstrated substantial improvements in creating patient-centric systems as patients were presented with a range of interaction mechanisms and increased flexibility in healthcare access.

The combination of these three enablers and the adoption of telehealth combined with selective face-to-face consultations in a hybrid model allowed risk mitigation by clinicians and allowed practice teams to feel confident in their clinical and administrative decision making. The results highlighted the need to continue to engage with

Table 1: Digital resources supporting GP medical centre telehealth services during the COVID-19 pandemic.

GP medical centres	Full transition to new digital solutions	Updated PMS	Electronic referrals	Electronic prescription	Electronic lab	Video consult	Doctor info	Manage my health
GPMC1	Yes	✓	✓	✓	✓	✓	✓	✓
GPMC2	Yes	✓	✓	✓	✓	✓	✓	✓
GPMC3	No		✓	✓	✓		✓	
GPMC4	Yes	✓	✓	✓	✓			
GPMC5	Yes		✓	✓	✓	✓	✓	✓
GPMC6	No		✓	✓	✓			
GPMC7	Yes		✓	✓	✓		✓	✓
GPMC8	Yes	✓	✓	✓	✓		✓	
GPMC9	Yes	✓	✓	✓	✓		✓	✓
GPMC10	Yes	✓	✓	✓	✓		✓	✓
GPMC11	No		✓	✓	✓		✓	
GPMC12	Yes	✓	✓	✓	✓	✓	✓	✓
GPMC13	Yes	✓	✓	✓	✓	✓		✓
GPMC14	Yes	✓	✓	✓	✓	✓	✓	✓
GPMC15	Yes	✓	✓	✓	✓	✓	✓	✓
GPMC16	Yes		✓	✓	✓		✓	
TELHNZ	No		N/A	N/A	N/A		✓	

Table 2: Enablers of GP medical centre digitalisation during the COVID-19 pandemic (n=86).

Purpose	Themes	Sub-themes	Number of participants who identified the sub-themes	Total number of references to the sub-themes within the interviews	Percentages and rank in each theme
Enablers of GP medical centre digitalisation during the COVID-19 pandemic	Existing information communication technology	Telehealth capability with existing hardware and systems	76	187	88%
		Accessibility, integration and ease of use	73	191	84%
		Forced ICT transition	71	175	82%
		Willingness to adopt and retain new technology	57	96	66%
	Organisational agility and adaptability	Well-designed digitalised innovative systems	51	88	59%
		Reduction in workload due to adoption of technology	45	77	52%
		Incorporation of digital administration processes	59	106	68%
		Work flexibility, time efficiency and remote work	58	101	67%
		Understanding of local needs and priority setting	55	103	63%
		Good communication and support for the community	41	70	47%
		Gain of income and revenue from new services and subsidies	40	81	46%
		In-house knowledge, fast appropriate training and adaptability	38	52	44%

Table 2 (continued): Enablers of GP medical centre digitalisation during the COVID-19 pandemic (n=86).

Purpose	Themes	Sub-themes	Number of participants who identified the sub-themes	Total number of references to the sub-themes within the interviews	Percentages and rank in each theme
Enablers of GP medical centre digitalisation during the COVID-19 pandemic (continued)	Internal and external processes and practices	Risk awareness and risk averseness	63	99	73%
		Changed operational processes, guidelines for collaboration	59	105	68%
		Health organisation support (PHOs, MoH, IT providers)	58	118	67%
		Open to telehealth or face-to-face consults	54	92	62%
		Introduction of a new legal framework for telehealth & telemedicine	41	56	47%
	Patient expectations and market demand	Patient-centric systems and operational processes	58	111	67%
		Expectations towards managing a pandemic amongst the public	50	87	58%
		Readiness to respond to pandemic-induced demand	49	85	56%
		Patient attitudes and preferences towards telemedicine	46	78	53%
		Patient demand for and interest in telehealth	42	61	48%
		Utilisation of existing good practices examples from other countries and successful pilot schemes	36	69	42%

Table 3: Barriers to GP medical centre digitalisation during the COVID-19 pandemic (n=86).

Purpose	Themes	Sub-themes	Number of participants who identified the sub-themes	Total number of references to the sub-themes within the interviews	Percentages and rank in each theme
Barriers to GP medical centre digitalisation during the COVID-19 pandemic	Organisational leadership and financial barriers	Loss of time, revenue and resources	62	127	72%
		Disruption of existing practices, routines, and culture	44	90	51%
		Inadequate/incorrect/conflicting/failed communication	42	78	49%
		Cost of equipment, system membership and remote work	30	39	35%
	Role of management and collaboration barriers	Lack of digital administration processes and resources	52	91	61%
		Lack of readiness to respond to a pandemic	40	61	46%
		Privacy, confidentiality, and security-related concerns	25	33	29%
		Outdated legal framework and requirements from MoH	24	34	28%
	Systems and technology barriers	Lack of ideal design, systems connectivity, compatibility and ease of use	57	125	66%
		Doubts regarding ability to provide services or adequate data quality	31	57	36%
		Old, out-of-date patient management systems unable to accommodate telehealth requirements	49	97	57%
		Poor quality devices and equipment, phone and internet services	24	34	45%

Table 3 (continued): Barriers to GP medical centre digitalisation during the COVID-19 pandemic (n=86).

Purpose	Themes	Sub-themes	Number of participants who identified the sub-themes	Total number of references to the sub-themes within the interviews	Percentages and rank in each theme
Barriers to GP medical centre digitalisation during the COVID-19 pandemic (continued)	User knowledge and preference barriers	Lack of knowledge, awareness and interest	63	156	73%
		Preference for face-to-face patient interactions over telehealth	55	114	64%
		Perceived risk caused by lack of physical contact with patients and perceived low utility of telehealth systems	52	98	60%
		Preference for social interaction over digital interaction	52	93	60%
		Preference for doctor-centric systems, not patient-centric	39	59	45%

patients face-to-face if unsure about a diagnosis during the course of a teleconsult or video consult. GPs created their own assessment requirements and parameters and applied them to each patient regarding their suitability for telemedicine consults. This assessment took into account the necessary degree of confidentiality and the amount of needed face-to-face interaction for each patient, as well as the patient's capacity to use communication technology. The three enablers identified were dependent on a fourth, overarching enabler; new legal and regulatory guidelines from the MoH alongside new funding for telehealth that gave a framework and model for business sustainability. Legal guidelines allowed the use of available systems, such as electronic-prescription, electronic-lab, electronic-referrals, teleconsults and video consults. However, initially, this enabler created substantial tension as the full details were being adapted in real-time to a dynamic pandemic environment, leaving practices uncertain regarding their medico-legal standing. In one example, the MoH changed the legal requirements of having doctors physically sign each prescription. This then allowed for e-scripts and greater facilitation of remote consultation. However, this created a medico-legal issue that the MoH then had to address, as GPs increasingly consulted and prescribed remotely but could not examine the patient remotely, leading to a hypothetical increase in the risk of clinical error.

