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The employment gap: the relationship between medical student career choices and the future needs of the New Zealand medical workforce

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On the health effects of radiofrequency radiation

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The costs associated with ankylosing spondylitis/axial spondyloarthritis in Aotearoa/New Zealand

Douglas White, Chunhuan Lao, Megan Williams, Ross Lawrenson, Nicola Dalbeth

This study has detailed the costs of spondyloarthritis (SpA) in Aotearoa/New Zealand. We have demonstrated a meaningful reduction in quality of life and work productivity in patients with SpA. The major driver of direct costs in SpA are biologic medications.

Electronic cigarette online marketing by New Zealand vendors

Niveditha Gurram, George Thomson, Nick Wilson, Janet Hoek

New Zealand urgently needs effective regulation that prevents the seductive marketing of vape products to young people. Few of New Zealand vape marketing websites, or their easily accessible Facebook or Twitter accounts, had health or addiction warnings. Two of the most popular websites had over 170 fruit/candy flavoured vape refills.

Outcomes of patients with ST elevation myocardial infarction in the era of second-generation drug eluting stents; five-year follow-up

Mohammed Alawami, Matthew Sadler, Chethan Kasargod, Timothy Watson, Mark Webster, Peter Ruygrok

Heart attacks remain a big killer despite our best efforts in reducing the death rates and fast medical treatment. New coronary stents show good results after a few years. Missing out on medications after a heart attack can result in serious complications and early death. Smoking after a heart attack can block off the stent and cause further heart attacks and death.

Influential factors in patient uptake of influenza vaccination during pregnancy; a survey-based audit in a tertiary hospital setting

Kristin Andre, Vesko Gavrilov, Sarah Graham, Simon M Scheck, Anita Chandler, Katie Hunter, Rebecca Crabbe, Daisy Wildash, Paul Canning, Sam Lepine

Influenza is a serious and potentially fatal condition that more severely affects pregnant women. Influenza vaccination during pregnancy is reliable, safe and provides benefit to the infant after birth. The most common reason in this study against receiving vaccination was found to be due to a lack of information given to pregnant women.

The employment gap: the relationship between medical student career choices and the future needs of the New Zealand medical workforce

Sam Seleq, Emmanuel Jo, Phillippa Poole, Tim Wilkinson, Fiona Hyland, Joy Rudland, Antonia Verstappen, Warwick Bagg

This paper aims to compare New Zealand medical students' graduate intentions with the health workforce requirements in 2028, where medical graduates are anticipated to have completed training. At graduation, half of medical students were undecided on a career pathway. We found that the career intentions of medical students who had decided on a vocational pathway did not align with workforce requirements, with the main gap existing in general practice. The key limitation is the assumption that medical students career decisions and workforce requirements remain constant.

Surgeon-performed ultrasound-guided fine needle aspiration of thyroid nodules is cost effective and efficient: evaluation of thyroid nodule assessment in a provincial New Zealand hospital

Michael Reeves, Rajeshbhai Patel, Christopher Harmston

This study shows that ultrasound assessment of thyroid nodules results in lower costs than if it is perfomed by a radiologist. There is also improved timeliness of care.

Equity by 2030: achieving equity in survival for Māori cancer patients

Jason Gurney, Shelley Campbell, Chris Jackson, Diana Sarfati

Māori diagnosed with cancer are more likely to die—and to die sooner—than non-Māori with cancer. New Zealand stands at the junction of a crucial philosophical choice: whether, in good conscience, to accept the existence of this inequity for our indigenous population, or to do whatever we need to do to close the gap. In this article, we talk about a new goal to achieve equity in cancer survival for Maori by 2030, give some recommendations for how we can achieve this goal and then talk about some of its likely criticisms.

Taking BMI off the table

Lucy Carey

All four-year-olds in New Zealand are offered a B4 School Check, which is a health and development check that aims to identify and address any concerns before children start school. As part of this, children have their body mass index (BMI) calculated based off their height and weight and the parents are then told whether their child is underweight, normal weight, overweight or obese according to their BMI. But BMI has been shown to be inaccurate in scientific studies, and is particularly inaccurate for Pasifika, Māori and Asian children. Plus, recent research shows that telling parents their child is in the overweight or obese BMI category may actually cause the child to gain proportionally more weight over time, even if they were not really overweight to begin with. This paper calls for BMI to be removed from the B4 School Check and instead every family talked to about the healthy behaviours that prevent and combat obesity—adequate sleep, cooking at home, eating together as a family, etc.

New Zealand Minimum dataset for a standard transthoracic echocardiogram

Kerryanne Johnson, Helen Walsh, Alex Sasse, Mark Davis, Belinda Buckley, Sally Greaves, Andrew To

This paper outlines the recommended images and measurements that are obtained during a cardiac ultrasound scan and aims therefore to promote standardisation across New Zealand. Furthermore, it recommends how to maintain quality within individual departments and how these investigations should be reported.

Cancer survival equity by 2030: a Treaty compliant systems approach required

Bridget H Robson, Lis Ellison-Loschmann, Mona Jeffreys, Fiona McKenzie

The Waitangi Tribunal's Inquiry into Health Services and Outcomes WAI2575 is underway and includes claims related to cancer outcomes for Māori. That Māori are twice as likely as non-Māori to die from their cancer after diagnosis[1] is further evidence that our health system breaches Te Tiriti o Waitangi. This breach must be righted. Gurney and colleagues have taken an important first step by establishing the goal of achieving equitable cancer survival for Māori by 2030. In this issue,[1] they lay out the current evidence of factors driving disparities in cancer survival. They then discuss the steps that could be taken to address them, with a particular focus on those that are amenable to health system intervention, including addressing comorbidity, mitigating the impacts of deprivation and improving equitable access to early detection and standardised high-quality treatment.

Is it feasible to achieve equity in cancer-specific survival by 2030? We have seen gaps narrow before. During the post-WWI period, Māori life expectancy increased at a faster rate than that of non-Māori such that the gap would have closed within 10 years, had the same trends continued.[2] However, Crown-led structural changes to New Zealand's economic and welfare system in the 1980s and 1990s reversed the situation, stalling Māori life expectancy while the growth in non-Māori lifespans accelerated.[3] Disparities in deaths amenable to healthcare and ambulatory sensitive hospitalisations[4] indicate that, rather than mitigating the rapidly widening socioeconomic gaps of the decades of disparity, our health system remains implicated in this injustice. Equitable cancer outcomes will not be accomplished by accident, or by a 'trickle-down effect'. It will take resolute, sustained, systematic actions that are resourced for and accountable for equity-positive results. Previous trends in life expectancy indicate that we could make the 2020s a decade of equity. The required changes to our health system would improve outcomes for Māori beyond cancer, and indeed produce equitable outcomes for other populations in Aotearoa.[5]

Gurney et al make a strong case for the importance of health professionals, both in terms of their key roles in the provision of care, and as potential enablers of access equity for Māori patients throughout the cancer continuum. Effective change in addressing equity challenges requires a systems thinking and acting workforce.[6] The Health Quality and Safety Commission is encouraging practitioners to understand the potential for bias in healthcare and to monitor their own practice.[7] The NZ College of Public Health Medicine is urging the Medical Council to strengthen standards for doctors regarding the provision of culturally safe care, not only at the individual level, but also recognising their responsibility to contribute to the development of culturally-safe organisations "since healthcare organisations play a key role in determining the systems and structures which either promote or prevent inequities in health outcomes."[8]

Māori health providers are a key workforce group who play a critical but often unrecognised role for Māori cancer patients and whānau, facilitating access to early detection services, assisting with transport to treatment centres, supporting whānau experiencing barriers to treatment due to costs and advocating for the highest quality of care for whānau. In essence, Māori providers are attempting to address many of the proximal health system factors impacting cancer survival equity identified

by Gurney and colleagues. Coordination of care has been identified as a critical aspect of cancer services given the recognised complexity of the cancer care pathway and was an important driver in the development of Māori cancer navigator positions.[9] The inclusion of Māori cancer navigators in multidisciplinary teams can strengthen the information flow for patients and affect other key aspects of care management such as the coordination of appointments as well as being a consistent support person for the patient and whānau throughout the whole of their cancer journey.[10,11] Māori cancer navigation programmes are reliant on funding from individual district health boards (DHBs) and unfortunately these positions have not been consistently established throughout the country.

It is vital that health professional and workforce changes are backed by policy. Some components of the system can be addressed at the individual level but a policy shift is also required. The example of vaccination showed that with concerted effort, equity could be achieved. However, as soon as we returned to business as usual, vaccination rates for Māori returned to pre-intervention levels.[4] To ensure sustainable change, we need policy that re-orientates all parts of the system to ensure equity remains front and centre for the long term. Intersectoral work on cancer prevention is also needed to achieve equity in survival for all cancers combined, since lower-survival cancers such as lung, liver, stomach and pancreas make up a higher proportion of all cancers for Māori than for non-Māori.[4] Prioritising prevention and greater investments in more effective treatments for these cancers will also be necessary. Cancer treatment is a field with moving goalposts, making access to research and innovation an equity issue. An equity lens would prioritise the most advanced care to those who need it most, not those who can best afford it or most easily access it.

Gurney and colleagues call for renewed investment in information systems related to cancer stage and treatments.[1] Extending and improving the capability of current information systems will facilitate better integrated systems in our healthcare for monitoring and tracking. As noted, the differential in missing staging data for Māori needs to be investigated and rectified, and co-morbidity data improved in order to understand survival disparities. Current hospital admission data is insufficiently detailed and may result in residual confounding when used to measure or adjust for comorbidities. Further work is needed to standardise the reporting and collection of data across the different systems and DHBs, to allow for continuous and real-time monitoring and quality assurance. Monitoring for equity within the secondary care system requires treatment data, which, although collected for specific cancers (eg, breast cancer patient registers) or for specific research projects (eg, colon cancer study), needs to be done in a comprehensive manner. Furthermore, for tracking cancer inequities in access to primary care and follow-up, a nationwide primary care integrated system is also necessary.

Te Tiriti o Waitangi is central to addressing inequities in Aotearoa New Zealand. The Waitangi Tribunal has identified Treaty breaches relating to DHB governance and inadequate resourcing of Māori primary health organisations. These will have had direct effects on cancer outcomes for Māori. As Baker and colleagues noted recently in this journal, the Hauora Inquiry "may provide renewed impetus for the health system to reconstruct its relationship with Māori…and to push hard towards equitable health outcomes."[12] Achieving equity in survival for Māori cancer patients by 2030 is a Treaty-compliant goal that will require Treaty-compliant action—a cultural shift in focus, a systems-change approach and fundamental changes across the whole cancer continuum.

Competing interests:
Nil.

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The costs associated with ankylosing spondylitis/ axial spondyloarthritis in Aotearoa/New Zealand

Douglas White, Chunhuan Lao, Megan Williams, Ross Lawrenson, Nicola Dalbeth

ABSTRACT

AIMS: To evaluate costs associated with a diagnosis of spondyloarthritis (SpA) in an Aotearoa/New Zealand cohort.

METHODS: Patients with SpA attending specialist SpA clinics in Auckland and Hamilton completed a series of questionnaires on costs associated with ankylosing spondylitis, disease parameters (BASDAI), work productivity (WPAI, WLQ) and quality of life measures (EQ-5D, ASAS-HI).

RESULTS: Eighty-one patients (median age 43 years) completed the study. All fulfilled the ASAS criteria for axial spondyloarthritis and 44 (58%) fulfilled the Modified New York Criteria for ankylosing spondylitis. The mean (SD) score on the EQ-VAS was 69mm (24.1). More than half reported difficulties with usual activities and more than 80% had moderate pain or discomfort despite current treatment. Sixty-six (82%) were in the workforce, and the mean work productivity loss was 4.8%. The mean (SD) annual cost was NZ$15,677 (NZ$11,269) with NZ$12,189 direct cost and NZ$3,488 productivity loss. The largest cost driver was use of biologic medications, which were used by 48% patients.

CONCLUSIONS: This study has quantified the direct and indirect costs of spondyloarthritis (SpA) in Aotearoa/New Zealand, and demonstrates meaningful reduction in quality of life and work productivity in patients with SpA. The major driver of direct costs in SpA are biologic medications.

Axial spondyloarthritis (axSpA) and ankylosing spondylitis (AS) are part of a spectrum of spondyloarthritis (SpA); chronic inflammatory conditions characterised by spinal involvement, with pain, stiffness and reduced range of movement. The condition typically starts in the second or third decades of life and affects men 2–4 times more commonly than women. Physical functioning and quality of life are affected, and previous studies have identified a significant burden in terms of work impairment, early retirement, lifetime health and social care resource utilisation.[1–18] In 2018, Arthritis New Zealand released a report on the economic burden of arthritis in Aotearoa/New Zealand.[19] This report used data from the New Zealand Health Information Service (NZHIS) to gather data on inpatient episodes, the Royal New Zealand College of General Practitioners (RNZCGP) database for data on GP visits, and data from Pharmac on medication costs to generate the reported data. A number of limitations are acknowledged within this report, in particular, the lack of comprehensive 'bottom-up' or 'top-down' data in Aotearoa/New Zealand. This project aims to address the lack of 'bottom-up' data on the effect of SpA on quality of life and the economic impact in New Zealand.

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Methods

Data collection

Participants who fulfilled the Assessment of Spondyloarthritis International Society (ASAS) Criteria for SpA, and a subset who also fulfilled the modified New York criteria for AS, attending specialist clinics at Auckland District Health Board and Waikato District Health Board were invited to participate. Patients were offered the option of completing a paper version of the questionnaires or completing them online using a custom built website. We linked the questionnaires to clinical data on disease duration, activity and severity contributed by the treating physician. The combined dataset included: 1) patient information: age, gender, ethnicity, education level, occupation, marriage status, AS diagnostic date and HLA-B27; 2) disease severity and patient's health: using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath AS metrology Index (BASMI) and ASAS Health Index; 3) work and activity limitation: using the Work Limitations Questionnaire (WLQ) and Work Productivity and Activity Impairment Questionnaire (WPAIQ); 4) quality of life: using the EQ-5D-3L and EQ visual analogue scale (EQ-VAS); 5) AS related costs/resources: transport, accommodation, subsidised and unsubsidised medications, investigations, general practitioner consultations, outpatient specialist consultations, inpatient, and self-funded visits to other health professionals. The list of medications used for SpA was obtained from the treating clinician, sourced from hospital records.

The BASDAI consists of six questions rated on a 0 (no problem) through 10 (worst problem) scale assessing the five major symptoms of AS: fatigue, spinal pain, joint pain/swelling, areas of localised tenderness, morning stiffness duration and morning stiffness severity.[20] BASMI includes clinical measurements of cervical rotation, tragus to wall distance, lumbar flexion, lumbar side flexion and intermalleolar distance, with 0 for mild, 1 for moderate and 2 for severe on each measurement giving a total score of 0–10.[21] Clinicians were asked to provide the most recent scores prior to the study visit. The ASAS Health Index (HI) questionnaire contains 17 items measuring 'functioning, disability and health' with a sum score range from 0 (good functioning) to 17 (poor functioning).[22]

The WLQ is a self-administered questionnaire measuring the degree to which health problems interfere with the ability to perform job roles.[23] We used the 25-item version measuring four WLQ scales: time management scale, physical tasks scale, mental-interpersonal tasks scale and output tasks scale. The responses on these scales were then converted to a percentage of at-work productivity loss. WPAIQ measures absenteeism, presenteeism as well as the impairments in unpaid activity during the past seven days.[24]

The EQ-5D-3L consists of five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) with three levels for each dimension (no problems, some problems, severe problems). Based on the answers to the EQ-5D, the quality of life was estimated using the New Zealand EQ-5D tariff.[25] The EQ-VAS records self-rated health on a vertical, visual analogue scale where the endpoints are labelled 'Best imaginable health state (score 100)' and 'Worst imaginable health state (score 0)'.