The Accident Claims Corporation (ACC) and Work and Income NZ (WINZ) also had to adjust to the new environment at the beginning of the pandemic, and this took time to materialise. The impact of this adaptation time by the MoH, ACC and WINZ is illustrated by an interview at GP medical centre (case 16), which focussed on the requirement to see patients face to face; an interviewee stated:

> *"There were also the medico-legal ramifications if you haven't seen a patient if you haven't touched them, can you do as effective an assessment? ACC (Accident Claims Corporation) and Work and Income require in-person assessments; you've got to sign that you have seen and touched this patient today. So even where it was just an extension of something that potentially could have been signed off without an examination, there was that requirement. So, I think that the system kind of reinforced that expectation that you were seeing people in person rather than virtually."*

The resolution of inconsistencies in the medico-legal and regulatory environment was crucial to the success of New Zealand GP digitalisation.

Barriers to digitalisation

The first barrier identified was staff familiarity with and training in digital solutions. In the majority of the 16 GP medical centres, employees were hesitant in adopting the digital solutions that were available prior to the COVID-19 pandemic. However, it was clear from some interviews that lack of knowledge and awareness of digital technology played a significant role in creating a barrier to adoption. 73% of the research participants mentioned they were not motivated to adopt digitalisation innovations in practice as they were unaware of what was available or did not know enough about existing technology capabilities to readily adopt it in daily operations. Additionally, there were barriers caused by managers' difficulties in setting up employees for remote work and remote working practices, which would allow for GPs, nurses and admin staff to collaborate in a flexible, digitalised environment.

Specific categories of staff were impacted more than others by this barrier. General practitioners were the most impacted group, followed by the administrative staff. The administrative staff were responsible for moving manual and paper-based processes into the digital space. As a result, there was a drastic change in the type of work these teams were expected to perform. Nursing staff were the least impacted, as many reported that they were still focused on triaging over the phone, making wellness calls, updating files and seeing patients face-to-face to provide wound care services or vaccination.

Lack of knowledge of and prior training in Information Technology (IT) systems for effective telehealth delivery among GPs and administrative staff was one significant aspect of this barrier. Training and setting up patients to use video consults was the second significant aspect and the most tedious and time-consuming part of the transition into digitalisation as reported by GPs. A large proportion of patients were elderly with little to no knowledge of how to utilise video consults or the supporting technology. Therefore, the majority of GPs choose to use teleconsult instead of video. A secondary reason for this choice, especially in remote and rural clinics, was a perceived

unreliability of the internet infrastructure and its ability to sustain reliable video consults.

Administrative staff had the most prominent role in supporting the transition to digitalisation. Some of the administrative staff transitioned from advising and supporting patients face-to-face to processing online billings, uploading pictures to patient files, supporting e-prescriptions if there were any issues with the pharmacist and educating and training patients on digitalised consults.

The perceived inadequacy of existing ICT systems was identified by numerous participants. The perceived inadequacy was caused by technical difficulties setting up e-prescriptions, e-lab, Doxy-Me (video consult capability) and remote desktops. The second barrier encompasses the transition of manual and paper-based administrative processes outside of what existing systems and software could provide for remote working staff. Poor internet connections, outdated Patient Management Systems (PMS, mostly MedTech32) and old hardware devices also generated the perception that digitalisation may not be able to adapt quickly enough to involve admin processes and allow ongoing support by practice managers in difficult situations. The second barrier to the digitalisation of GP services was partially dependent on the first and consisted of the perception of risk and the potential impact/utility of health interventions delivered via digital vs face-to-face means among primary care teams and patients.

GPs commented on the risk associated with telehealth services due to lack of physical touch.

> *"It would be okay for some things, but [to] get them [the patient] to touch their own tummy and tell me if it hurts doesn't help an awful lot because you want to know if they've [got] rebound [tenderness] or rigidity or all these other sorts of things that a person themselves can't tell you."*

GPs also commented on how patients value the social interaction inherent in a face-to-face consult.

> *"As soon as we went into Levels 1,2,3 and up, people call in and say, 'can I have a face-to-face?' although we always say to them, these are always options, you can either do a phone consult, Zoom consult, or face-to-face, the majority preferred face-to-face."*

The third major barrier identified was individual resistance to change among medical teams and patients; resistance to change was largely determined by personality traits and beliefs among medical centre staff and patients that GP medical centres and practice managers could not directly overcome, especially in a short time. Resistance was particularly strong among GPs due to the fear of the unknown and the required learning effort involved in changing from face-to-face to teleconsult or video consults.

Conclusion

This study identified three main enablers and three main barriers to the digitalisation of GP medical services in New Zealand.

Enablers:

1. The availability of existing technology and devices within the GP medical centres.
2. The ease of use of the current technology to facilitate digitalisation combined with cost effectiveness and secure communication.
3. Forced Information Communication Technology (ICT) adoption caused by COVID-induced business disruption, and social and physical distancing restrictions (a necessity-based enabler).

Barriers:

1. The perception of risk and potential impact/utility of health interventions delivered via digital vs face-to-face means among primary care teams and patients.
2. Individual resistance to change amongst medical teams and patients.
3. Lack of knowledge and prior training in Information Technology (IT) systems for effective telehealth delivery amongst GPs and administrative staff.

As the COVID-19 pandemic evolves into an endemic in New Zealand, there is no doubt that GP medical centres leaders and GPs especially deserve recognition for their management and support to the communities they serve. As in most Westernised healthcare systems, New Zealand GPs provide an overwhelming majority of the medical care in New Zealand for a very small fraction of the New Zealand healthcare budget. Their focussed efforts in the face of a global pandemic caused by a disease with no known vaccine or cure (in early 2020), disruption, uncertainty and substantial business volatility ensured the

continuation of effective and safe healthcare services for patients. For GP medical centres, the decision to adopt digitalisation had a deep impact, disrupting the norm but also allowing continued access to health services to patients who were the most vulnerable during the pandemic.[27–29]

The pandemic forced the change to digitalisation and led to "*more change in 48 hours to GP business models than there had been in the preceding ten years*." Several challenges were recognised by GPs, practice managers and their teams during the early pandemic: education of staff and patients, knowledge of technology, time management, resources and system technical capabilities. Accurate triaging of potential COVID-19 cases via telehealth was also a significant challenge as the diagnostic criteria kept evolving. Management and administration staff demonstrated role adaptability and assisted GP colleagues in meeting healthcare service demand and their obligations in providing healthcare advice.[3,30–31] For patients, the flexibility and adaptability of the GP medical centre enabled continuity of care that was effective and fit for purpose in the COVID-19 pandemic. Interestingly, in-person interactions between patient and GP, which is uniquely highlighted as an integral part of health service requirements by the MoH, was demonstrated to be less crucial than anticipated to continuity of care. Of note, and in a time of crisis and uncertainty, the GP medical centre management teams acted and thought like leaders—often in the face of conflicting advice from regional- and national-level bodies that was constantly evolving. Health and safety were prioritised, followed by healthcare service standards and the development of flexible solutions for business continuity. Despite the barriers identified in this study, the participants acknowledged and commented on the remarkable mobilisation, commitment, speed of change and agility of their GP medical centres and of their patients.

There has been a change in GP medical service provision in New Zealand since the start of the COVID-19 pandemic. It remains to be seen how the rapid change effected during this period correlates with patient satisfaction and how the digitalisation capabilities that have been built impact on future primary care services.[32–34] This study suggests that changes brought about by COVID-19 may pave the way to an expansion of GP telehealth services, which would permanently change the primary care landscape. The research in this study also provides some insight into the controllable enablers and barriers that could be utilised to instigate and maintain digitalisation processes.

Whether the benefits of digitalisation overcome the desire for human touch and face-to-face contact among GPs and their patients as the pandemic recedes as a threat is a subject worthy of future study.

COMPETING INTEREST
Nil.

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Sleep-in to stay well: addressing school start times for the health and wellbeing of teens in Aotearoa

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ABSTRACT

The under-acknowledged malleability of secondary school start times may be a lever towards addressing poor sleep, particularly the sleep deprivation that many adolescents living in Aotearoa New Zealand experience on a daily basis. Scrutinising morning school start times has not been prioritised in terms of a logical, modifiable way to counteract sleep deprivation in adolescents in Aotearoa. Importantly, later start times align with adolescents' natural sleep-wake biology that shifts at puberty to favour later bedtimes, meaning they naturally need to wake later in the morning. In this viewpoint we argue that a later school start time (no earlier than 9:45 am) every day for senior secondary school students is an attractive, non-stigmatising approach to address adolescent sleep. Increased sleep also has the potential to favourably impact multiple areas of adolescents' health and wellbeing, as well as school success. In fact, we argue that later school start times are a public health imperative to address the sleep and mental health issues faced by youth in Aotearoa today.

We need to talk about sleep and adolescent health in Aotearoa (New Zealand). Sleep is essential for survival as well as being vital for children's health, wellbeing and development. It is well known that insufficient and poor-quality sleep is endemic in adolescents,[1,2] to the detriment of their health and wellbeing, yet we have failed to prioritise the issue. As teenagers have less scope for optimising and controlling their sleep than adults, we urgently need novel ways of ensuring youth get the sleep they need. Furthermore, the detrimental effects that sleep issues have on health and wellbeing is more likely to be experienced by Māori. Therefore, ensuring sleep health equity in Aotearoa is paramount to address.[3,4] Good sleep is a fundamental right and addresses Te Tiriti o Waitangi/Treaty of Waitangi obligations. Improving sleep in durable, community-centred ways is one way forwards to reduce health inequities, as it shifts the focus from sleep being an individual problem to a public health issue.

United States (U.S.) researchers have dominated efforts to introduce school settings as population-based initiatives for improving adolescent sleep health. This is perhaps not surprising, given that school start times are often much earlier in the U.S. than other countries. For example, in 2019 California was the first state to uphold the protection of youth sleep by legislating that senior students must start no earlier than 8:30 am.[5] However, even though schools in Aotearoa do not start before 8:30 am, many teens are still clearly not getting enough sleep.[2,6] We need to go beyond the U.S. research and propose school starts no earlier than 9:45 am as a more appropriate start time for senior high school students in Aotearoa to address their sleep health and wellbeing.

The problem with adolescents' sleep

While insufficient sleep (defined as a sleep quantity inadequate to meet sleep needs) and poor-quality sleep (defined as disturbed sleep, which can include difficulty falling or staying asleep, sleep that is fragmented or the perception of not sleeping well, and includes sleep quantity as a component) promote poorer physical and mental wellbeing at any age, the unique developmental period of adolescence, marked by increased physical changes as well as independence and emergence of new social roles, presents distinct challenges. The ability for adolescents to obtain enough sleep each night is influenced by many factors, such as use of electronic devices

and engagement with social media, after-school activity commitments, homework requirements[7] and differing cultural sleep norms.[8] In addition, dramatic changes in sleep biology are a hallmark of adolescence, whereby their chronotype (sleep timing preference) shifts to become more evening-based, and is a major factor in the argument for later school start times. Across the day, the pressure to sleep builds (termed sleep homeostasis); however, during adolescence that pressure increases more gradually, so that teens stay alert much later into the evening than adults.[9] Further, during this developmental period, sleep and wake timing, primarily influenced by the 24-hour light-dark cycle, changes. There is a delay in the release of the "night" hormone melatonin that aids sleep onset.[9] Prior to sleep onset, electronic device use is rife, providing stimulation and light exposure that also contributes to delayed sleep onset, and also feeding back to the processes that drive sleep and wake regulation.[10] To aid morning waking, melatonin release is suppressed around 3 hours before waking. In adults, this is around 4 am, but in adolescents, this is not until about 7 am. In essence, this means that waking a teen at 7 am every day is similar to waking an adult at 4 am.[11]

Bedtimes become later with each passing year during adolescence.[1] Later bedtimes mean adolescents need to wake later in the morning to obtain their full sleep quota, but school start times during the week prevent this. In turn, adolescents accumulate a sleep debt across the weekdays, recovering at the weekends and holidays with more opportunities for "catch-up" sleep in the mornings. However, it is becoming clear that these variable weekday–weekend patterns (also known as social jet lag) can be detrimental, with links to attention problems, depressive symptoms, poorer academic performance, higher risk of substance use, overweight/obesity, self-harm and suicidality.[12] Therefore, later school start times not only accommodate the unique biological needs of all adolescents, they also have the potential to reduce social jet lag.