Cost analyses

A cost estimation was derived from the societal perspective. All costs were valued in 2017/2018 New Zealand dollars (NZ$). Direct costs were calculated by adding up out-of-pocket costs and costs of public healthcare services. Costs of public healthcare services were computed using the bottom-up approach, by multiplying the amount of medical resources with the unit costs of each medical resource type. The unit costs of pharmaceuticals were from the PHARMAC online Pharmaceutical Schedule.[26] The unit costs of inpatient and outpatient services were provided by the Waikato District Health Board. Indirect productivity loss costs were calculated using the human capital approach. Costs of productivity loss included the loss of salary because of absenteeism and presenteeism due to AS.

Statistical analyses

Quality of life and total costs were compared by gender, ethnicity, age group (18–24, 25–44, 45–64, 65+ years), disease duration (0–5, 6+ years), ASAS HI score (<6, 6+), BASDAI score (<4, 4+) and biologic

drugs user (Yes, No). Biologic drugs include adalimumab, etanercept, and infliximab. Mann-Whitney U test and Kruskal-Wallis 1 way ANOVA were used to examine the differences between subgroups. All data cleaning and analyses were performed in IBM SPSS statistics 25 (New York, United States). For all tests, $p<0.05$ was taken as the level of significance.

Ethics

Ethical approval for the study was granted through the Central Health and Disability Ethics Committee, reference: 16/CEN/172. Institutional approval was obtained from Auckland District Health Board and Waikato District Health Board.

Results

Our study cohort included 81 patients. Table 1 shows the patient characteristics and disease information. Nine patients chose to use the website for data collection, and the remainder used the paper version of the questionnaires. There were 17 (21%) women and 64 (79%) men; eight (10%) identified as Māori and 71 (90%) as non-Māori. The majority of patients (83%) were aged 25–64 years old, and most (66, 82%) were in paid employment. Half of patients (40, 53%) were diagnosed within five years of participation in the study. Twenty-five (31%) patients had private medical insurance. Forty-four

Table 1: Patient characteristics and disease information.

	Number	**Percentage**
Gender		
Female	17	21%
Male	64	79%
Ethnicity		
Māori	8	10%
NZ European	64	81%
Asian	5	6%
Middle Eastern	2	3%
Not reported	2	
Age at survey (years)		
18–24	4	5%
25–44	39	48%
45–64	29	36%
65+	9	12%
Marital status		
Married/living with partner	59	73%
Single/widow(er)	22	27%
Highest education		
Bachelor degree or above	29	36%
Others	52	64%
Employment (working for pay)		
Yes	66	82%
No	15	19%

Table 1: Patient characteristics and disease information (continued).

Private medical insurance		
Yes	25	31%
No	56	69%
Disease duration (n=76/81)		
0–5 years	40	53%
6–10 years	12	16%
11–20 years	9	12%
21+ years	15	20%
Modified New York Criteria fulfilled		
Yes	44	54%
No	37	46%
HLA-B27 (n=76/81)		
Negative	11	14%
Positive	65	86%
BASMI (n=73/81)		
0–1	42	58%
2–3	11	15%
4–5	7	10%
6–7	11	15%
8–9	2	3%
BASDAI Score (n=80/81)		
0–<2	30	38%
2–<4	21	26%
4–<6	19	24%
6+	10	13%
Biologic medication user		
Yes	39	48%
No	42	52%

(58%) patients fulfilled the Modified New York Criteria for AS. Sixty-five (86%) patients were HLA-B27 positive. More than half of patients had a BASMI score of 6–9 (13, 18%), and 10 (13%) patients had a BASDAI score of 6+. Biologic medications were used by 39 (48%) patients.

Seventy-two patients answered the WLQ, and the estimated average at-work productivity loss was 4.8% (Table 2). From the WPAIQ, on average one hour in the prior seven days was missed from work and two hours of productivity were affected due to SpA.

All patients provided the EQ-5D-3L data, with a mean (SD) score of 0.66 (0.18) (Table 2). The mean (SD) score on the EQ VAS was 69.0 (SD 24.1). The ASAS Health Index questionnaire (ASAS-HI) found a mean (SD) score of 5.7 (3.9). Thirty-four (42%) patients had some problems in mobility, 16 (20%) patients had some problems with self-care, more

Table 2: WLQ and EQ-5D results.

Measurement tools	Number of answers	Average score (SD)	Non-biologic user	Biologic user
WLQ At-Work Productivity Loss	72	4.8% (4.5%)	4.9% (4.1%)	4.8% (5.0%)
WPAIQ (in the past 7 days)				
Hours missed from work due to SpA	67	1.0 (2.9)	1.1 (3.4)	1.0 (2.2)
Hours with affected productivity due to SpA	67	2.0 (2.0)	2.3 (2.0)	1.8 (2.0)
Hours actually worked	67	36.4 (15.9)	40.6 (12.4)	31.8 (18.2)
EQ-5D	81	0.66 (0.18)	0.65 (0.17)	0.68 (0.18)
EQ VAS	81	69.0 (24.1)	63.9 (25.1)	73.7 (22.4)
ASAS Health Index	81	5.7 (3.9)	5.5 (3.5)	5.8 (4.2)

than half of patients had some problem with usual activities (43, 53%), 65 (80%) patients had moderate pain or discomfort, and 28 (35%) patients had moderate anxiety or depression (Table 3).

Mean (SD) annual salary was $62,167 ($35,332). The average (SD) annual costs were $15,677 ($11,269) with $12,189 (78%) direct cost and $3,488 (22%) productivity loss (Table 4). The majority of the direct cost

Table 3: EQ-5D results by dimension.

Dimensions	Number	Percentage
Mobility		
I have no problems in walking about	47	58%
I have some problems in walking about	34	42%
I am confined to bed	0	0%
Self-care		
I have no problems with self-care	65	80%
I have some problems washing or dressing myself	16	20%
I am unable to wash or dress myself	0	0%
Activity		
I have no problems with performing my usual activities	37	46%
I have some problems with performing my usual activities	43	53%
I am unable to perform my usual activities	1	1%
Pain/discomfort		
I have no pain or discomfort	14	17%
I have moderate pain or discomfort	65	80%
I have extreme pain or discomfort	2	3%
Anxiety/depression		
I am not anxious or depressed	53	65%
I am moderately anxious or depressed	28	35%
I am extremely anxious or depressed	0	0%

Table 4: Components of annual costs.

List of items	Costs	
	Mean	SD
All direct costs	$12,189	$10,623
GP costs (government contribution)	$98	$106
GP costs (patient contribution)	$91	$123
Outpatient cost	$688	$588
Inpatient cost	$0	-
Medication cost	$10,701	$10,327
Other out-of-pocket cost	$611	$1,230
Productivity loss	$3,488	$5,045
Absenteeism	$1,078	$3,021
Presenteeism	$2,410	$3,116
Total costs	$15,677	$11,269

was medication cost ($10,701, 88%). Other direct costs included GP cost ($189), outpatient cost ($688) and other out-of-pocket costs ($611). Amongst the productivity loss, $1,078 (31%) were due to absenteeism and $2,410 (69%) were due to presenteeism.

There was no significant difference in quality of life or costs by gender, ethnicity, age or disease duration (Table 5).

Patients who had an ASAS-HI score of less than 6 had better quality of life than patients with an ASAS-HI score of 6+ (0.75 vs 0.56, p<0.001), and had lower costs ($13,408 vs $18,245, p=0.03). Patients who had an BASDAI score of less than 4 had better quality of life than patients with an BASDAI score of 4+ (0.73 vs 0.54, p<0.001), but similar costs ($16,327 vs $14,512, p=0.75). The costs for biologic medication users were 4.5 times the costs for those not on biologic medications ($25,073 vs $5,559, p<0.001).

Discussion

This is the first study in Aotearoa/New Zealand that has gathered bottom-up health economic data on people with spondyloarthritis (SpA). The cohort studied is representative of those attending hospital based secondary care clinics and thus may be skewed towards patients with more severe disease, as those with milder SpA may be managed—if not diagnosed—in primary care. However, the characteristics of the current cohort are similar to other published cohorts of patients with spondyloarthritis.[27,28]

Identifying where additional costs are being incurred both by patients and the public health system, may help to identify areas where improvements in health provision and efficiency, could save health dollars and improve patients' quality of life. The majority of the costs were related to the use of biologic medications (~77%) with a smaller but significant contribution from lost productivity (~22%). The costs of biologic medications may fall a little over time with the introduction of biosimilar medications. Additionally, newer agents being developed to treat spondyloarthritis are available as tablets, which may reduce the medication costs further. Productivity loss is likely therefore to become a greater proportion of the total costs over time. Although this study has not looked at the effect of diagnosis or treatment on productivity loss, others have found that earlier diagnosis and treatment can reduce the detrimental impact of this condition on work productivity.[30]

It is evident from the data presented in Table 2 that those on biologic medications have similar levels of work productivity loss but appear to work fewer hours than those

Table 5: Quality of life and annual costs by subgroup.

Subgroups	Quality of life		Costs	
	mean	p-value	mean	p-value
Gender				
Female	0.70	0.69	$13,987	0.52
Male	0.65		$16,126	
Ethnicity				
Māori	0.61	0.27	$21,326	0.12
Others	0.67		$15,289	
Age (years)				
18–24	0.58	0.33	$13,200	0.16
25–44	0.66		$16,581	
45–64	0.67		$16,759	
65+	0.75		$15,686	
Disease duration (years)				
0–5	0.64	0.88	$15,825	0.65
6+	0.68		$15,795	
ASAS-HI				
<6	0.75	<0.001	$13,408	0.03
6+	0.56		$18,245	
BASDAI				
<4	0.73	<0.001	$16,327	0.75
4+	0.54		$14,512	
Biologic medication user				
No	0.65	0.86	$5,559	<0.001
Yes	0.68		$25,073	

not on biologic, since biologic medications are given to those with more severe disease. This is a cross-sectional study and it is not possible to make any conclusion about the use of these medications on change in quality of life or work productivity. This would require a detailed analysis of our prospective data and will be the subject of future work. Data from the British Society of Rheumatology Biologics Registry showed that biologic medication use does improve work productivity for those with spondyloarthritis; in a study of 161 patients commencing biologic therapy, at 12-month follow-up, there were significantly greater improvements (relative to those on non-biologic therapy) in presenteeism, overall work impairment and overall activity impairment.[28] The proportion of patients receiving biologic therapy in our study (48%) is equivalent to overseas cohorts.[27] In Aotearoa/New Zealand, the precise cost of biologic medications is confidential and for this study, the 'list price', which is likely to be higher than the actual cost, was used.

In 2015, Cooksey et al[29] found an annual cost of £19,016 per patient per year in the UK, including direct medical costs, direct non-medical costs and productivity loss costs. Even for those on biologic therapy, our cost data published here compare favourably.

It is perhaps surprising that the mean time taken off work was just over one hour in the past week. This may be subject to recall bias but is very similar to the UK data published by Cooksey et al[29] who found a mean of 1.15 hours absence in the past seven days using the same questionnaire. Shim et al[28] also reported that absenteeism did not change when commencing biologic therapy, suggesting that this may be independent of disease activity.

There were some limitations to our study. Recruitment proved harder than we expected. We did not gather data on early retirement in this study, which may have increased the amount of productivity loss related to spondyloarthritis.

Despite the above limitations, we have found evidence to suggest that spondyloarthritis is associated with a meaningful reduction in quality of life and reduced work productivity in Aotearoa/New Zealand. Understanding the health economic implications can assist with service provision and funding of treatment options. Data from Aotearoa/New Zealand are needed across a range of musculoskeletal conditions to help us understand the impact these conditions are having.

Competing interests:
Douglas White reports speaker fees for Abbvie outside the submitted work and has been an investigator on several clinical trials sponsored by Abbvie. Nicola Dalbeth reports speaker fees from Abbvie and Janssen, outside the submitted work.

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Electronic cigarette online marketing by New Zealand vendors

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ABSTRACT

AIMS: To examine the characteristics of the online marketing environment and the presence of safeguards to protect children from e-cigarette (ENDS) experimentation and uptake in New Zealand.

METHODS: The search engine 'Google Chrome' was used to identify New Zealand vendor websites, Facebook and Twitter accounts. 'YouTube NZ' was searched for videos related to ENDS.

RESULTS: A total of 59 New Zealand vendor websites were identified; of these, only 10% (6/59) required age proof before purchase. A majority (68%) had no detectable health warnings, and only 25% mentioned nicotine addiction. Most (92%) of the websites used at least one social networking or video sharing site in their marketing. The lowest ENDS price advertised in the websites reviewed was $NZ9.95 (US$6.60) and the cheapest 10ml e-liquid bottle was $NZ3.50. All 60 accessible Facebook accounts, and nearly all (96%; 25/26) accessible Twitter accounts associated with New Zealand vendors, had no health or addiction warnings. Of the 52 accessible YouTube videos that had links to New Zealand vendor websites, none had a health or addiction warning.

CONCLUSIONS: This study suggests that the online marketing of e-cigarettes (ENDS) by New Zealand vendors lacks adequate information for consumers and does not effectively prevent access by children and young people. Careful monitoring of ENDS online marketing is required to inform policies that reduce the risk that children and non-smokers may experiment with ENDS. International health bodies and government policy-makers should actively consider regulations designed to reduce the risks that online ENDS marketing appeals to youth and adult non-smokers, and promotes experimentation.