A stealth approach for sleep health equity

Later school start times are a "stealthy" way to improve the sleep health of our teens as a pathway towards better health and wellbeing for all. Due to teens' changing sleep biology, the later years in the secondary education context provide an unparalleled opportunity to address sleep inequities, reaching adolescents from all ethnicities and socio-economic positions. Like many health issues in Aotearoa, there are inequities in sleep health across all age groups,[2,3,13] and for adolescents, in the many health and developmental outcomes that are a consequence of both insufficient and poor-quality sleep.[7]

Later school start times have the potential to be a component of broader interventions that can be utilised to address health inequities.[14] The approach is one of responsiveness to inequitable health outcomes that exist for Māori, beyond differences in socio-economic position, enabling sleep as the key driver towards a multitude of health and wellbeing benefits for adolescents. Starting school later has the potential to benefit *all* students, rather than the more privileged who all too often benefit the most from interventions (i.e., non-Indigenous). Additionally, the opportunity to activate Matua Moana Jackson's term, re-powering Māori adolescents through increased sleep, could be a factor towards the growth of on-task adolescents and social engagement in school communities.[15]

Pasifika sleep research has started a sleep health conversation,[16,17] although the baton has not yet been ushered forwards by comprehensive adolescent research with the multiplicity of diverse Pasifika peoples in the Aotearoa setting. Beyond national statistics reporting prevalence figures for different ethnic groups meeting public health guidelines for sleep,[6] there is much to explore with Māori and Pasifika teens' sleep in Aotearoa.

In fact, we argue that later school start times are a public health imperative to address the sleep and mental health issues faced by youth in Aotearoa today. Over two thirds of teens growing up in Aotearoa report good overall wellbeing, but many do not.[18] The number with depressive symptoms has risen (increased from 13% in 2012 to 23% in 2019), and disproportionately affects ethnic groups, particularly Māori.[18] Poor sleep and mental health are inextricably linked, with longitudinal and treatment studies suggesting that sleep disturbance could act as a precursor to depression in adolescents.[19] By addressing sleep, we have the opportunity to also impact mental health difficulties.

American National Sleep Health Foundation guidelines suggest that adolescents aged 14 to 18 years require 8 to 10 hours of sleep per night for optimal health and daytime functioning. These guidelines have been adopted by many countries including Aotearoa.[6] However, studies from across the globe continue to report that the aver-

age sleep duration in adolescents is less than these recommended amounts. Aotearoa is no exception, with 39% of teens sleeping less than the recommended hours for their age, and 57% reporting their sleep is of poor quality.[2] The issues of poor sleep are far reaching and adversely impact adolescent health broadly, including across multiple areas like the risk of mood disturbances, depressive symptoms, cognitive and behavioural problems, suicidality, unintentional injuries, motor vehicle accidents and risk of overweight and obesity.[7] In turn, many of these issues have the ability to adversely influence academic achievement, absenteeism rates and school enjoyment.[1] When sleep loss is chronic, associated health issues in adolescents include lowered resistance to common infections and illnesses,[20] and an increased risk of cardiovascular disease in obese teens[21] and type 2 diabetes.[22]

Later school start times for adolescents, a recommendation of the American Academy of Pediatrics (AAP),[23] is highlighted here as one important intervention that addresses the preference for a later sleep onset by aligning students' day activities with their natural biological rhythms, and provides more opportunities for adolescents to get the recommended 8–10 hours of sleep, although the AAP recommendations were made based on 43% of public high schools at the time (in 2014) having a start time before 8 am. A systematic review evaluating six pre-/post-design studies, where school start times were delayed by 25–60 minutes in four different countries (original start times between 7:30 and 8:30 am), reported increases of 25–77 minutes in total sleep time per weeknight with significant reductions in daytime sleepiness and tardiness.[24] While it's commonly assumed that later school start times will encourage teens to just stay up later, in practice there is little evidence for this; most sleep gains are through later wake times,[25] aligning with teens' sleep-wake biology.

Are schools' current practices standing in the way of sleep health equities?

Health (including sleep) and education are more intricately intertwined than we often acknowledge. Factors related to adolescent school success are a complicated nexus. Outcomes (defined by and centred in the community and whānau) today are more likely to be associated with the successful weaving of threads in the wellbeing of the whole person, rather than focussing narrowly on academic success.[26] Student engagement and school retention are areas where equity- and population-based approaches to adolescent wellbeing are needed to address issues of progressive student disengagement and dropout/pushout rates. In this way, the organisational and structural features of educational contexts tend to act in concert to the extent that schools can hold responsibilities for barriers to adolescent wellbeing, which also includes sleep.

Non-Māori and non-Pasifika ways of making sense of the world have subordinated the centrality of Māori and Pasifika cultures, leading to environments that still limit Māori students' connectedness and belonging on a daily basis.[27] As a result, schools may have diminishing opportunities to retain students, and their "school holding power" is challenged because the school connectedness that is so valuable for students has either been eroded, or was never adequately fostered. Effective population-based policy, therefore, has an important role to play in the development of interventions that address racial discrimination so that equity-based sleep health and wellbeing is achieved for secondary school students.[3] From the standpoint upheld by Macfarlane et al. (2007),[28] all aspects of Māori students' wellbeing are to be acknowledged and supported at school. Integral to a student's wellbeing so they can thrive at school is the opportunity for a good night's sleep, each and every night.

Concerning downward trends in attendance rates in Aotearoa, heightened by the COVID-19 pandemic, have recently been brought to the attention of the government. Among the options to improve attendance rates are front-line roles for attendance officers to support schools;[29] roles that run the risk of being viewed as service-centred rather than student-centred. Whether school attendance and school retention rates in Aotearoa could be lifted by later school start times remains unknown. Overseas research has documented mixed success,[25] but one study stands out in that it began with school start times similar to ours; a state school in the U.K. shifted from 8:50 am to 10 am starts and reported a significant decline in absenteeism due to illness, starting out well above the national average to below after two years.[30] Culturally sustaining approaches towards school attendance are undoubtedly essential—likely a multi-layered undertaking—but we suggest that for senior students at least, a starting point is the time the school day begins.

In Aotearoa, there is mixed evidence from dif-

ferent age groups regarding associations between ethnicity, socio-economic position and a variety of sleep health issues, with scant data in the adolescent age group.[2,3,13,14,31] Adding another layer of consideration to the issue of student wellbeing is the school decile system in Aotearoa. Even though it is targeted for phasing out, there is some immediacy in relation to the Māori and Pasifika student over-representation in the lower deciles. Importantly, overseas research on later school start times has shown that those who are economically disadvantaged and do not do so well academically benefit the most in terms of improved attendance, lower dropout rates or greater academic gains.[32]

Policy implications and future research

Closer collaboration between the health and education sectors in the endorsement of initiatives to improve sleep and wellbeing could assist community-centred cohesion in various school decile locations. This may also have a positive influence on Māori and Pasifika identities that are sometimes different from traditional cultural markers, such as language and places of worship or meeting. For some students these cultural reference points have shifted so that students' identities can be more of a localised sense of belonging according to the area/s—urban and rural—in which they live.[33] In relation to sleep, this can be multiple home environments and multiple interpretations of ethnicity within the same whānau that teens are navigating, before they then navigate their identities at school.

Therefore, institutions such as schools can be agents that contribute to cultural identity. Educational contexts, as holistic environments, should include sleep health in conjunction with strengths-based approaches that support adolescent wellbeing, identity, achievement and sense of belonging. The pertinent issue is that later school start times are increasingly seen to be a logical, modifiable factor to synchronise schools with adolescent biology in many countries. While some students in the junior high school levels could also benefit, younger teens' chronotypes are more suited to earlier waking than older teens.[2] The hours before school starts when the child could potentially be home alone is also an issue. It is illegal in Aotearoa to leave a child under the age of 14 years home alone without reasonable provision for their care, although this does not always fit with the realities of whānau life.

Multi-disciplinary and multi-method approaches to research in adolescent sleep health ought to alleviate an acknowledged under-valuing of similar nuanced social and policy determinants. Areas of analyses where data may be under-utilised in terms of outcomes include motor vehicle crashes, rates of substance abuse, after-school crime, mental health and youth employment. Aspects that could also be examined further are school violence and its association with poor sleep and family conflict over bedtimes with the potential to impact adolescents' sleep and mental health.

Research also needs to also explore the barriers and facilitators to later school start times as perceived by different stakeholders in different communities to understand specifics about the various levels of engagement that need to be involved in co-designing sleep interventions to assist in decisions regarding implementation. Qualitative research approaches may be best for this, enabling heterogeneous groups to contribute in substance, rather than just form, and are particularly important for developing community sleep interventions. Although there are many stakeholders with a vested interest, ensuring the participation and the hearing the voices of adolescents as key stakeholders is essential and important for expansiveness and sustainability in each context.

After much-needed conversations, and consultation within communities, a process of change may also be assisted by the Board of Trustee regulations that from 2016 enabled individual schools to make decisions regarding school start times. Few schools in Aotearoa, however, have overtly explored a later school start time in order to amplify student success inclusive of health outcomes. It seems likely that minimal numbers of students, parents, teachers or administrators are aware of the malleability of daily scheduling in secondary schools. The concept of a later school start time for Year 12 and 13 students in Aotearoa is still relatively new despite one school—Wellington High School—having offered later scheduling every day (9:45 am Monday to Friday, with the exception of 10:20 am on a Wednesday) for senior students since 2006, with research suggesting benefits to students' sleep and alertness levels.[34] What is also important to note is that the school has managed to adapt their timetables so as not to change the school finishing time. We are aware of several high schools in Aotearoa that offer a later start one day a week. While this is a positive initiative, if offered on a midweek day this could compound social jet lag as

the student has to adapt to three, instead of two, changes in their sleep-wake schedule across a full week. A Monday or Friday later start, adjoined to the weekend days, would offer the most benefit for teenagers' sleep health.

Conclusion

Later school start times are a "no-brainer" to the authors of this commentary, in order to address the poor sleep of adolescents as a pathway towards the better health and wellbeing of senior high school students in Aotearoa. While we are not dismissing the importance of healthy sleep behaviours for addressing sleep health issues (e.g., avoiding light and screen time before bed, and stimulant drinks), later starts offer a non-stigmatising approach to benefit all. It could be argued that an increased understanding of the role of sleep for overall adolescent health needs to be reinforced to all key stakeholders, inclusive of policy makers, especially as students in Years 12 and 13 benefit from later waking since their sleep-wake biology has shifted. Further dimensions of sleep health related to ethnicity and societal changes with the COVID-19 pandemic may compel schools to investigate later start times.[35] Quantitative and qualitative data would be valuable resources for informing school communities on the benefits of trialling later school start times. Such resources would also be a reminder that social determinants of health include sleep health. Rather than later school starts playing an under-recognised role in improving adolescent sleep health, a systems-based approach to school start change that reinforces "culture is not static" has the potential to benefit a vast range of communities both locally and globally, and in a measurable way.

COMPETING INTERESTS
Nil.

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Stroke thrombolysis in a patient on dabigatran in the extended time window

Stewart Shiu, Bobae Lee, Karim M Mahawish

Dabigatran reversal with idarucizumab before thrombolysis is increasingly accepted as a treatment option for patients presenting with acute ischaemic stroke. Published data to date have included only patients presenting within the conventional thrombolysis window of 4.5 hours. Here we report a successful case of thrombolysis in a patient on dabigatran reversed with idarucizumab, following a wake-up stroke, guided by computed tomography (CT) perfusion imaging.

Case report

A 75-year-old female on dabigatran for atrial fibrillation and with previous bilateral middle cerebral artery infarcts presented to hospital after being found that morning with reduced responsiveness and a right-sided facial droop. She was last seen well the previous evening, 11 hours prior. Although alert, she was agitated and not responding to visual stimuli. She was also noted to have mild dysarthria and dysphasia. At baseline, she was independent with activities of daily living with a Modified Rankin Score of 1 for mild dysphasia, which manifested itself during periods of stress. The National Institutes of Health Stroke Scale (NIHSS), a scoring system used to describe the degree of neurological impairment (range 0–42 with higher scores reflecting greater deficit), was 8.

Investigations included an elevated dilute thrombin clotting time (>80 seconds) consistent with therapeutic dabigatran levels. The stroke protocol CT demonstrated a reduction in cerebral blood volume in the right medial occipital lobe, representing the ischaemic core (Figure 1), with a significantly larger area of increased Tmax in the bilateral posterior cerebral and posterior inferior cerebellar artery territories, representing salvageable penumbra (Figure 2). On angiography, no retrievable thrombus was identified.

Given the favourable imaging and disabling symptoms, we proceeded with idarucizumab reversal followed by thrombolysis 9 hours and 25 minutes post onset (taken from the midpoint of sleep onset and awakening) after obtaining informed assent from the husband.

The following day, there were no new residual neurological findings, and notably her visual fields were normal. Follow-up CT brain scan showed a right medial occipital lobe infarct with mild haemorrhagic staining (Figure 3). Her 24-hour post-thrombolysis NIHSS was 1, for mild dysphasia. On day 7, repeat brain imaging demonstrated favourable appearances. She was restarted on dabigatran and discharged 9 days post-stroke with a NIHSS of 0. Her husband noted post-stroke fatigue but otherwise reported her to be at baseline level of functioning.