E-cigarette or electronic nicotine delivery systems (ENDS) heat e-liquids that contain compounds including nicotine, propylene glycol, vegetable glycerine and flavours to form an aerosol that users inhale. ENDS include 'pod mods', also called pod vapes, vape pods and mini vapes. The heating of e-liquids may produce unstable compounds that have potentially toxicological effects on users.[1–3]

There appears to be a substantial need for caution about the safety of vape products, the effects of exposure to secondhand vapour, and ENDS' efficacy as harm reduction and tobacco dependence treatments.[3–5] Passive exposure to ENDS vapour may cause adverse health effects in non-users.[6–8] The use of vape products by non-smoking adolescents raises serious public health concerns, as youth have increased vulnerability to the effects of nicotine, which negatively affects brain development.[9,10]

ENDS advertising has used themes likely to appeal to young people, including claims of enhanced social status, activity and romance, and endorsements by celebrities esteemed by young people.[11] These promotions may stimulate youth initiation and ongoing use.[12] Increasing use of social media to promote ENDS is likely to expand the advertising reach among youth, further promoting initiation and use.[13]

The value of the ENDS global annual sales was estimated at US $10 billion in 2015,[14] with a recent entrant, JUUL Labs, valued at US$15 billion in 2018.[15] Brand value has been aggressively supported by online marketing[16–18] and appears unconstrained by regulations that impede youth uptake. For example, a US-based study found that more than 35% of online ENDS vendors did not use age verification.[19]

Study context

In New Zealand, the ASH Year 10 survey of 2017 found that 29% of Year-10 students had tried an e-cigarette that year, up from 21% in 2014.[20] Weekly use was reported at 3.9% of all students, but at only 1.4% for never-smokers.[20] The Youth Insights Survey 2016 of Year-10 students found that the ENDS current and daily use among Māori (indigenous) youth was higher compared to non-Māori.[21] The wording in these surveys may result in underestimations of use, as some young people differentiate between 'e-cigarettes' and 'pod mods'.[22] In a comparison of smokers and recent ex-smokers (aged 18 years or over) in 14 countries, New Zealand had the second-highest level of vaping (7.8% for daily use of nicotine vaping products).[23] We found no data on the estimated size of the ENDS market in New Zealand.[24]

In June 2018, New Zealand Government's Ministry of Health (MoH) announced that "vaping products manufactured from tobacco" (ENDS containing nicotine) and heated tobacco products "can be legally sold in New Zealand".[25] Current legislation appears to prohibit the sale and supply of vaping products to those aged less than 18 years,[25] although we found no evidence that these regulations are enforced. The MoH has stated that the Smoke-free Environments Act 1990, which prohibits tobacco advertising and sponsorship, also applies to vaping products (see online Appendix 1 for details of the relevant regulations).[25] In November 2018, the New Zealand Government announced that there would be new regulations for "changes to the way vaping products are displayed in retail stores" but no mention was made of online marketing.[26] In May 2019, the Government was reported to be aiming to pass the legislation on ENDS containing nicotine "before the middle of 2020".[27]

Given this background, we aimed to describe the online marketing of vape products in New Zealand by exploring characteristics of New Zealand-based ENDS online vendors and their websites, along with their use of social media platforms such as Facebook, Twitter and YouTube. In particular, we examined the presence of safeguards to protect New Zealand children and youth (under 18 years of age) from ENDS experimentation and uptake.

Methods

Online searches were conducted to identify New Zealand-based ENDS online vendors targeting New Zealand consumers. All web searches were conducted during September 2018 on Google Chrome in the 'incognito' mode, to minimise the influence of browser history and search history. The words 'New Zealand' or 'NZ' (one at a time) were added to all searches.

Search strategy for data collection from New Zealand commercial websites

From the 13 key search terms used by Zhu et al 2014 (which covered permutations of 'e-cigarette' and 'vape'),[28] we used Google Trends to identify the five most popular search terms in New Zealand that related to ENDS, in the 12 months to August 2018. Google Trends was used to compare five terms at a time and eliminated the least popular terms. The five most popular terms found were 'vape', 'vaping', 'e cigarette', 'e cig' and 'ecig', which we then used separately in searches. We collected website addresses for the first 50 items found for each of the five search terms (plus either 'New Zealand' or 'NZ'), for a total of 500 websites addresses.

A list of websites was compiled from these search results, with duplicates removed. We then reviewed the content of all websites and applied inclusion and exclusion criteria. For our study, the five inclusion criteria for being a 'NZ online ENDS vendor' were: either having their business address in New Zealand, having their Internet Protocol (IP) address (by using 'command prompt' function and 'IP tracker Geolocation') located in New Zealand, having a New Zealand URL, having a physical retail store in New Zealand or having links to

other websites with physical retail stores in New Zealand. Websites that met any of these five criteria were included. We excluded websites containing only news articles, non-commercial (information only) websites, support groups, commercial websites with no sales of ENDS and international websites that had no physical retail stores or links to physical retail stores in New Zealand. ENDS vendor social networking sites were considered in the separate search using the terms 'Facebook' and 'Twitter' (see below).

We examined each website meeting at least one inclusion criterion and collected data on age verification procedures, the lowest prices, number and types of flavours, links to social networking services or video-sharing websites for marketing, websites' addresses, health and addiction warnings, other ENDS vendor links and the marketing of tobacco or paraphernalia for tobacco (see Tables 1 and 2). We did not collect data regarding health claims made by these websites for marketing, as a number of studies have already examined this question.[11,29–32]

Using Google Trends (ie, by comparing five terms at a time and eliminating the least popular terms), we identified the five most popular ENDS business names from the final list of websites created after exclusions. To obtain a more comprehensive understanding of flavour marketing, we further assessed these five websites. Specifically, we collated the number of flavours available, number of fruity/candy flavours, number of dessert flavours and number of other flavours offered. Because fruit and candy flavours were difficult to differentiate, we categorised these into one group.

Search strategy for data collection for New Zealand ENDS vendors using social networking services

The approach outlined in a US-based study that examined the activity of internet-based ENDS vendors on Facebook and Twitter (nearly all of whom were located in the US), was followed.[19] To obtain comparable data, Facebook and Twitter accounts of New Zealand-based ENDS vendors were also assessed.

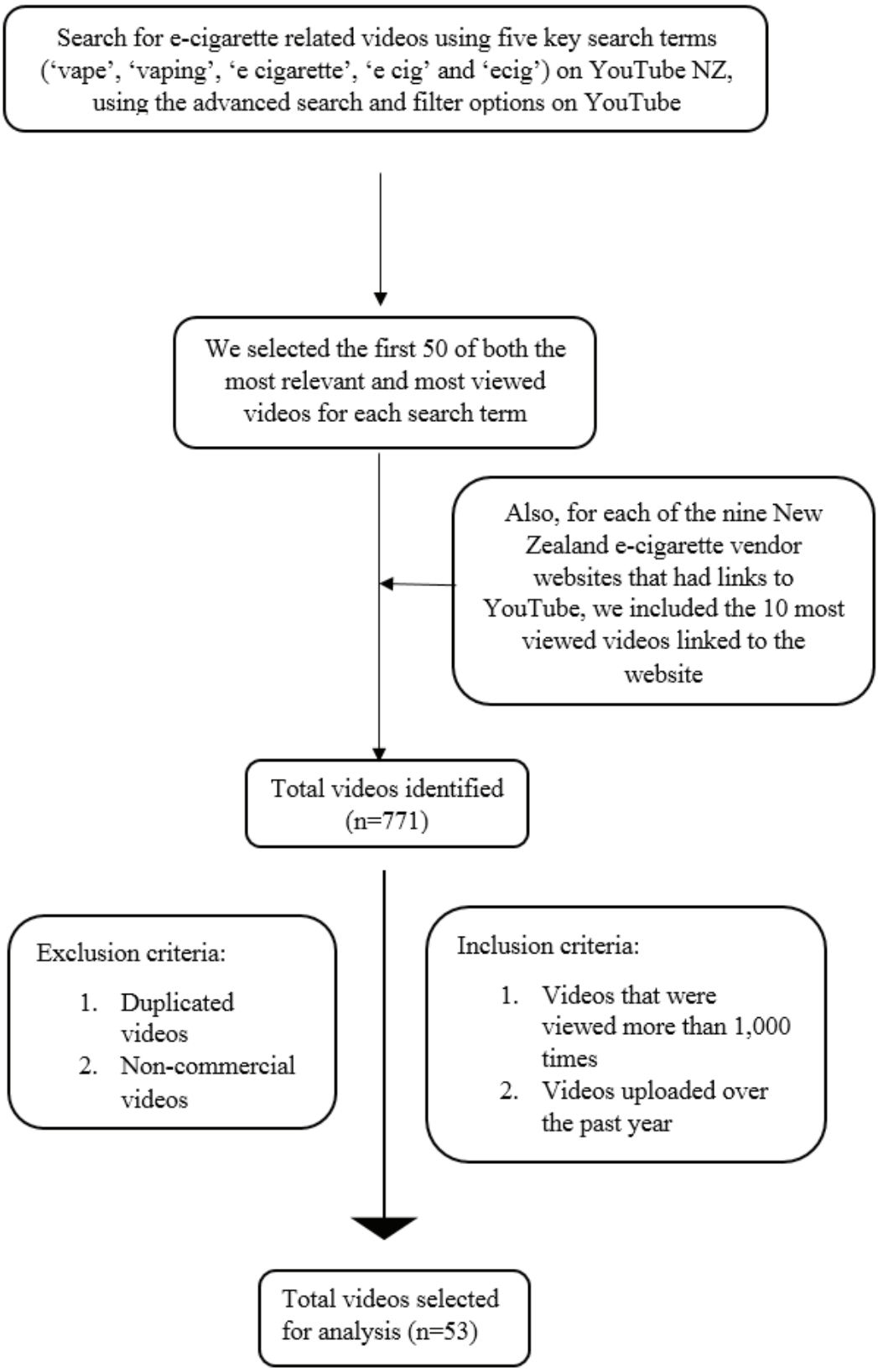
We used the same key search terms on Google Chrome as for the website search strategy, adding the extra terms 'Facebook' and 'Twitter'. The web addresses for the first 50 items found were collected for each of 'Facebook' and 'Twitter', and the linked Facebook and Twitter pages from the previous list of websites were also noted. We included only accounts geographically located in New Zealand, which we established using location information or New Zealand URL links on vendors' Facebook and Twitter pages. After removing duplicates, we constructed a list of Facebook and Twitter accounts from the search results. We then collected data including any age verification process, lowest prices, geographical location and inclusion of health warnings.

Data collection for video sharing websites

Analysis of the links to videos on New Zealand vendors' websites showed that all routed to YouTube. We therefore searched YouTube NZ, using the same five search terms as used for vendor websites. These searches used YouTube's 'advanced search' and 'filter' options, and included only videos uploaded during the past 12 months. We included the first 50 of both the most relevant (as determined by Youtube) and most viewed videos. For each of the nine New Zealand ENDS vendor websites that had links to YouTube, we also included the 10 most viewed videos linked to the website. We removed duplicates and non-commercial videos, and included only videos linked to New Zealand ENDS vendor websites that had been viewed more than 1,000 times. The search strategy for YouTube videos is summarised in Figure 1.

We analysed the age verification process required to access these videos, and analysed health and addiction warnings. Because many videos featured alcohol use along with ENDS marketing, we also systematically collected data on alcohol use.

Figure 1: Search strategy for YouTube videos relating to ENDS marketing in New Zealand.



Results

Websites

After excluding duplicates from the 500 websites retrieved, we reviewed 129 websites. A further 70 were excluded after applying the exclusion criteria outlined above, resulting in a final total of 59 websites. Of these, 88% (52/59) sold both ENDS and e-liquids, two only sold ENDS, and five only sold e-liquids. The key findings for websites marketing to New Zealand are summarised in Table 1. Detailed data sheets are available on request for all results.

Location of websites

Of the 59 websites, 25% (15/59) were located outside New Zealand. The IP location of these 15 websites showed Ottawa in Canada (as they used web-hosting platform Shopify), Australia or the US. We included these websites in our study as they either had an internet link (URL) for New Zealand or a physical retail store in New Zealand (the websites linked to 126 New Zealand physical retail stores).

Age verification

Of the 59 websites, 47% (28/59) used a pop-up or dialog/tick box to 'verify' age for *access* to the site and 41% (24/59) did not use any detectable form of age verification. To make a *purchase*, 10% (6/59) required identity proof (eg, scanned driver's licence or passport). One site required only credit card payments; in New Zealand people from age 14 may become an additional card-holder on a parent's credit card.[33]

Links to social networking services

Most (92%, 54/59) websites used one or more social networking services as part of their marketing, including Facebook (90% of websites), Instagram (61%) and Twitter (39%) (see Table 1). In addition, 37% (22/59) were linked to Google Plus and 10% (6/59) to Snapchat. Among video sharing websites, YouTube (15%, 9/59) was the only platform linked to any of the 59 websites.

Table 1: Findings for 59 websites marketing vape products to New Zealanders (column percentages).

Characteristic	Marketing for both physical retail stores and online* (n=35)	Online only* (n=14)	Online vendors only but linked to other websites with physical retail stores in NZ* (n=8)	Others (physical retail vendors outside NZ, but online only vendors in NZ)* (n=2)	Total# (n=59)
Presence of age verification	19 (54%)	8 (57%)	7 (88%)	1 (50%)	35 (59%)
Presence of health warnings	9 (26%)	5 (36%)	4 (50%)	1 (50%)	19 (32%)
Links to Facebook	32 (91%)	12 (86%)	8 (100%)	1 (50%)	53 (90%)
Links to Twitter	14 (40%)	6 (43%)	2 (25%)	1 (50%)	23 (39%)
Links to Instagram	22 (63%)	6 (43%)	7 (88%)	1 (50%)	36 (61%)
Links to YouTube	5 (14%)	3 (21%)	1 (13%)	0 (0%)	9 (15%)
Using pictures for flavour marketing	18 (51%)	6 (43%)	2 (25%)	2 (100%)	28 (47%)

*Percentages based on the denominator of the type of marketing.
#Percentages based on the total 59 websites.

Health and addiction information

A third of vendor websites (32%, 19/59) displayed one or more health warnings. Five mentioned only the health effects of nicotine, two mentioned nicotine addiction, one mentioned the health risks associated with vaping for pregnant and/or breastfeeding women, and three mentioned both nicotine addiction and nicotine health effects. A further four mentioned both nicotine addiction and the health risks associated with their use by pregnant and/or breastfeeding women, and four mentioned all three types of risks. None mentioned potential health risks from inhaling e-cigarette vapour. The majority of health warnings appeared to be in small font and were located among the website terms and conditions.

Twenty-four of the 59 (41%) websites provided links to articles or reports on the relative harm or safety of vaping when compared to that of traditional smoking. Seven (12%) provided links to testimonials provided by customers.

Refills and flavours

Of the 57 websites that sold liquid refills for ENDS, 49% (n=28) used pictures to depict flavour options (see references[34,35] for examples of the pictures). More than 50 flavours were offered by 24 (42%), and 22 (39%) had more than 50 sweet flavours. Table 2 outlines these findings.

Of the five most 'popular' vape companies (based on Google Trends for analysis of New Zealand websites), two offered more than 200 flavours on their websites. The most common flavours available on these two websites (https://www.vapo.co.nz/ and https://www.shosha.co.nz/), were fruit/candy flavours (208 and 177 of these flavours, respectively) followed by dessert flavours (180 and 39 options, respectively). Online Appendix 2 provides data for all five websites.

Prices of ENDS devices and e-liquids

The cheapest ENDS devices on these websites ranged from $9.95 to $99.99, and the cheapest refills ranged from $3.50 (for 10ml) to $60 (all in NZD). The cheapest ($9.95) ENDS was a disposable—non-refillable. The sizes of e-liquid bottles varied from 10ml to 120ml.

Tobacco-related data

Of all the 59 websites, 19% (11/59) also sold paraphernalia for smoking tobacco or herbal products, such as herbal vaporisers, hookah vases, grinders, scales, pipes, rolling papers, blunt wraps etc, and 4% (2/59) also sold loose tobacco, cigarettes, cigars or hookah tobacco.

Table 2: The numbers of flavours offered by websites selling refills for vape products for the New Zealand market.