Discussion

Atrial fibrillation (AF) increases the risk of intracerebral and systemic thromboembolism fivefold and is responsible for over 15 percent of ischemic strokes.[1] Multiple studies have demonstrated that direct oral anti-coagulants (DOACs) are similar or superior to warfarin in two aspects; stroke prevention and risk of major haemorrhage.[2] However, there remains a 1–2 percent risk of ischaemic stroke per annum in patients on DOACs.[3]

Intravenous thrombolysis with alteplase is the mainstay treatment for acute ischemic stroke. It attempts to restore the blood flow to the ischaemic penumbra. Currently, international guidelines make no recommendation about thrombolysis in patients on DOACs.[4,5]

There have been attempts to establish the safety and efficacy of dabigatran reversal using idarucizumab before thrombolysis. In a New Zealand-based cohort study of 1,336 patients, similar early post-thrombolysis safety outcomes were seen in idarucizumab reversed dabigatran users and non-anticoagulated patients.[6] Further, a systematic review of 251 patients who received thrombolysis after dabigatran reversal showed similar rates of haemorrhagic transformation, symptomatic intracerebral haemorrhage and mortality compared with previous studies in non-anticoagulated patients.[7]

Following a meta-analysis of perfusion-guided thrombolysis trials,[8] international guidelines now recommend thrombolysis in patients with favourable perfusion imaging presenting up to 9 hours

Figure 1: Cerebral blood volume (core infarct represented by dark blue and purple).

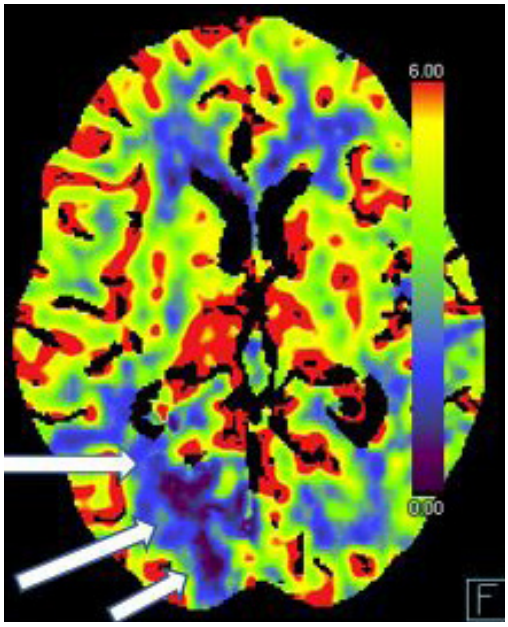


Figure 2: Tmax (salvageable ischaemic penumbra represented by green and yellow).

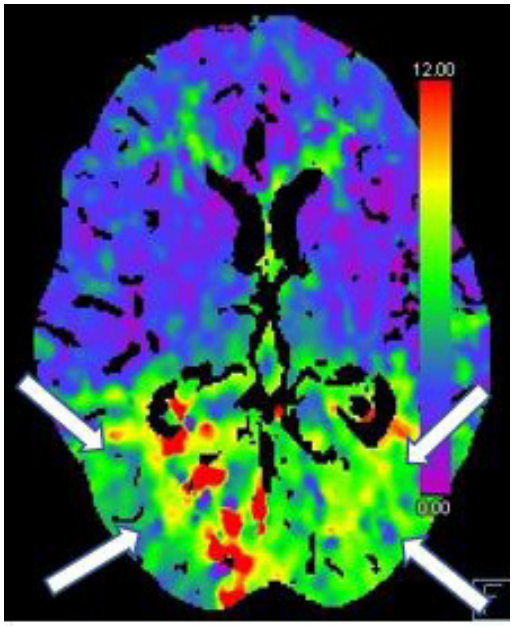
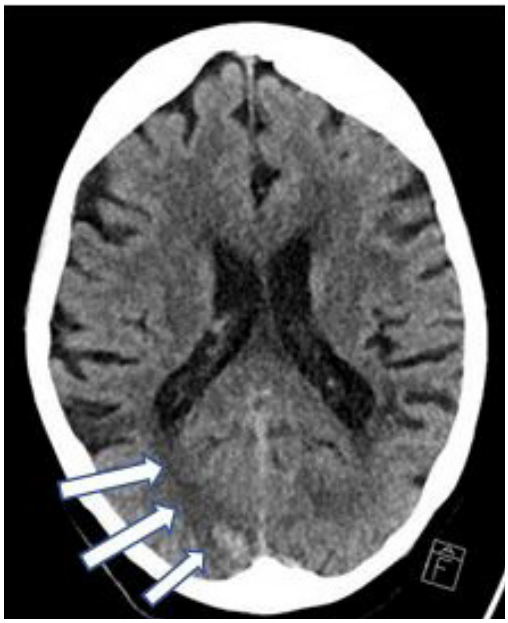


Figure 3: Right medial occipital lobe infarct with mild haemorrhagic staining.



from last known well or from the midpoint of sleep.[9] This is given a strong recommendation in the Australasian stroke guidelines, with a number needed to treat for functional independence of 5 and a number needed to harm for death of approximately 40.[9] A recent economic evaluation of alteplase versus placebo in the extended window demonstrated cost-effectiveness.[10] While there is no cost-effectiveness data on prior dabigatran reversal in this cohort, idarucizumab costs $4,250 per treatment. Based on 2015 Aoteroa New Zealand data, in-hospital care costs approximately $1,000 per day[11] and therefore, in our patient, a net cost saving due to a shorter hospital stay is likely despite the higher upfront cost.

To our knowledge, this is the first report of a patient receiving thrombolysis following dabigatran reversal in the extended window using perfusion imaging. This case suggests reversal of dabigatran to facilitate thrombolysis in the extended time window is reasonable, though more data is needed to confirm its safety and efficacy.

COMPETING INTERESTS
Nil

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Patient consent was obtained.

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Reply to Iupati et al: paediatric palliative care

Brian Ensor, Sarah Clunie

Thank you to the authors for their survey of Hospice Care in Aotearoa New Zealand. It includes the question of whether there is a paediatric hospice in Aotearoa New Zealand. Although strictly speaking there is no paediatric-only hospice,[1] Rainbow Place is a dedicated paediatric palliative care service, within Hospice Waikato, currently caring for about 40 children in the community. With a clinical nurse manager, two clinical nurse specialists, three registered nurses (plus one vacancy) and three healthcare assistants, it works with the children's usual paediatricians, the community services of Te Whatu Ora and True Colours Children's Health Trust to provide a comprehensive hospice service. Paediatricians at Waikato Hospital retain their role as the child's medical lead and have access to the hospice prescribing system. The hospice provides psychosocial input, including counselling and music therapy through the Hospice Waikato team. Tertiary expertise is accessed from Starship.

Within the hospice inpatient unit, using paediatric trained nurses, the provision of inpatient respite, symptom management and end-of-life care occurs. Over the time of COVID-19, "In-Home" respite started, which has proved very valuable and is therefore continuing. Such developments are guided by the invaluable services of a parent/consumer advisory group. It is well supported by the community through fund raising and sponsorship

Paediatric palliative care is different in many ways from adult palliative care,[2] as the children are often chronically ill with complex interventions, and the case mix is very different, for example, only 7.5% have malignancy, many have multiple diagnoses—the most common of which is neurological.