The number of flavours available	**Number of websites (n=57)**
>100	16 (28%)
75–100	4 (7%)
50–74	5 (9%)
25–49	12 (21%)
<25	20 (35%)
Total websites selling flavoured refills	**57 (100%)**
The number of sweet flavours available (fruit, candy, desserts)	
>100	11 (19%)
75–100	1 (2%)
50–74	10 (18%)
25–49	13 (23%)
<25	22 (39%)
Total websites selling sweet flavour refills	**57 (100%)**

Table 3: Facebook accounts used for marketing of vape products to the New Zealand market.

Characteristic	Yes	No
Age verification	0	60 (100%)
Health warnings	0	60 (100%)
Posts about ENDS	42 (70%)	18 (30%)
Posts about e-liquids/flavours	48 (80%)	12 (20%)
Use of pictures for flavour marketing	14 (23%)	46 (77%)
Information about sales, new arrivals and vouchers	49 (82%)	11 (18%)

New Zealand Facebook marketing

After the removal of duplicates and the application of exclusion criteria, we found 60 New Zealand Facebook accounts used for marketing ENDS, all located in New Zealand (see online Appendix 3 for exclusion/inclusion details). The key findings for Facebook are summarised in Table 3.

Of the 60 accounts, none had any form of age verification, or any health or addiction warnings. Nine provided links to reports or articles on the relative harm or safety of ENDS compared to tobacco products. Of all the accounts, 52% (31/60) had more than 1,000 followers, with a median follower count of 1,079, and 7% (4/60) featured posts from the business owner about paraphernalia for tobacco smoking.

New Zealand Twitter marketing

After the removal of duplicates and application of exclusion criteria, we found 26 Twitter accounts used for marketing ENDS, accessible without an account login (see online Appendix 3 for exclusion/inclusion details). None of these accounts had any detectable age verification and only one mentioned any health or addiction effects from vaping. ENDS device marketing was found on 62% (16/26) and there was e-liquid/flavour marketing on 58% (15/26). Of the 26 accounts, 19% (5/26) used images to market flavours and 69% (18/26) provided information about sales, offers and new arrivals. One account included tweets from the business owner about paraphernalia for tobacco smoking.

New Zealand YouTube marketing

The search strategy identified 771 YouTube video links; after removing duplicates, 352 videos remained. After removing those that had no links to New Zealand ENDS vendor websites and had been viewed fewer than 1,000 times, 53 videos remained for analysis. Of these 53 videos, only one required YouTube sign-in to access the video. Of these remaining 52 videos, 51 had links *to* New Zealand ENDS vendor websites (on the YouTube site below the video) and one video was linked *from* a New Zealand vendor website. Of the 52 videos, nearly all (50/52) were from the same uploader located in Australia. None of the 52 had any detectable age verification process or health or addiction warnings. ENDS device marketing was found in all the videos and 87% contained e-liquid/flavour marketing (45/52). Video view numbers ranged from 4,814 to 150,578, with total views of 1,330,341 and average views of 25,583. Of the 52 videos, alcohol use was visible in most (90%, 47/52). See reference[36] for example images from these videos with alcohol.

Discussion

Principal findings

Despite existing New Zealand law apparently prohibiting ENDS sales to youth, 90% of New Zealand ENDS vendor websites marketing to New Zealand consumers did not require age-verification prior to purchases. These findings are concerning, given US evidence that youth can easily access ENDS by internet purchases; these sites either have inadequate methods of age verification or claim that age will be verified at delivery.[37] Age verification procedures through credit card payments may also be ineffective, as youth may obtain credit cards issued on their parents' accounts.[38] Inadequate age verification processes in New Zealand ENDS vendors' websites may enable

young New Zealanders aged 18 and under to buy and use vaping products.

A majority (68% of websites, 100% of Facebook accounts, 96% of Twitter accounts and 100% of YouTube videos) did not contain health or addiction warnings. Given the importance of minimising ENDS uptake among non-smoking adolescents, New Zealand policy-makers should draw on international research that found warnings may reduce uptake among adolescents.[39]

Around two-fifths of the marketing websites examined offered more than 50 sweet flavours. Flavoured ENDS are associated with higher chances of user initiation, lower odds of intention to quit smoking and also weaker perceptions of tobacco harm among youth.[40] Adolescents in the US preferred flavoured ENDS to non-flavoured ENDS,[41] and found sweet flavours most appealing.[42]

The websites provided ENDS and e-liquids at prices that appear to be within the reach of many New Zealand children and adolescents, with the cheapest ENDS at NZ$9.95 and the cheapest 10ml e-liquid refill at $3.50. In comparison, the cheapest mobile phone and computer tablet identified on a popular New Zealand technology store website was $49.99 and $139.99 respectively.[43,44] In 2019, the cheapest pack of 20 cigarettes on one New Zealand online store was $24.50 (for the 'Easy' brand).[45]

The media used to market ENDS have high reach among youth. Most (92%) of the websites reviewed used one or more social networking service to amplify their marketing reach. Social media platforms offer marketers extensive reach at a low cost and are valued among those marketing to youth because of their ability to influence peer to peer networks.[46]

Implications for public health

International health bodies (eg, WHO) and government policy-makers should actively consider requirements that would reduce the risks online ENDS marketing may pose to young people. Specific measures could include reducing the ease with which young people may currently purchase online ENDS products. For example, governments could require online marketers to provide a physical business address, which would allow the location and monitoring of businesses, as well as providing an avenue for customers' feedback.

Internationally, effective age verification processes have required date of birth evidence in conjunction with a Social Security number.[38] However, many countries, including New Zealand, do not have individual identity numbers, although tax numbers or drivers' licences may be a possible substitute for those old enough to obtain either. Another alternative is government-led e-ID schemes, used by many countries to prevent youth access to online gambling.[19,47] With the known side-effects of nicotine on brain development during the adolescence period,[9,10] and evidence that ENDS ever-use may be related to smoking initiation,[48,49] an effective age verification process seems essential.

There is very little evidence on the type of health warnings required to reduce the prevalence of vaping among youth.[50,51] We found that warnings (on the few sites where these were present) were suboptimal in content, format and location/visibility on the websites. We suggest that all online vape marketing pages should be required to feature visually salient health warnings about nicotine addiction and potential health risks.

We interpreted the relevant current national law (see *Background* and online Appendix 1) to be that only words (not pictures) may be used in marketing vape products on the internet, using only black lettering on white backgrounds, with only the brand, variant, amount and price. This approach could be used for strengthened new regulations in New Zealand and elsewhere.

Evidence that some youth consider flavour the most significant factor in trying ENDS, were more likely to initiate vaping through flavoured ENDS,[52] and vape more frequently when using flavours, raises serious concerns about the widespread marketing of flavours.[40,53] Policy-makers could consider restricting flavours most commonly used by youth (eg, all but mint, menthol and tobacco flavours as proposed in the US), or a total ban on flavours for vape liquids.[54] In addition, they could require e-liquid marketing to use standardised packaging, a measure that would

reduce the visually appealing imagery often featured on these products. Around half of the websites, 33% of Facebook pages and 19% of Twitter pages studied used images for flavour marketing. Research indicates that images on Instagram and Pinterest play an important role in ENDS marketing.[55]

This study found the New Zealand vendors who marketed ENDS during the time we collected data were largely unaware of or did not follow existing legislation and Ministry of Health guidance. This gap between policy-makers' expectations and marketing practices suggests that regulations could focus on mandating health and addiction warnings, requiring effective age verification, and reducing the widespread availability of flavours likely to appeal to young people.

Regulating New Zealand online ENDS vendors appears to be within the ability of the New Zealand Government.

All, or nearly all, of the websites examined were based in New Zealand, either through a physical store, a business address, a New Zealand IP address or a New Zealand URL, and thus may be subject to New Zealand Government policies.

Strengths and limitations of this study

This study is the first to analyse ENDS marketing in New Zealand. Limitations include the difficulty of classifying flavours, given the overlap in categories; our decision to combine some categories rather than make spurious distinctions between these may limit comparisons with earlier studies. The location of health and addiction warnings in subpages or within website terms and conditions, and their typically small font size, meant it was often difficult to detect this information. It is therefore possible that we under-recorded these warnings; however, given we were systematically searching for this information, the difficulties we had suggest casual website visitors will be even less likely to locate warning information. Limits on our search terms, the items from each search, the number of Facebook and Twitter posts, and the number of videos examined may mean that our results are not fully comparable to studies based on more extensive searches.

For future research

This study did not include international websites that market ENDS to the New Zealand population but have no direct link to New Zealand. Future research needs to develop methods to assess the online marketing *to* a particular jurisdiction from all locations. The very limited research on vape product marketing on Instagram[55] indicates that research is needed to explore the detailed characteristics of vendors on Instagram and their use of third-party endorsers;[56] as well as use of other increasingly popular social media such as Google Plus. As the availability of sweet flavours can encourage vaping initiation among youth, a detailed study of flavour use by youth may help inform relevant policies. A US-based study found that Twitter posts promote ENDS.[57] Further investigation of social media 'viral' promotions may increase understanding of the 'soft' marketing used to promote ENDS and the audiences reached.

Conclusions

This study suggests that the New Zealand online marketing of ENDS lacks adequate information for consumers. These findings suggest that clear and enforced regulations are required to manage online vape product marketing. The June 2018 announcement by the New Zealand Government on 'vaping products manufactured from tobacco'[25] appears to have opened the door to legal sales, without sufficient and timely Government policies and mechanisms to control marketing. Our data indicates that the Ministry of Health statement urging 'trade[ing] responsibly'[25] had, as at October 2018, been ineffective in regards to online marketing.

This policy gap is particularly problematic, given the uncertain long-term effects of vaping and the potential risks of harm to non-smoking youth.[58] Insufficient age verification, the absence of health and addiction warnings, use of social networking services and video sharing websites, and the presence of many sweet flavours may all promote vaping initiation among youth and non-smokers. Current policy mechanisms do not appear to mitigate this risk, and policy in development by the New Zealand Government should prioritise the wellbeing of children and young people.

Appendix 1: New Zealand Ministry of Health information about the marketing of vape products as at May 31, 2019

The Ministry interpretation of the legislation and case law is that the Smoke-free Environments Act (SFEA) 1990 prohibition of tobacco advertising also applies to vaping products:

"An implication of the Court's decision is that the same SFEA regulatory controls apply to smoked tobacco, heated tobacco and vaping products that are manufactured from tobacco. This includes the ban on sales to minors and restrictions on advertising."[59]

The SFEA applies to the broad range of media, such as radio, television, billboards and the internet. Accompanying legislation (Section 23 (3)) states:

"Any person who offers any tobacco product for Internet sale … may, …. allow to be visible … information that is only in the form of printed or written words, and that—

(a) does no more than identify the tobacco product and indicate its price; …"[60]

The relevant regulations under the SFEA state (s.55):

"How information about tobacco products offered for Internet sale must be provided …

(3) The information must be in the form of printed or handwritten words in black on a white background.

(4) The information must be— (a) limited to the brand of tobacco product, the variant, the amount or quantity or size, and the price; …"[61]

The Ministry has stated:

"Until the SFEA is amended, retailers should continue to trade responsibly and, in particular, not to advertise or sell vaping products to children and young people under 18 years of age"[59]

Appendix 2: Flavours offered by the five most popular New Zealand ENDS marketing websites

Results as at September 2018:

Name of website	Website address	Number of flavours	Number of fruit/candy flavours	Number of dessert flavours	Number of tobacco flavours	Number of menthol flavours	Other flavours	Pictorial representation of flavours
Lawless	https://www.lawless.co.nz/	8	8	0	0	2	0	No
Vapo	https://www.vapo.co.nz/	224	208	180	23	22	6	No
Shosha	https://www.shosha.co.nz/	203	177	39	26	21	31	No
Vape NZ	https://www.theministryofvape.co.nz/	59	30	24	4	3	2	Yes
Vaporium	https://vapourium.nz/	34	17	10	3	6	5	Yes

Appendix 3: Operation of exclusion/ inclusion criteria for Facebook and Twitter.

New Zealand Facebook

A total of 553 Facebook website addresses were found using our search strategy. After the removal of duplicates and the application of exclusion criteria, we found 90 New Zealand Facebook accounts used for marketing ENDS, all located in New Zealand. Of these, 28 (31%) needed a Facebook account login and one could not be accessed, leaving 61 accessible accounts which did not require a Facebook login. Of these 61, two accounts redirected to another vendor Facebook account which was not on our list. Thus, we did not include those two accounts, and instead included the further account in our list, for a total of 60 Facebook accounts.

New Zealand Twitter

Our search strategy produced a total of 523 Twitter accounts, with 31 left after the removal of duplicates and the application of exclusion criteria. Out of the 31, one was not accessible and four were redirected to one further ENDS vendor's Twitter page, which was not on our list. Hence, we excluded those four redirecting accounts and included the one further Twitter account, for 27 accounts. Of the 27, one required a Twitter account login to access, leaving 26 accounts accessible without an account login.

Competing interests:
Nil.

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Outcomes of patients with ST elevation myocardial infarction in the era of second-generation drug eluting stents; five-year follow-up

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ABSTRACT

AIM: The second-generation everolimus and zotarolimus drug eluting stents (DES) have shown superiority for repeat revascularisation and safety to the first-generation devices for stable patients. However, the benefit of those devices in the setting of ST elevation myocardial infarction (STEMI) has remained questionable due to concern regarding stent thrombosis (ST) seen with the first-generation devices. We review the outcomes of patients with STEMI treated in our centre at a time when the second-generation DES became the standard of care.

METHODS: All patients who presented to our institution with STEMI and underwent emergency percutaneous intervention (PCI) in 2012 with second-generation DES were identified. Case notes and electronic records were reviewed. Patients undergoing staged PCI to non-culprit lesions were excluded. Patients who died during the primary cardiac event with cardiogenic shock were also excluded.

RESULTS: A total of 399 patients (mean age 65+/-12, 274 (76%) male) were identified. Thirty-five patients (8.7%) died during hospitalisation with cardiogenic shock and were excluded from the subsequent analysis. A further 35 patients died during follow-up. Patients received a mean of 1.15 DES. Median follow-up time was 4.7 years. Median door to reperfusion time was 90 minutes. The all-cause mortality rate for STEMI survivors was 9.6%. Cardiac mortality rate was 3.6%. Thirty-one patients (8.5%) re-presented with symptoms leading to repeat coronary angiography. In-stent restenosis (ISR) was observed only in eight patients (2.2%). The significant factors associated with re-presentation were smoking and medication non-compliance.

CONCLUSION: Early mortality rates following emergency PCI for STEMI remain high despite low reperfusion times. The five-year follow-up data would suggest that STEMI survivors have good outcomes with the second-generation DES.

The first-generation drug eluting stents (DES) were first introduced in 2002. Randomised controlled trials between 2002 and 2004 on sirolimus DES[1–4] and paclitaxel DES[5-7] showed lower rates of in-stent restenosis (ISR) compared with equivalent bare metal stents (BMS). Stent thrombosis (ST) is the most feared complication of percutaneous coronary intervention (PCI). The rates of ST did not improve with the use of the first-generation DES compared with BMS and remained the highest among patients with ST elevation myocardial infarction (STEMI).[8]

Evolution in stent design led to reduction in stent strut thickness and use of everolimus or zotarolimus with more biocompatible carrier polymers, now

referred to as the second-generation DES. These second-generation DES were shown to have improved efficacy and safety profile in various large randomised controlled trials compared to paclitaxel DES[9–11] and sirolimus DES.[12] Pertinently, this included lower rates of ST. However, only a small number of patients included in those trials had STEMI. Thus, concerns about ST in this cohort have persisted, particularly as the major pathological hallmark of STEMI is presence of thrombus due to plaque rupture. A recent meta-analysis showed a significant reduction of ST with the use of the second-generation everolimus DES compared with the first-generation sirolimus DES in the context of STEMI.[13]

Methods

All patients at our institution who had primary PCI for acute STEMI during the 2012 calendar year were identified. The characteristics of this cohort have been previously reported.[14] Case notes and electronic records were reviewed. These allow for comprehensive data capture at all public healthcare institutions in the Auckland region. Follow-up data was obtained until at least December 2016. Patients who died during the index admission due to complications from the STEMI were excluded. Patients who did not have a local address and we could not track were also excluded. The door to reperfusion time (DTRT) for the same study population was previously reported and a DTRT of ≤120mins was achieved in 66% of patients.[14]The outcome of patients was measured with different factors. The all-cause and cardiac mortalities were obtained from the clinical records. Re-presentation after STEMI was counted if a patient developed symptoms or clinical signs that led to unplanned repeat coronary angiogram. Planned staged PCI procedures were excluded from this analysis. We analysed different variables for association with re-presentation after STEMI. The relative risk, its standard error and 95% confidence interval were calculated according to Altman.[15] Medication compliance was determined using pharmacy dispensing records. Non-compliance was presumed if there is a subjective large gap in the community dispensary of medications. Statistical analysis was done using MedCalc online software (MedCalc Software, Ostend, Belgium).

Results

After excluding patients who lacked sufficient data (non-local residents), a total of 399 patients were identified. Thirty-five patients died during the index admission due to cardiogenic shock and were also excluded. We therefore analysed data for 364 patients. The baseline characteristics are shown in Table 1.

The median follow-up time was 4.7 years. Thirty-five patients (9.7%) died during follow up. Of these, 13 patients died due to cardiac-related events including acute coronary syndrome (ACS), sudden arrhythmic cardiac death and heart failure. Non-cardiac causes of death included malignancy, sepsis and other causes. The causes of death are listed in Table 2.

Most patients were treated with a single stent in the index procedure, with a mean of 1.15 DES per patient. Thirty-two patients of the total number received bare metal stents (total 42 stents) for medical reasons requiring shorter dual anti-platelet therapy or potential issues with compliance with medications.

A total of 31 (8.5% of total cohort) patients developed symptoms leading to unplanned hospital re-admission and coronary angiography. The characteristics of those patients are shown in Table 3. Five had a widely patent stent and absence of any other significant coronary artery disease. Three patients died during the repeat hospitalisation, one of whom had issues with non-compliance and died as a result of ST. The full findings of the repeat coronary angiography are found on Table 4.

The rate of implanted BMS was 9.1% of the total number of stents (Table 1) for reasons mentioned above. In patients who re-presented, BMS usage was around 28% (Table 3). None of those patients with BMS had a normal angiogram on re-presentation.

Variables were tested to determine whether there was any association between those factors and re-presentations leading

Table 1: Baseline characteristics.

Number of patients		N, 364
Male (%)		76
Age (+/- SD)		65 (+/- 12)
Ethnicity		
NZ European Other European Māori Pacific Peoples Indian Asian Other		216 (59%) 48 (13%) 35 (10%) 33 (9%) 40 (11%) 24 (6%) 3 (<1%)
Culprit artery		
LMS LAD/diagonal LCx/OM RCA/PDA/PLB Grafts		2 (<1%) 166 (45%) 50 (13%) 179 (49%) 2 (<1%)
Total number of stents used	Second-generation DES BMS	419 42
Use of aspiration thrombectomy		304 (83%)
Number of patients undergoing staged PCI for non-culprit vessels		93 (25%)
Risk factors	Hypertension Smoking Diabetes mellitus	185 (50%) 242 (66%) 70 (19%)

Key: LMS: left main stem, LAD: left anterior descending. LCx: left circumflex, OM: obtuse marginal, RCA: right coronary artery, PDA: posterior descending artery, PLB: postero-lateral branch, DES: drug eluting stent, BMS: bare metal stent.

Table 2: Causes of death.

Cause of death	Number of patients
Cardiac • ACS • Arrhythmia • Heart failure	13 5 6 2
Non-cardiac • Malignancy • Sepsis • Stroke • Renal • Trauma • Other	22 8 5 3 2 2 2

Key: ACS: acute coronary syndrome.

to a repeat coronary angiogram (Table 5). Two factors which had statistical significance were smoking (P=0.01, CI 1.3–8.6) and medication non-compliance (P=0.001, CI 2.1–10.1).

Discussion

In our study of contemporary DES for primary PCI in STEMI, we demonstrated good outcomes during our five-year follow-up. Only a total of 14 patients (3.5%) had significant ST or re-stenosis of the culprit vessel. The mean time of developing ST or ISR was 22.3 months. The risk is increased in those with a history of smoking or medication non-compliance. The measure of non-compliance is challenging, and we relied on subjective

Table 3: Characteristics of patients who re-presented within five years.

Total number	N, 31
Male (%)	74
Age (+/- SD)	63 (+/-13)
Ethnicity	
NZ European Other European Māori Pacific Peoples Indian Asian Other	14 (45%) 4 (12%) 4 (12%) 2 (6%) 5 (16%) 1 (3%) 1 (3%)
Culprit artery	
LMS LAD/diagonal LCx/OM RCA/PDA/PLB Grafts	0 (0%) 11 (35%) 6 (29%) 14 (45%) 0 (0%)
Type of stent	
DES BMS	23 patients (30 stents) 9 patients (12 stents)
Stent diameter (range)	3.09mm (2.25–4.5mm)
Documented history of medication non-compliance	6 (29%)
Risk factors	
Hypertension Diabetes mellitus Smoking	14 (45%) 6 (29%) 26 (84%)

Key: LMS: left main stem, LAD: left anterior descending. LCx: left circumflex, OM: obtuse marginal, RCA: right coronary artery, PDA: posterior descending artery, PLB: postero-lateral branch, DES: drug eluting stent, BMS: bare metal stent.

Table 4: Coronary angiography findings on re-presentation.

Angiography finding	**Number of patients (total = 31)**
Normal	5
In-stent restenosis (ISR)	8
Acute stent thrombosis	6
Other lesion-previously thought mild-moderate	5
Other lesion-previously left for medical management despite being severe	7

Table 5: Potential risk factors for re-presentation with clinical findings leading to coronary angiogram.

Factor	Relative risk	P-value	Confidence interval
Smoking	3.37	0.01	1.3–8.6
Hypertension	0.95	0.88	0.4–1.8
Non-compliance	4.6	0.001	2.1–10.1
Diabetes mellitus	1.09	0.83	0.4–2.5
Culprit artery			
LMS	2.1	0.55	0.2–27
LAD/diagonal	0.77	0.7	0.3–1.5
LCx/OM	1.6	0.2	0.6–3.7
RCA/PDA/PLB	1.02	0.95	0.5–2.0

Key: LMS: left main stem, LAD: left anterior descending. LCx: left circumflex, OM: obtuse marginal, RCA: right coronary artery, PDA: posterior descending artery, PLB: postero-lateral branch.

measures based on the frequency of community medication dispensing on the electronic records. However, we can confidently identify some patients who had issues with compliance presenting acutely with ST or ISR. We counted any history of smoking reported by the patient regardless of their current smoking status. There was also a significant association between smoking and re-presentation, which to some degree might have confounding bias. Assuming that non-smokers are more likely to adhere to medical management and adopt a healthier lifestyle.

At least seven patients of this cohort did not have full revascularisation despite having severe non-culprit lesions. This was for various reasons; firstly, during the study period, "full" revascularisation was inconsistently practised. Indeed, the results of the major clinical trials investigating full vs targeted revascularisation in MI patients were only published during 2013 and 2015.[16–18] Secondly, Auckland City Hospital acts as a referral centre for various district hospitals, and patients are routinely transferred back to their base hospital after primary PCI. The subsequent management is often determined by non-cardiologists.

In-hospital mortality was 8.7% in this cohort. In the SWEDEHEART registry the in-hospital mortality rates were 7.2 %.[19] This has decreased in the same registry from 12.5% after primary PCI became the standard of care and was more readily available. The adjusted mortality risk in the NCDR AR-G American registry involving more than 15,000 STEMI undergoing PCI patients was 6%.[20] There are multiple factors involved to account for our higher mortality rate, including time to first medical contact, age and co-morbidities, but also the unique geography of New Zealand meant that many patients must travel long distances, often by helicopter for primary PCI leading to unavoidable delay. It is well documented that each one-hour delay after thrombolysis has an important impact on survival and it is likely the same is true for those undergoing primary PCI.

The all-cause mortality rates also remain relatively high during the five-year follow-up after STEMI with a rate of 9.7%. In our cohort, non-cardiac mortality had higher rates than cardiac mortality (6% vs 3.7% respectively) (Table 2). It is uncertain whether those who died from stroke or renal failure (total = 5) had direct or indirect relation to the primary PCI. There was a time lag in all those patients, but the risk of worsening renal function with contrast cannot be totally excluded. Compared to previous studies, the five-year mortality rate has decreased since the late 1980s from 25.2% to 20.2% in the early 1990s, which has been attributed to increase in the rates of revascularisation and better medical management.[21] A more recent study involving 1,974 patients with STEMI showed that after an eight-year follow-up the adjusted mortality rate for STEMI patients undergoing PCI was 22.5%.[22] The unadjusted mortality rate at five-year follow-up was around 20%. This was conducted during the time of BMS and the first-generation DES.

BMS were used occasionally in our cohort in some cases for the mentioned reasons. BMS are largely replaced nowadays with drug-coated stents and DES with bioabsorbable polymer. We did include patients with BMS in our analysis to give a comprehensive picture of the outcomes during that era. If those cases were to be excluded, the percentage of representation would have fallen as the percentage of BMS use was 9.1%, whereas the percentage of BMS use during re-presentation was 28.5%. This may have further supported the outcome findings. However, the specific clinical settings leading to their use may have created some bias as this group was suspected to have a tendency to bleed, or issues with medication compliance.

We observed a high rate of aspiration thrombectomy performed in STEMI patients at 76%. This was probably driven by the results of the TAPAS trial in 2008 that suggested that thrombus aspiration in STEMI patients leads to a better reperfusion and a better outcome.[23] Subsequent TASTE trial in 2013[24] and TOTAL trial in 2015[25] failed to show an improvement in outcome and there was an increased risk of stroke in the TOTAL trial. The high rate of aspiration thrombectomy devices used has not affected the results of subsequent re-presentation either way as all re-presentations are due to unrelated issues. We did not investigate procedural complications in our study. It would be interesting to see how those landmark trials change our practice in the subsequent years.

Conclusion

The contemporary second-generation DES demonstrated good outcome in STEMI survivors. Compliance with medications and smoke cessation are of high importance to achieve an optimum outcome.

Competing interests:
Nil.
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Influential factors in patient uptake of influenza vaccination during pregnancy; a survey-based audit in a tertiary hospital setting

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ABSTRACT

AIM: The aim of this study was to determine the key influential factors for pregnant or recently pregnant women in deciding on influenza vaccination.

METHOD: This study was conducted in a single tertiary hospital in New Zealand using an anonymous and voluntary patient survey. Ethnicity, age and stage of pregnancy along with self-reported data on factors that influenced the decision to vaccinate against influenza during pregnancy were recorded.

RESULTS: We included 101 participants over the one-week study period, 76% of whom had received the influenza vaccination. The most commonly reported reason for vaccination was the desire for neonatal protection, the common reasons for not being vaccinated were not receiving information on vaccination or safety concerns.

CONCLUSION: There are a variety of factors influencing women when deciding on antenatal influenza vaccination. Further studies are needed to expand on the findings of this small local study in order to be able to improve vaccination uptake through empathetic delivery of evidence-based recommendations.

Influenza is a significant illness worldwide estimated to result in between 250,000–500,000 deaths annually.[1] Identifying at-risk groups is therefore essential in order to prevent and limit disease burden. In 2012, The World Health Association (WHO) recommended pregnant women to be prioritised as a high-risk group in the immunisation program. This decision was based on a range of factors, including higher disease risk in pregnant women, potential protection of infants through placental antibody transfer, safety and efficacy of vaccination and programmatic opportunities.[2]

There is little data on the incidence of influenza in pregnant women.[3,4] A recent systematic review[3] found three studies reporting serologically confirmed disease (two from the UK and one from the US) ranging from 5–11%.[5–7] Influenza is a major indication for admission to intensive care units (ICU) both in New Zealand and internationally.[8–10] During the 2009 H1N1 pandemic, pregnant women accounted for 5.7% of influenza-related deaths worldwide (while only accounting for 1% of the population)[9] and in New Zealand pregnant or postpartum women accounted for 8% of the mortality attributed to

this influenza outbreak.[11] Māori and Pacific peoples have an increased likelihood of ICU admission due to influenza,[10] and the New Zealand Ministry of Health have identified a trend to higher mortality in these ethnic groups.[11] There are also neonatal implications as a result of severe maternal infection including preterm birth (odds ratio 5,5),[12] which is associated with neonatal and long-term morbidity and mortality. Increased caesarean section delivery rates have also been reported with maternal hypoxaemia more frequently listed as an indication and some studies suggest caesarean sections are more frequently occurring outside a controlled operating room setting.[9]

Pregnancy is an indication for influenza vaccination as previously described and there is robust safety data.[13,14] Influenza vaccination effectiveness in pregnancy is best estimated at between 44–63% for laboratory confirmed influenza with a 36% decreased likelihood of febrile respiratory illness.[15,16] In 2018 during the study period, the estimated vaccination effectiveness in New Zealand was 38% for protection against hospitalisation, and 35% for consultation for a an influenza-like illness in the general population.[17] There is also convincing evidence for neonatal benefit with vaccination effectiveness between 49–63% in prevention of confirmed influenza.[15,18]

An Australasian study on the heels of the 2010–2011 H1N1 pandemic showed only 60% of pregnant women were offered influenza vaccination,[19] yet the most important factor in vaccination uptake is advice from health professionals providing antenatal care, with women 20 times more likely to be vaccinated following a recommendation.[20–23] The difference in practice among varying care providers might also be an influential factor with patients receiving the majority of their antenatal care from a private obstetrician significantly more likely to have been recommended vaccination than those seen in hospital or by their general practitioner (GP).[20] Previous vaccination, high-risk co-morbidity, older age and family support are positively correlated with vaccination rates, while lower socioeconomic status is negatively correlated.[24–26] The most commonly reported motivational factors for vaccination are neonatal protection and perceived level of influenza risk,[20,25] while the most common factors leading to decide against vaccination are concern about side effects, teratogenicity and a perceived lack of benefit.[25,26]

The aim of this study was to determine the key influential factors for pregnant or recently pregnant women in deciding on influenza vaccination by way of a survey conducted in a tertiary New Zealand hospital.