While there is only "a small number" of children on existing hospice programmes, this belies a significant need for paediatric palliative care hidden within our communities. This was recognised in a report to the Ministry of Health in 2012, which set out a plan for Aotearoa New Zealand[3] and was followed by the development of clinical guidelines.[4] Although Aotearoa New Zealand may not be populous enough to have paediatric-only hospice services, Rainbow Place demonstrates that it is possible to provide meaningful service for paediatric patients within a community hospice, linked to existing paediatric and community services.

COMPETING INTERESTS
Nil.

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Auckland City Society.

NZMJ 1923

This Society has just completed its second year of work, and can record a most satisfactory session. The membership increased to eighty, and there was an average attendance of forty-eight for fifteen meetings. By the courtesy of the Hospital Board and Dr. Maguire, Medical Superintendent, the meetings were held in the schoolroom of the Children's Hospital. The meetings lasted for an hour and a-half, during which time an average of eight subjects were dealt with, a special feature being made of the demonstration of patients, photographs and lantern slides, stress being laid on the needs for brevity and the desirability of emphasising deviations from the more generally recognised features of the disease. A few minutes of each evening were devoted to a pathological demonstration by Dr. Gilmour, and the evening terminated with the serving of light refreshments.

It is generally felt that these meetings have not only had great value from an educative point of view, but have also done much to promote a spirit of fellowship among the members of the profession in Auckland.

Dr. Hardie Neil has again held the Presidency of the Society, to the satisfaction of all.

We submit brief notes of certain of the matter presented which appears of the sufficient interest to put on record.

The President demonstrated by the direct method, a case of paralysis of one side of the palate, pharynx and larynx, together with spinal accessory palsy. There was also some lingual paresis, the case thus conforming to the Hughling's Jackson syndrome. He also showed fibroma, papilloma, and malignant cord cases.

Dr. Geo. Fenwick showed a group of cases of irido-cyclitis of differing ætiology. He emphasised the value of treatment by isolation. Later, he exhibited a case of sympathetic irido-cyclitis that was, by this method, given useful vision and a quiet eye. This demonstration aroused universal interest. He also showed excellent result from West's operation for Dacryocystitis.

Dr. Fairclough demonstrated three cases of Hemianopia from cerebral hæmorrhage, and showed patients with lipoma and dermoid of the conjunctiva and rodent ulcer of the lids, outlining the necessary plastic work for the latter. *Dr. Goldstein* showed a stationary traumatic cataract, its association with an old injury bringing it under the Worker's Compensation Act.

RAT BITE FEVER.–*Dr. Bull.*

In this case a girl had been bitten by a wild kitten. There was no local reaction but five weeks later she developed fever with a high remittent temperature, much malaise, enlargement of lymphatic glands, diffuse erythematous rash and much œdema of the nasal mucous membrane with free nasal discharge. The illness was severe, but was controlled by intravenous injection of novarseno-billon. There have been several relapses since, the last occurring seven months after the infection. Wassermann reaction has been negative, and examination of the blood and of an excised gland failed to show the causal organism. In the discussion that followed, a number of cases were cited, showing that the condition is not rare in this district. A patient was also shown who had had a severe attack 3 years before, a ragged primary sore forming suddenly on a finger six weeks after a rat bite. He was treated with galyl and is now well.

ADDISON'S DISEASE.–*Dr. Abbott.*

A middle-aged man had been off work for three weeks prior to his admission to hospital. He had complained of symptoms which seemed to indicate cardiac weakness. No definite heart lesion could be found—the blood pressure was 130. With rest he improved, and was getting about again when he was seized with severe abdominal pain and vomiting. He was sent to hospital with a provisional diagnosis of an acute surgical lesion of the abdomen, and the vomiting was frequent and distressing, all nourishment taken being immediately returned, and a certain amount of bile and mucus addiction. X-ray examination was impossible owing to his inability to retain the barium meal. The bowels were not disturbed. Neurological examination and the Wasserman test were negative, there was no pigmentation of the skin. The man's condition became steadily worse, and, after consultation, and exploratory operation was done, but no lesion discovered. Death occurred on the same day. *Post mortem* examination showed a complete replacement of the adrenal tissue by caseous tubercular material. There was present, also, healed tuberculosis of the lungs and dorsal spine.

The unusual features of the case were the short

duration of symptoms, the intensity and duration of the pain, the absence of pigmentation, and the comparatively high blood pressure a few weeks before death. Unfortunately no later measurements were taken.

ENCEPHALITIS.–*Dr. Tewsley.*

Four cases of encephalitis lethargica were shown at varying stages of the disease. One was a case of several years' standing, and showed permanent sequel of the disease, Parkinsonian mask, constant dribbling of saliva and interference with finer muscular coordination. A second case had been accompanied by severe epileptiform seizures at long intervals. Attention was directed to the fact that these cases are less infrequent than is generally supposed and that they are protean in their manifestations.

TORSION OF THE SPLEEN.–*Dr. Holmden.*

An elderly woman had been aware of a tumour in the lower abdomen for a number of years, but it had given rise to no symptoms. She was seized with sudden abdominal pain and symptoms suggestive of intestinal obstruction. A tumour of the contour of the spleen could be felt just at the brim of the pelvis. Operation showed several turns in the pedicle. Removal was easy.

CHYLOUS ASCITES.–*Dr. Milsom.*

A boy of 12, admitted to hospital with swelling of the left side of the scrotum and adjacent portion of the thigh. A laparotomy was done, and chylous fluid found in the abdominal cavity. Mesenteric glands were enlarged, but there was no other lesion. Following the operation the abdomen began to fill up with the fluid and has required frequently repeated tapping, while the œdema of lower limbs, scrotum and abdominal wall has become very great. Chylous fluid has also been aspirated from the left pleural cavity. The causative lesion is not definite but is thought to be tubercular glands of the mediastinum, causing pressure upon the thoracic duct.

ADEMONATOSIS OF THE COLON WITH CARCINOMA.–*Dr. Kenneth Mackenzie.*

A male, aged 22, complained of severe diarrhœa, much abdominal pain and loss of weight. A large carcinomatous mass was found in the rectum. An abdomino-pereneal excision was done. The excised segment showed, in addition to the carcinoma, numerous small tumours of the mucous membrane microscopically simple adenomata. Subsequent examination with the sigmoidoscope showed similar tumours extending as far as could be seen along the colon above the excision. It is presumed that cancer, uncommon in so young a subject, had has its origin in one of these adeomata.