Materials and methods

Setting and population

The study was carried out Wellington Hospital, a tertiary unit within the Capital and Coast District Health Board (CCDHB). The CCDHB provides public healthcare to a population of approximately 300,000, with low levels of deprivation relative to the New Zealand average with one in five living in the least deprived areas (NZDep2013 decile1).[27] There is a lower proportion of Māori (10%) and higher proportion of Pacific (7%) and Asian peoples (11%) than the national average.[27]

Survey design

The survey design was based on the US Centre for Disease Control and Prevention Pregnancy Risk Assessment Monitoring System Phase 8 (2016) Topic Reference questionnaire and modified to adapt to the local context by consensus from the author group.[28] The questions were designed to elucidate the main reasons why women underwent influenza vaccination. It was not possible to validate the questionnaire due to the limited timeframe available to the author group for designing the study and collecting the material.

The survey was anonymous and responses kept in secure data storage. Self-reported data included age, parity, ethnicity (as per Ministry of Health reporting guidelines[29]) and vaccination status for the 2018 influenza season. The survey was distributed during the seven-day period 10 August 2018–17 August 2018. The survey is displayed in Appendix 1.

Inclusion criteria and recruitment

Women who were known to be greater than 12 weeks pregnant up until less than six weeks postpartum were eligible for inclusion.

Posters were placed in common areas around the inpatient and outpatient areas of Wellington hospital from 17 August until 24 August 2018. This corresponds to the penultimate week of the southern hemisphere winter at such time that we estimated all potential study participants have had a reasonable opportunity to consider influenza vaccination. In New Zealand, immunisation is funded between 1 April through 31 December annually.[30] Verbal invitation to participate was offered opportunistically within the context of routine clinical care by the junior obstetric staff, which comprise the authorship group, to consider participation in this study.

Ethical approval

Ethical approval for this study was granted by the University of Otago Ethics and Research Committee. Approval to conduct the study at Wellington Hospital was granted by the CCDHB Women's Health Research and Audit Committee. Consultation to undertake research with Māori was sought and approved by Research Advisory Group—Māori, which is the Māori consultation board to the CCDHB. The patient information form, consent form, survey and advertisements were reviewed prior to commencement by the aforementioned committees.

Participants were provided a patient information form with a Flesch reading score of 54.5 and access offered for interpreter services and/or Māori cultural support in order to explain the aims of the study. It was emphasised that this was voluntary and would not have implications for their antenatal care. Their decision to participate or not was left to the patient and their family in the absence of any supervision by the authorship team.

Results

The questionnaire was completed by 101 eligible women. Eighty-three women (82%) were currently pregnant whilst filling out the survey, and 18 (18%) were postnatal.

Forty-three women (43%) were aged between 30–35 years; 24 (24%) were aged 25–29. Seven participants (7%) were aged over 40 years and no mothers under the age of 25 took part in the study.

New Zealand European was the most prevalent ethnicity in the study group, at 54% (n=54), followed by Asian 19% (n=19), Pacific peoples 12% (n=12), Māori 11% (n=11), Middle Eastern/Latin American/African 3% (n=3) and 9% (n=9) of other origin. Women identifying as more than one ethnicity were counted in all identified groups. The ethnicities of our participants are displayed in Table 1.

Influenza vaccine uptake in our study population was 76% (n=77). Ninety percent of women (n=91) recalled being offered the influenza vaccine. Of those offered the vaccine, the majority had received it (n=75, 82%). Of the 16 women who did not accept influenza vaccination after being offered it, four had already been vaccinated during the current influenza season before falling pregnant.

The most common reasons for having influenza vaccine are described in Table 2. Neonatal protection against influenza was the leading influencer in those receiving the vaccination at 78% (n=60), followed by concern about contracting influenza at 64% (n=49), and information from medical staff at 49% (n=38). Few women considered themselves to be at a higher risk of influenza due to a known chronic medical condition

Table 1: Ethnicity of participants.

Rank	Ethnicity	Number of women	Percentage
1	NZ European	54	54%
2	Asian	19	19%
3	Pacific	12	12%
4	Māori	11	11%
5	MELAA*	3	3%
6	Other	9	9%

*Middle Eastern, Latin American, African ethnicities.

Table 2: Influential factors for receiving influenza vaccination.

Rank	Reason	Number of women	Percentage
1	Wanting to protect baby against flu	60	78%
2	Worried about getting the flu	49	64%
3	Information from medical staff	38	49%
4	Information from friends or family	7	9%
4	Information from media	7	9%
5	Chronic medical condition	6	8%

(n=6, 8%). Other reasons for being vaccinated added in the free text option included: information given at workplace, wanting to minimise common cold symptoms and one woman described previous pneumonia, making her more likely to protect herself from any further severe illness.

Among the 16 women who did not receive the vaccine, the most common reason was not receiving information about the vaccine (n=8, 50%) or not being offered it (n=6, 38%). Other reasons are displayed in Table 3. Additional reasons given in the free text included belief that efficacy of the vaccine was poor, lack of evidence supporting safety for baby, healthy lifestyle making the vaccine unnecessary, close relative with a severe reaction to the vaccine and cultural differences.

The majority (n=44, 57%) of vaccinations had been given within primary care (general practitioner, pharmacy or community midwifery team). A further 29% (n=22) had been provided by an employer and the remaining 10% (n=8) administered in an antenatal clinic.

Four women (4%) stated they did not plan to fully vaccinate their child, and only one of those women had received the influenza vaccination.

Only five women (5%) had known someone with severe influenza causing hospitalisation, and these women had all received influenza vaccine this season.

Discussion

The overall aim of this study was to gain insight into the pregnant woman's perspective on influenza vaccination. We have identified several key factors influencing pregnant New Zealand women on their choice around influenza vaccination, many consistent with similar international studies.

In our study population there was an 82% rate of vaccination. Our findings suggest that protection of the infant was a leading reason for women to choose to be vaccinated against influenza. This finding is consistent with previous studies.[19,20]

Table 3: Influential factors for not receiving influenza vaccination.*

Rank	Reason for not receiving vaccine	Number of women	Percentage
1	No information received during pregnancy	8	50%
2	Worried about side effects for self	6	38%
3	Worried about harm to baby	5	31%
4	Information from media	4	25%
5	Information from friends or family	3	19%
6	Previous bad experience from vaccination	2	13%

*Total number of women 16.

Conversely, 31% of women who did not choose to be vaccinated reported infant safety concerns as a reason. Again, this is consistent with previous findings.[19] This would suggest that promoting neonatal protection and emphasising safety may be areas to focus on when suggesting vaccination to pregnant women.

Almost half of patients (49%) receiving the vaccination indicated information from healthcare providers was a significant factor influencing their decision; however, the leading factor for not receiving vaccination was the absence of information provided to patients. This points to an avenue for quality improvement through regular education of obstetric, midwifery, pharmacy and general practice staff. Promotion packages have been described which could be tailored to the New Zealand population, requiring specific considerations for accessibility and equity.[31,32] Currently, the National Influenza Strategy Group (NISG) provide leaflets, posters and brochures with tailored information to pregnant women around the influenza vaccine.[30] The media influenced women both positively and negatively towards influenza vaccination. The role of social media in promoting health literacy remains an interesting area for future investigation; at present evidence is unclear if this is likely to be a beneficial or detrimental tool,[33] but potentially could this be an area of further vaccination promotion by the Ministry of Health.

When considering distribution of resources for a vaccination campaign, our results would suggest that a focus on the primary care setting would be beneficial as this was the most common location of vaccine administration. There may also be gains to be made in educating women about the risk factors for severe influenza, which goes along with the current New Zealand immunisation strategy.[30] Only 6% indicated their medical health was an influential factor; other studies have also indicated this to be a minor factor.[34,35] We elected not to request self-reported data on weight, but a raised BMI may be an additional reason to vaccinate pregnant women and in New Zealand we would anticipate approximately 50% of our population to fit this criteria.[36] Information around these risks might provide a further improvement in coverage.

While this study has relatively small numbers, it captured a range of results and was able to demonstrate some key attitudes which seem consistent with previous studies. Our ethnicity distribution showed adequate representation of Māori and Pacific women, compared with the catchment area. However, it did not include any women below the age of 25, which could potentially have an impact on our results.

There are several limitations to this study. Firstly, there might be a selection bias in women choosing to participate despite our efforts to preface this when introducing the survey. When offering participation, we did not document how many chose not to partake or their reasons for this, and hence this might affect our results. The impression of the authors was however that the vast majority of women approached chose to fill out the questionnaire. Secondly, the study may be biased towards women with the ability to access secondary care services. This may explain our higher than expected vaccination rates,[19] but more importantly may potentiate health inequities due to access barriers and specifically previous studies have shown socioeconomic factors are influential in this area of healthcare.[32] We also chose to conduct our research during the influenza season, meaning the community awareness might be higher and therefore increasing vaccination coverage. The small number of women (16) in this study who chose not to get vaccinated means it is difficult to draw any firm conclusions from these results, but it may still provide important insight on influential factors and suggest further area of research. Furthermore, the most likely choices in the questionnaire were the ones at the top of the list, suggesting this might be a potential source of bias; however, the findings of this study are still consistent with those of previous studies.[19]

Further areas of research are needed to better inform healthcare workers on the optimal means for promoting influenza vaccination. Re-audit would be easily achieved, and in future studies it would be interesting to add BMI to the survey as obesity increases morbidity and mortality associated with influenza; therefore these women should be prioritised.[11] Another aspect not covered in our survey was the attitude of the partner towards influenza vaccination which could be an area to expand on in further research.

Appendix 1: patient survey

Influential factors in patient uptake of influenza vaccination during pregnancy

Thank you for participating in our survey. We hope to improve the health of our pregnant patients in the coming years.

Please enter below your date of birth

Please enter below the number of children you have

Please indicate the ethnic group you identify with;

NZ Māori	
Tokelauan	
European other	
Latin	
Indian	
SE Asian	
Chinese	
Tongan	
CI Māori	
African	
Fijian	
Middle Eastern	
Samoan	
Not stated	
Other	

Please fill out questionnaire **ONE** if you *did* receive the flu vaccination this year.

Please fill out questionnaire **TWO** if you *did not* receive the flu vaccination this year.

We respect your decision either way.

Questionnaire ONE

Please circle the single most influential factor in your decision regarding the flu vaccination.

Please tick all those factors that were influential in your decision regarding flu vaccination.

I wanted to protect the baby	
I wanted to prevent influenza	
GP recommended	
Info from family/friends	
Info from media	
Social media	
Traditional media	
I normally get the flu vaccine	
Obstetric recommendation	
Midwife recommended	
I have a chronic medical condition	

Questionnaire TWO

Please circle the single most influential factor in your decision regarding the flu vaccination.

Please tick all those factors that were influential in your decision regarding flu vaccination.

I was worried about risk to the baby	
No one mentioned influenza vaccination	
I was worried about vaccine risk for myself	
I do not normally get the flu vaccine	
Other reasons	
GP advised against	
I had barriers to access the vaccine	
I wasn't provided culturally appropriate information	
Midwife advised against	
Obstetric doctor advised against	

Competing interests:
Nil.

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The employment gap: the relationship between medical student career choices and the future needs of the New Zealand medical workforce

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ABSTRACT

AIMS: To determine the career decision intentions of graduating doctors, and the relationship between these intentions and the predicted medical workforce needs in New Zealand in 10 years' time. **METHODS:** A workforce forecasting model developed by the Ministry of Health (MOH) has been used to predict the proportion of doctors required in each medical specialty in 2028 in New Zealand. The future work intentions of recently graduated doctors at the Universities of Auckland and Otago were collected from the Medical Student Outcomes Data (MSOD), and compared with these predicted needs. **RESULTS:** Between 2013 and 2017, 2,292 doctors graduated in New Zealand, of whom 1,583 completed the MSOD preferences section (response rate 69%). Of these only 50.1% had decided on a future medical specialty. The most popular were surgical specialties (26.2%), general practice (20.7%), and internal medicine (11.0%). Compared to the MOH workforce forecast model there appears to be insufficient interest in general practice at the time of graduation. **CONCLUSIONS:** To shape the medical workforce to meet forecast needs, multiple stakeholders will need to collaborate, with a special focus on the early postgraduate years, as many doctors have yet to decide on specialisation.

Understanding when medical students and doctors make choices about their future medical career is of importance to universities, postgraduate colleges and for individual doctors. Choosing a career is influenced by a number of factors which are well studied,[1–3] including background and personal factors, as well as the nature of the job itself. Proactively shaping the career intentions of medical students is possible, albeit complex, using a holistic multi-factorial approach that begins before medical school and extends into the early years after graduation.[4,5] A coordinated workforce strategy involving multiple stakeholders is necessary to enable the shaping of the medical workforce to best serve the needs of the whole country.[6–9]

Workforce development is an emerging concept, at the core of which is the concept of 'learning for work'.[10] The selection, education and training of medical students and graduates needs to be taken into account in shaping the workforce.[4,11,12] Additional factors that shape the workforce are the changing healthcare needs and expectations of the public, along with frequent

technological advancements.[13] In considering these factors, planners need to take into account the long gestation from entry to medical school until commencing work as a specialist, approximately 14 years later.

Understanding the timing of career decision-making and the career intentions of graduating medical students, and how these align with predicted workforce needs in the future is a useful starting point. This information allows individual doctors, medical educators and workforces planners the opportunity to know when career shaping might usefully occur. Limited data are currently available in New Zealand on when career decisions are made and comparing career intentions to future workforce needs, however similar comparisons have been made overseas, with interventions suggested to help shape the workforce.[14]

The aim of this study is to identify the career decisions intentions of graduating medical students and compare the career intentions of students (2013–2017) in New Zealand, with predicted workforce requirements 10 years later, in 2028, when these junior doctors will be practising as specialists.

Methods

We compared data from the Ministry of Health Workforce Forecasting model with data from the New Zealand Medical Schools Outcomes Database (MSOD).

Ministry of Health Workforce Forecasting Model

The Ministry's Workforce Forecasting Model uses dynamic models to forecast the medical workforce for the next 10 years (for example, 2019–2028) for each specialty.[15]

The model is flexible enough to test numerous scenarios by changing age, specialty-specific entry numbers or trainee numbers, career entry, exit and re-entry patterns, working hour patterns, in order to predict how many doctors need to train in order to achieve an adequate workforce in a defined specialty in the future. These predictions can be used to inform health workforce policies. An important limitation, however, is that such predictions assume no change in models of care or scopes of practice.

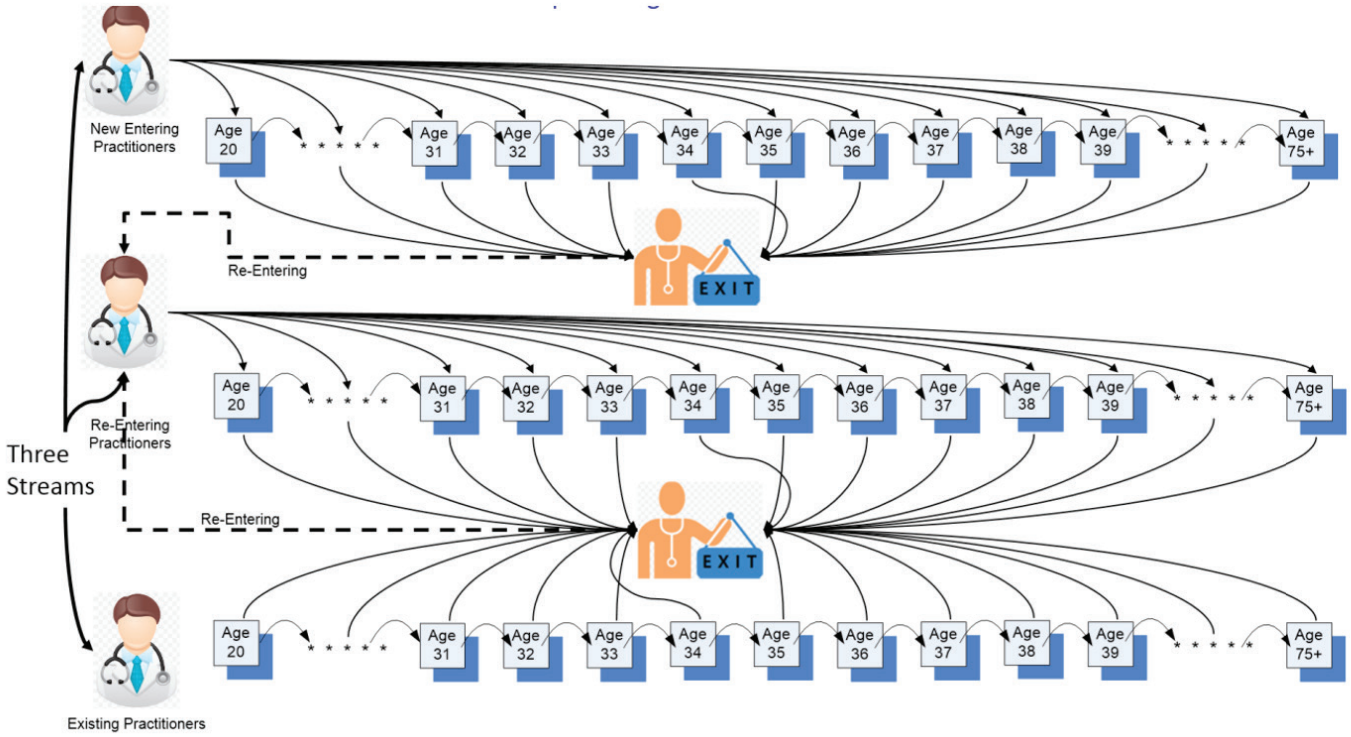
Medical workforce data were obtained on every doctor holding an Annual Practicing Certificate (APC) in New Zealand from 2003–2018. The APC data were sourced from the Medical Council of New Zealand's 2003–2018 registration database and the 2016 Workforce Survey.

The model focuses on three streams within each specialty (Figure 1). The first stream consists of "Existing Practitioners", defined as senior medical officers (SMO) currently practising in their specialty. The second stream consists of "New Entering Practitioners", defined as senior medical officers newly entering the specialty after completion of vocational training and registration as fellows of their respective training college. This group also includes migrant doctors entering the SMO workforce. Doctors in each of these streams are characterised by age as there are different entry and exit rates by age, and tracked over time.

The third stream, "Re-Entering Practitioners", comprises doctors from either of these two streams who exit and then re-enter the workforce. This includes SMOs leaving the workforce for overseas fellowship training, or for personal reasons such as family or sickness, who then re-enter. The third stream also allows SMOs to exit and return to the third stream again. Medical Council practising certificate renewals were used to determine exiting specialists. The lack of renewal of annual practising certificate was taken as evidence that a doctor had exited the New Zealand workforce.

Data presented include workforce data in 2018, expressed as both full time equivalents (FTE) and headcount (HC). Using the forecasting model, an algorithm was devised to allow for the calculation of the required annual new SMO entry between 2018–2028 to maintain the current workforce in FTEs of SMOs per population for the year 2028. We highlight that the assumption that the workforce required per population in 2028 will be similar to the level in 2018 is dependent on a similar model of healthcare delivery.

Figure 1: Conceptual diagram of workforce simulation.



Medical Schools Outcomes Database

Data from the New Zealand Medical Schools Outcomes Database (MSOD) were used to determine graduating medical students' workforce intentions. The MSOD project is a collaboration of Australasian medical schools, founded with the intent of tracking students from all Australian and New Zealand medical schools from selection through their medical school programme, and through their postgraduate years.[16] As the world's first bi-national workforce study, it continues to explore the interaction between students' background, demographics and the medical curriculum, and how this shapes their future career choices.[16]

We focused on New Zealand data. The University of Otago began enrolling participants into MSOD in 2007, and University of Auckland in 2012, although Auckland medical students had participated in that university's Health Career Pathways Project since 2006, and these data have been used to backfill the MSOD database. A New Zealand MSOD Steering Committee was established in 2012 to coordinate the project with financial support from Health Workforce New Zealand. All medical students are invited to complete a questionnaire at both entry to and graduation from the programme. Questionnaires are also administered one, three, five and, from 2019, eight years after graduation. For the purposes of this study, we collated data from the *National report on students graduating medical school in New Zealand in 2013–2017*, which analysed responses to the Exit Questionnaire from New Zealand medical students.[17] At this time in their training, about half the students indicated a firm career preference, with the remainder less certain, but still able to indicate preferences. We focused specifically on those students who had indicated that they had decided on a training specialty. Given the expected progression through training in New Zealand, we anticipate that these students would have entered or be entering the medical workforce as SMOs in 2028. A key assumption is that graduating medical student intentions translate to long-term vocational choices.

The comparison required that smaller non-surgical vocations listed in the MSOD questionnaire be grouped together: these are represented as 'other' in Table 1. MSOD data collects all surgical specialties under the category of 'surgery', therefore

Table 1: Exiting students preferences compared with current and predicted New Zealand workforce requirements in 2028 (FTE).

	A*	B*	C*	D	E	F	G
	2018 current SMO distribution (FTE) (%) N=10,174	2018 current SMO distribution (HC) (%) N=10,120	Required proportion of annual new SMO entry from 2019–2028 to maintain 2028 doctors per population at 2018 levels (%) N=515 per year	Distribution of 2013–2017 graduate intentions (%) N=806	Graduate intentions vs current SMO FTE workforce (D-A)	Graduate intentions vs current SMO HC workforce (D-B)	Graduate intentions vs required new SMO entry (D-C)
Specialty							
Adult medicine/internal medicine	12.2%	10.8%	8.9%	11.0%	-1.3%	0.1%	2.0%
Anaesthesia	9.0%	8.1%	7.5%	6.7%	-2.3%	-1.4%	-0.8%
Diagnostic and interventional radiology	5.1%	4.8%	4.8%	3.0%	-2.1%	-1.8%	-1.8%
Dermatology	0.7%	0.7%	0.8%	0.9%	0.2%	0.2%	0.0%
Emergency medicine	3.0%	3.0%	2.1%	4.7%	1.7%	1.7%	2.6%
General practice	30.2%	35.7%	37.4%	20.7%	-9.5%	-14.9%	-16.7%
Intensive care medicine	1.3%	1.0%	0.4%	1.3%	-0.1%	0.3%	0.9%
Obstetrics and gynaecology	3.4%	3.1%	3.2%	5.7%	2.3%	2.6%	2.5%
Ophthalmology	1.5%	1.5%	1.1%	2.3%	0.8%	0.9%	1.2%
Oral and maxillofacial surgery	0.3%	0.2%	0.2%	0.9%	0.6%	0.6%	0.6%
Paediatrics and child health	4.1%	4.0%	2.7%	6.1%	1.9%	2.1%	3.4%
Palliative medicine	0.5%	0.6%	0.9%	0.6%	0.1%	0.0%	-0.3%
Pathology	3.2%	3.0%	3.0%	1.0%	-2.2%	-2.1%	-2.0%
Psychiatry	6.2%	6.1%	7.3%	3.5%	-2.8%	-2.7%	-3.8%
Public health medicine	1.6%	1.7%	2.6%	0.5%	-1.1%	-1.2%	-2.1%
Rural and remote medicine	1.3%	1.2%	1.1%	2.2%	1.0%	1.1%	1.2%
Sports medicine	0.2%	0.3%	0.2%	1.5%	1.3%	1.2%	1.3%
Surgical - excluding O/Max	11.5%	9.4%	10.3%	26.2%	14.7%	16.8%	15.9%
Other	4.5%	4.9%	5.6%	1.3%	-3.2%	-3.6%	-4.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**0.0%**	**0.0%**	**0.0%**

*Reference 15.

all surgical specialties are represented within this category, with the assumption that projected requirements reflect those requirements across several specialties.

In our study, we specifically compared medical student intentions versus current SMO workforce, both FTE and HC. The key comparator was that of medical student intentions and the required new SMO entry into each specialty in 2028, in order to maintain the current workforce level.

SAS® (SAS Institute Inc., Cary, NC, USA) was used for the parameter calculations.

Ethics approvals for the MSOD project were granted by the respective Human Ethics Committees of the University of Auckland and University of Otago.

Results

From 2013 to 2017, 2,292 medical students graduated from the University of Otago and University of Auckland, of whom 1,583 students completed the medical specialty preferences section (response rate of 69%). From these respondents, 806 (50.1%) indicated that they had decided on a long-term specialty. The proportion of the cohort indicating preference for a particular specialty is displayed in Table 1 (Column D).

Most popular were surgical specialties (26.2%); followed by general practice (20.7%) and adult/internal medicine (11.0%). The surgical category included cardiothoracic, general, orthopaedic, otolaryngology head

and neck, paediatric, plastics and reconstructive, urology and vascular services. We excluded maxillofacial surgery as this requires dental training in addition. The 'adult medicine/internal medicine' category includes sub-specialties broadly categorised under the auspices of the adult medicine division of the Royal Australasian College of Physicians. Examples included there are cardiology, clinical pharmacology, endocrinology, gastroenterology and hepatology, acute care medicine, geriatric medicine, haematology, immunology, infectious disease, oncology, nephrology, neurology, respiratory medicine and rheumatology.

The 'other' category included clinical genetics, family planning and reproductive health, medical administration, musculoskeletal medicine, occupational medicine, pain medicine, radiation oncology, rehabilitation medicine, sexual health and urgent care.

The Ministry of Health Workforce data are also presented in Table 1 (Columns A, B and C). The SMO workforce in 2018 comprised 10,174 FTE and 10,120 doctors by head count. With regards to both FTE and HC, general practice is the largest specialty (30.2% and 35.7% respectively) followed by adult/internal medicine (12.2% and 10.8% respectively) and surgical specialties (11.5% and 9.4% respectively).

Using the workforce algorithm, we found that 515 new SMOs are required to enter into the vocational workforce per year between 2018 and 2028 to maintain the current service provisions in 2028. It needs to be noted that this figure, and the subsequent proportions in each specialty, include new migrant SMOs as well as New Zealand medical graduates (NZMG). The specialty that requires the largest proportion of new entrant SMOs is general practice (37.4%) followed by surgical services (10.3%) and adult/internal medicine (8.9%).

Columns E, F and G compare New Zealand student career intentions with projected workforce requirements. In particular, column G highlights the direct comparison of required new SMO entrants and student intentions, given that vocational training is expected to take 14 years. There are significant differences between student intentions and the predicted workforce requirement (Chi squared = 460.19, DF 18, P<0.0001). The largest mismatch between student intention and predicted requirement is for general practice.

Discussion

This is the first study to utilise MSOD data from graduating medical students' career decisions, and Ministry of Health data and modelling to explore how medical student career preferences align with the future healthcare needs of New Zealand.

Nearly 70% of students completed the medical specialty preferences section of the survey, a satisfactory response rate for survey-based questionnaires. The most notable finding of this study is that only half of the students who completed the medical specialty preferences section had decided on a specialty at the time of graduation. Thus, maintaining a broad undergraduate medical curriculum is important for students to explore a wide range of medical specialties. Decisions made in the early postgraduate years will significantly impact the proportions of doctors training in different specialties. This may also represent a significant opportunity to further "shape" specialty choices.

The second significant finding of this study is that if graduating medical students who have decided on a career maintain their graduating choices, and if those who are undecided have ultimate career choices in similar proportions to those who are decided, then there may be a mismatch of specialty intentions and future health workforce needs. This is an especially important finding as there appears to be "over interest" in certain specialties, eg, surgical specialties. Conversely, there is potential "under interest" for specialties such as general practice and psychiatry. However, these findings need to be interpreted with caution as they relate to only a third of students surveyed. Nevertheless, these results provide valuable information to guide workforce strategies to shape the medical workforce. Given that graduating students indicated that the atmosphere, work culture and the experience they have of a specialty during medical school are the most important factors influencing career decisions, there is potential for

enhanced efforts to be made to attract more specialists in these areas.[17] Personal interest is another factor that has been reported to heavily influence career decisions locally.[2] Furthermore, training cost and medical student debt do not significantly influence New Zealand medical student career choices,[18] therefore initiatives focused towards students' experience and perceptions of a specialty as well as employment prospects and conditions of working in those areas may help to shape the future workforce. Previous literature suggests that a multifactorial approach, involving selection criteria and targeted curriculums, can be used to influence, to some degree, medical students' career paths to match workforce requirements.[19]

This study has also highlighted that the provision of a general practice workforce for New Zealand appears to be particularly problematic, due to the combination of relatively low student interest in the profession, and an overall aging general practitioner workforce nearing retirement. Primary care workforce predictions from the US report a significant undersupply, with a 21% increase in resident or trainee registrar positions required to meet the primary health needs in 2035.[20] A recent New Zealand Government initiative to double the number of registrar training places in general practice is likely to assist in meeting the need. High-quality general practice attachments with experienced GP tutors have been found to be effective at attracting early graduates into the profession, and community-based attachments in the early postgraduate years are now being undertaken by an increasing number of house officers. Further evaluation of these interventions using post-graduate data would be valuable for stakeholders to improve general practice numbers. Psychiatric workforce sufficiency in New Zealand is another challenge, with shortages projected. As similar shortages are projected in Australia, joint efforts could be made to increase student interest and recruitment to meet future needs.[21]

A limitation of this study is that only half of graduating students who completed the medical specialty preferences section of the survey had decided on a career (35% of the total cohort). Secondly, the assumption that the career preferences of graduating students remain constant, and translate into corresponding vocational training pathways. The dynamic and rapidly evolving nature of medicine, and consequent alterations in models of care and/or scopes of practice make workforce modelling and predictions less accurate. This is evidenced by recent data demonstrating that graduates consider more specialties at graduation then they did previously, and up to a quarter of graduates end up in different specialties than those decided at graduation.[22,23] This means stakeholders need to remain dynamic in their projections and efforts to shape the workforce.[24] A third limitation of the study is that MSOD does not collect data on the medical and surgical subspecialty career intentions, nor can we further break down the general practice intentions and workforce into urban and rural patterns.

Conclusion

At graduation only half of New Zealand medical students have decided on a future medical specialty. There is thus a significant opportunity to "shape" the medical workforce in the early postgraduate years. This opportunity could be used to influence doctors to select specialties that are needed to match the future health needs of New Zealand. Strategies to address predicated shortages in vulnerable workforces may be particularly important.

Competing interests:
Dr Bagg was Head of the Medical Programme at the University of Auckland until February 2019. Ms Verstappen and Dr Poole report grants from Health Workforce New Zealand during the conduct of the study.