RAYNAUD'S DISEASE.–*Dr. Carrick Robertson.*

A woman in whom gangrene of the finger tips of both hands had resulted from Raynaud's disease. Peri-arterial sympathectomy was done in the upper arm on each side, with improvement in the condition. More striking results were mentioned as having been obtained by this method in similar cases.

SYPHILOMA OF BLADDER.–*Dr. Frank Macky.*

This was demonstrated with the cystoscope. History of gonorrhœal infection, with gleet since 1917. Urine turbid, gonococci in prostatic secretion. Cystoscope in May, 1920, showed a small inflamed patch to the left side of the bladder trigone. In spite of treatment direct to the bladder the lesion was found in November, 1920, to have increased, and in July, 1921, it had greatly increased so that the whole trigone was involved in a gross bullous œdema. There were present a gleet, a turbid urine, some frequency of micturition, and discomfort in the perineum. The Wasserman had all along been negative, but now an illustration in the *Medical Annual* suggested syphiloma and arsenical treatment was commenced, with striking result, the bullous condition subsiding and the urine clearing. Recent cystoscopic examination shows only slight scar traces at the site of the lesion.

SPRENGEL'S DEFORMITY OF THE SHOULDER.–*Dr. Kenneth Mackenzie.*

A boy of 14.—Deformity of the left shoulder since birth, becoming more marked with growth. The left scapula was fixed with its superior angle just below the occiput. The muscles on the side of the neck greatly shortened, and marked asymmetry of the face, with a slight torticollis. The dorsal spine showed a moderate scoliosis with the convexity of the left. There was no movement whatever of the scapula, abduction of the limb being limited to 90 deg.

X-ray showed the scapula smaller than normal, with elongation of its neck and much deepening of the ventral fossa by the forward bending of the superior border. No bony attachment of the spine could be demonstrated. The cervical vertebrae appeared to be reduced by fusion to three in number, and showed deficiency in their laminæ. There were also marked irregularities in the upper dorsal vertebræ. The ribs showed much abnormality. On the right side eleven were found, on the left side only eight, the first and second being undeveloped, and the third and fourth being represented by a single posterior piece, bifurcating anteriorly.

Operation showed a bony connection between the scapula and the traverse process of a cervical vertebra. The bone was removed. It was about

two inches in length, with a triangular base articulating with the venter scapulæ opposite the base of the spine. It tapered as it passed forward and outward and had fibrous attachment to the vertebra. Its removal was followed by a few degrees increase in movement of the limb. It was thought inadvisable to attempt to lengthen the muscles of the neck at his age.

EXTROVERSION OF THE BLADDER AND TERATOMA OF THE PERINEUM.–*Dr. Carrick Robertson.*

A newborn infant with complete extraversion of the bladder and a pedunculated teratoma of the size of an orange attached to the perineum. The teratoma was removed. Later deficiency of the anal sphincter showed itself in persistent rectal prolapse. Slips of gluteus maximus muscle were used to replace the deficiency with good immediate results.

Amongst the pathological specimens shown by *Dr. Gilmour* were the following:—

COMBINATION OF CARCINOMA AND TUBERCULOSIS OF THE STOMACH.

At operation an irremovable tumour of the pylorus was found. An enlarged gland was removed from the greater curvature. This proved to be tuberculous in nature. Death occurred some weeks later, and at *post mortem* the pyloric tumour was found to be carcinomatous. The enlarged glands were confined to the gastric area. Some showed cancer only, others tuberculosis only, and others a mixture of the two. No other tuberculous lesion was found.

PAGENT'S DISEASE.

The skull and the tibia showed the typical changes of the disease, which had existed for a number of years. Death resulted from a very large and rapidly growing sarcoma of the left ilium.

TYPHOIDAL SALPINGO-OOPHORITIS.

Specimens form a patient dying in the fifth week of typhoid fever. Bilateral ovarian abscesses and pyosalpinx. Rupture on one side with peritonitis. From the abscesses a pure culture of *B. typhosus* was obtained.

HORSESHOE KIDNEY.

The pelvis of each kidney was filled with a large branching calculus—bilateral pyonephrosis and perinephric abscesses.

HYDATIDIFORM MOLE WITH DOUBLE OVARIAN CYSTS.

Removed from a single woman aged 18. History of three months amenorrhœa, then about six weeks persistent slight hæmorrhage. Bilateral and apparently rapidly growing ovarian cysts were found at operation. No trace of ovarian tissue could be found, and they were removed together with the pregnant uterus. The uterus was, on opening, found to contain a vesicular mole. The question as to whether the destruction of ovarian tissue had any relation to the placental degeneration was put forward.

SPASMOFIC STRICTURE OF THE UTERUS.

Dr. Tracey Inglis reported two cases of dystocia from this cause. The first patient was a two-para. Eighteen hours after the commencement of labour no progress was being made although the cervix was well dilated, and no pelvic obstruction existed. A hand was passed into the uterus and tight constriction of uterine wall was felt around the child's neck. After fifteen minutes of full surgical anæsthesia, and some manipulation, the stricture relaxed and delivery was easily effected.

The second patient was a primipara. After 18 hours' labour, progress had ceased with the head low in the pelvis. Intra-uterine examination showed a stricture round the shoulders of the child. It relaxed under deep anæsthesia and a forceps delivery became simple.

Dr. Inglis queried the result of the administration of pituitrin or the application of forceps without recognition of the condition. He emphasised the absolute difference between a muscular stricture such as this and the physiological retraction ring.

Therapeutic notes were presented by *Dr. Carrick Robertson* on the use of intravenous injections of eusol in the treatment of streptococcal septicæmia, by *Dr. Kinder* on the use of the silver-arsenic preparations in syphilis, and by *Dr. Falconer Brown* on the value of guaiacol-glucose solution as a vehicle for the intra-muscular injection of N.A.B.

Dr. McDougall exhibited an interesting series of radiographs showing the bronchial tree of the living subject injected with bismuth emulsion; and also a number of slides of colon radiographs demonstrating the normal and the abnormal.

Dr. Bruce Mackenzie gave a short demonstration of radiographs illustrating changes recognisable in different types and stages of pulmonary tuberculosis; also radiographs of Dr. Holmden's case of transposition of thoracic and abdominal viscera, and of Dr. MacDiarmid's case of disease of the right sacro-iliac joint, where the only symptom was an abscess pointing in the left inguinal region. He also demonstrated by radiographs the diminution in size of an intra-thoracic tumour in an old standing case of lyphademona under X-ray treatment. *Dr. Bruce Mackenzie* also showed a case of mycosis fungoides responding to X-ray treatment, and another case of obstinate syphiloma of the nose which rapidly disappeared under the same treatment.

The last meeting of the year was devoted to re-exhibition of or further reports upon cases dealt with in the session.