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Surgeon-performed ultrasound-guided fine needle aspiration of thyroid nodules is cost effective and efficient: evaluation of thyroid nodule assessment in a provincial New Zealand hospital

Michael Reeves, Rajeshbhai Patel, Christopher Harmston

ABSTRACT

AIM: Surgeon-performed ultrasound-guided fine needle aspiration cytology (US-FNAC) and radiologist-performed US-FNAC are both accepted forms of thyroid nodule assessment. To date there have been no studies comparing cost of evaluation between these two models. The aim of this study is to compare surgeon-performed thyroid US-FNAC to radiologist-performed US-FNAC. The primary outcome of interest was cost of surgeon-performed US-FNAC compared to cost of radiologist-performed US-FNAC. Secondary outcome of interest was time to treatment decision.

METHODS: A retrospective analysis of all thyroid biopsies performed in 2016 and 2017 in a single centre were included. Costs were calculated using labour costs for SMO and allied technical personnel.

RESULTS: There were 92 patients included in the analysis. Forty-two underwent surgeon-performed US-FNAC and 50 underwent radiologist-performed US-FNAC. Mean cost in surgeon-performed US-FNAC was $653 compared to $1017 in radiologist-performed US-FNA. Time from first appointment to definitive management plan was 47 days in surgeon-performed USFNAC and 116 days in radiologist-performed US-FNAC.

CONCLUSIONS: This study demonstrates surgeon-performed US-FNAC for evaluation of thyroid nodules results in significantly lower costs and improved timeliness of care when compared to radiologist-performed US-FNAC.

Thyroid nodules are the most common reason for presentation to an endocrine surgeon.[1] Gold-standard evaluation of thyroid nodules consists of ultrasound (US) evaluation, and US-guided fine needle aspiration cytology (US-FNAC) to differentiate benign from malignant nodules. Traditionally radiologists perform US-FNAC; however, surgeon-performed US-FNAC is now also accepted practice.[1–3]

Surgeon-performed US-FNAC of thyroid nodules is as safe and accurate as radiologist-performed US-FNAC.[4,5] It also allows a more efficient model of care with fewer outpatient appointments and a faster time to diagnosis and definitive management plan for patients, resulting in decreased levels of patient anxiety.[1,6] It is likely that costs will also be reduced; however, no cost comparisons between surgeon-performed

and radiologist-performed US-FNAC have been published.

In the resource-limited New Zealand public health sector it is important to understand the cost implications of changes in practice. This helps guide resourcing of quality improvement initiatives and allows informed decision making when considering organisation of services.

Therefore, the aim of this clinical audit was to compare the cost of surgeon-performed US-FNAC with radiologist-performed US-FNAC in patients presenting with thyroid nodules.

Methods

All adult patients who underwent ultrasound-guided fine needle aspiration cytology (US-FNAC) of thyroid nodules between 1 January 2016 and 31 December 2017 in a single centre were included. The hospital records for each patient were examined for demographic data, nodule imaging and pathological characteristics, dates of procedures and clinics, and management plans.

The study group was divided into two cohorts: (a) patients who underwent US-FNAC by the surgeon in clinic for their initial test, and (b) patients who were referred to the radiology department for their initial US-FNAC. Patients in cohort (a) who needed a repeat US-FNAC due to inadequate results had repeat tests by the surgeon but were referred to the radiology department if more than two inadequate specimens were obtained.

The institutional financial department provided the cost of outpatient clinic and biopsy clinic appointments for the past financial year based on the labour cost for SMO and allied technician personnel. Cost of work-up was calculated by multiplying the number of clinics per patient by the cost of staff member time per clinic. Disposables and laboratory costs were the same for both groups and were minimal in comparison to labour costs; they were therefore omitted from the cost calculations.

Timeliness of care was evaluated by number of days from first specialist appointment (FSA) to definitive management plan and total number of outpatient clinic appointments per patient.

All surgeon-performed US-FNAC tests were undertaken by a single endocrine surgeon trained in thyroid FNA. Radiologist-performed US-FNAC tests were undertaken by one of six radiologists trained in the procedure.

Surgeon-performed US-FNAC

Patients requiring US-FNAC were identified based on ATA guidelines[2] for investigation of thyroid nodules. Following clinical evaluation and informed consent they underwent immediate US-FNAC biopsy of one or more nodules as part of the consultation, or were rebooked to the next available endocrine clinic where biopsy was possible. No additional time was allocated to patients requiring clinic US-FNAC over and above a standard FSA without biopsy.

A cytopathology scientist attended all clinic biopsies. The skin was cleaned with alcohol prep, and a 25G needle was passed under real-time USS vision into the nodule, and gently rotated, advanced and withdrawn a few millimeters to draw cellular material into the needle and hub. If this technique failed then a syringe was attached to allow aspiration. The cytopathology scientist prepared the slides and assessed them for specimen adequacy. If the sample was deemed inadequate the process was repeated.

All FNAC cytology was reported according to the Bethesda system of reporting.[7]

This audit was performed as part of a service evaluation of surgeon-performed FNA and an out of scope letter was obtained through the health and disability ethics committee.

Statistical analysis was performed using IBM SPSS Statistics version 25.

Results

Patient demographics and clinical outcomes

Ninety-two patients underwent a total of 130 US-FNAC biopsies. Mean age was 58 years and M:F ratio was 1:5.

Forty-two patients had surgeon-performed US-FNAC as their initial procedure; of these patients nine required a second biopsy to reach definitive management plan; one patient required a total of four

biopsies to reach definitive management plan. Eight of a total 62 biopsies in this cohort were reported as Bethesda 1 (inadequate for assessment), giving an inadequacy rate of 13%. Fifty patients had radiologist performed US-FNAC. Of these patients 10 required a second biopsy to reach definitive management plan. Twelve of 68 biopsies were reported as Bethesda 1 giving an inadequacy rate of 18%. There were no recorded complications of US-FNAC biopsy in any of the patients during the study timeframe.

The demographics, referral and clinical characteristics, and Bethesda scores of both cohorts are presented in Table 1.

Table 1: Demographics and nodule characteristics, Bethesda scores.

	Surgeon	**Radiologist**
N	42	50
Age		
Mean Median (range)	58 58 (27–85)	59 61 (25–87)
Sex		
F n (%) M n (%)	35 (83%) 7 (17%)	42 (84%) 8 (16%)
Ethnicity		
Māori n (%) European n (%) Other n (%)	15 (36%) 26 (62%) 1 (2%)	21 (42%) 25 (50%) 4 (8%)
BMI	28	30
Nodule size (mm)		
Mean Median (Range)	29 26 (9–56)	31 29 (10–88)
Nodule characteristics		
Solid (%) Mixed (%) Not described (%)	50% 40% 10%	66% 30% 4%
Referral source		
GP n (%) Other n (%)	26 (62%) 16 (38%)	39 (78%) 11 (22%)
Referral reason		
Lump n (%) Incidental n (%) Other n (%)	22 (52%) 20 (48%) 0	26 (52%) 20 (40%) 4 (8%)
Bethesda score		
I n (%) **II** n (%) **III** n (%) **IV** n (%) **V** n (%) **VI** n (%)	8 (13%) 35 (56%) 11 (18%) 3 (5%) 4 (6%) 1 (2%)	12 (18%) 30 (44%) 11 (16%) 10 (15%) 4 (6%) 1 (1%)

Table 2: Cost and timeframes for thyroid nodule work-up.

	Surgeon	Radiologist	*p*-value
Number of clinics Mean	2.0	2.8	< 0.001
Cost of work-up Mean (NZ dollars)	$653	$1,017	< 0.001
Time: **FSA – mx plan** Mean (days)	47	116	< 0.001
Time: **FSA – biopsy** Mean (days)	8	71	< 0.001
Time: **Biopsy – mx plan** Mean (days)	39	48	0.375

Costs

Table 2 presents the average cost, number of clinics and timeframe to reach definitive management plan for both cohorts.

Surgeon-performed US-FNAC resulted in an average saving of $364 per patient over radiologist-performed US-FNAC. If surgeon-performed US-FNAC was performed across the whole cohort then a saving of $16,744 per year would be realised.

Timeliness of care

Mean time from FSA to definitive management plan was 47 days in the surgeon-performed US-FNAC group, 69 days faster than the radiologist-performed US-FNAC group. This difference was due to reduced timeframes from FSA to biopsy with reduced clinic visits required. Once first biopsy was obtained there was no significant difference in time to definitive management plan.

Discussion

This audit has shown that surgeon-performed US-FNAC results in a significant cost saving compared to radiologist-performed US-FNAC, along with a significant reduction in number of clinic visits and time from first specialist appointment to management plan.

These findings are important, especially in the current climate of resource constraint in the New Zealand healthcare system, and can be used to guide quality improvement and resource allocation.

To our knowledge, there have been no cost analyses performed comparing the two accepted models of thyroid nodule evaluation. Considering the previous literature, we hypothesised that surgeon-performed US-FNAC would result in cost savings. Patients in the surgeon US-FNAC cohort attended significantly fewer clinics than the radiologist US-FNAC cohort, and this largely accounts for the lower cost. Radiologist-performed US-FNAC are undertaken with the assistance of a sonographer, whereas the surgeon-performed US-FNAC are not, further contributing to the difference in cost.

A systematic review of all head and neck US-FNAC showed an inadequacy rate of 10.8% for clinicians compared with 9% for radiologists,[8] while a recent cohort study comparing surgeon- and radiologist-performed US-FNAC in Australia also demonstrated acceptable clinician inadequacy rate.[1] Sample inadequacy rates were relatively high in both groups in our study, particularly in the radiologist-performed US-FNAC group. Previous studies have investigated reasons for inadequate US-FNAC results and found that cystic nodules or nodules with cystic components were associated with inadequate samples.[9] Nodule size does not seem to affect inaccuracy rates.[9] There was a difference in the distribution of nodule characteristics between our groups, although this favored the radiologist group and is therefore unlikely to have significant bearing on the

inadequacy rate or cost calculations. Inadequacy rates have also been shown to be higher in the first 100 samples taken by a clinician, indicating that there is a learning curve associated with this procedure.[9] There was a total of 130 US-FNAC procedures undertaken for thyroid nodules over two years in our centre; the radiologist cohort biopsies were shared between six radiologists while the surgeon cohort biopsies were all performed by a single surgeon. It is possible that the high inadequacy rate in the radiologist group is due in part to low numbers per radiologist.

Previous studies have also confirmed that surgeon-performed US-FNAC has been shown to improve timeliness of care with decreased timeframes from FNA request to diagnosis, fewer patient clinic visits and lower use of radiology resource.[1,7,10] These findings were mirrored in this study, with a significant reduction in time from first specialist assessment to management plan, largely achieved by a reduction in time from FSA to biopsy.

The authors accept the limitations of this study. It has a small sample size, was retrospective and was not randomised. Despite this, the two groups are comparable, with similar demographic and clinical characteristics. It is also likely that they are comparable to groups of patients being treated in provincial hospitals around New Zealand. For this reason we believe that the data is relevant and can help guide change in practice and guide quality improvement in this area in New Zealand hospitals.

Conclusion

This study demonstrates that in a provincial New Zealand centre, thyroid nodule evaluation with surgeon-performed US-FNAC results in fewer clinic visits, less use of radiology resource, faster time to diagnosis and therefore lower cost to the health system when compared to radiologist performed US-FNAC. In our resource-limited environment, consideration should be given to streamlining evaluation using surgeon-performed US-FNAC model.

Competing interests:
Nil.

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Equity by 2030: achieving equity in survival for Māori cancer patients

Jason Gurney, Shelley Campbell, Chris Jackson, Diana Sarfati

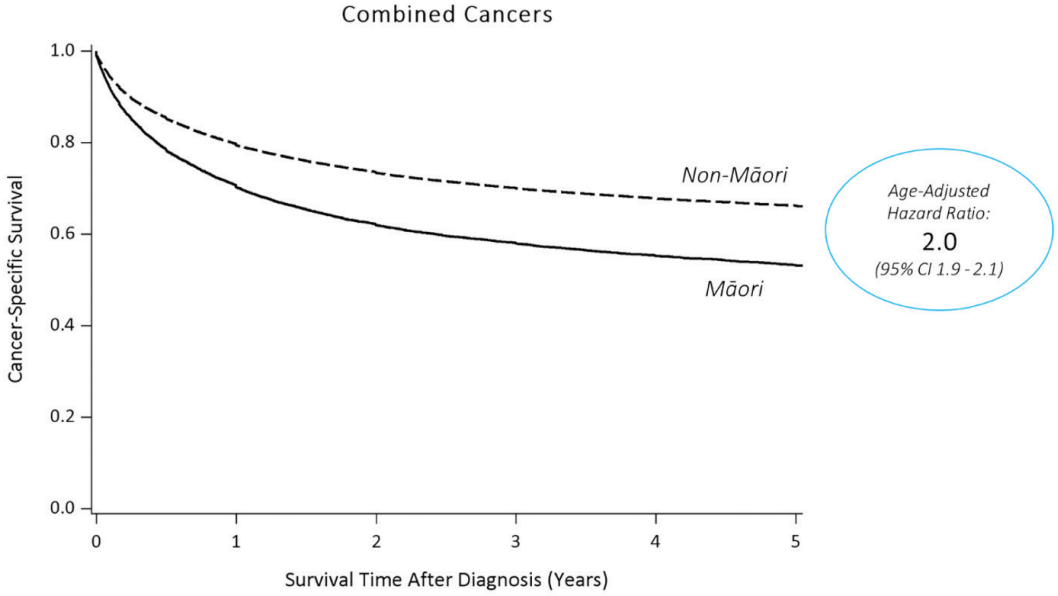
ABSTRACT

Māori diagnosed with cancer are more likely to die—and to die sooner—than non-Māori with cancer. If we accept that these inequities are unfair and avoidable, then we need a well-resourced and focused approach to eliminating them for Māori. Closing this gap will require significant action and sustained resourcing; but first, it requires an aspirational objective to enable collective ownership and navigation. At the Cancer Care at a Crossroads conference held in Wellington in early 2019, the wider cancer sector accepted a tabled goal: to achieve equity in cancer survival for Māori by the year 2030. In this viewpoint, we provide rationale for this goal, provide some recommendations for how it might be achieved, and address its likely criticisms.

The recent Cancer Care at a Crossroads conference, jointly convened by the University of Otago and Cancer Society of New Zealand, brought together leaders from across the cancer spectrum. A recurrent theme across the conference—as well as at the workshops held by the Ministry of Health immediately following it—was the urgent need for the New Zealand health system to strive for equity in cancer incidence, mortality and survival for Māori.[1]

With respect to survival, the urgent need for action is driven by strong and enduring evidence of disparities between Māori and non-Māori New Zealanders in terms of survival following a diagnosis of cancer. Māori diagnosed with cancer are more likely to die (and to die sooner) than non-Māori with cancer.[2,3] Figure 1 shows the extent to which five-year cancer-specific survival differs between Māori and non-Māori for all combined cancers

Figure 1: Five-year Kaplan-Meier curves, comparing Māori and non-Māori cancer-specific survival for all cancers diagnosed 2007–2015.



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between 2007–2015; after adjusting for age, Māori patients are twice as likely to die of their cancer than non-Māori patients.

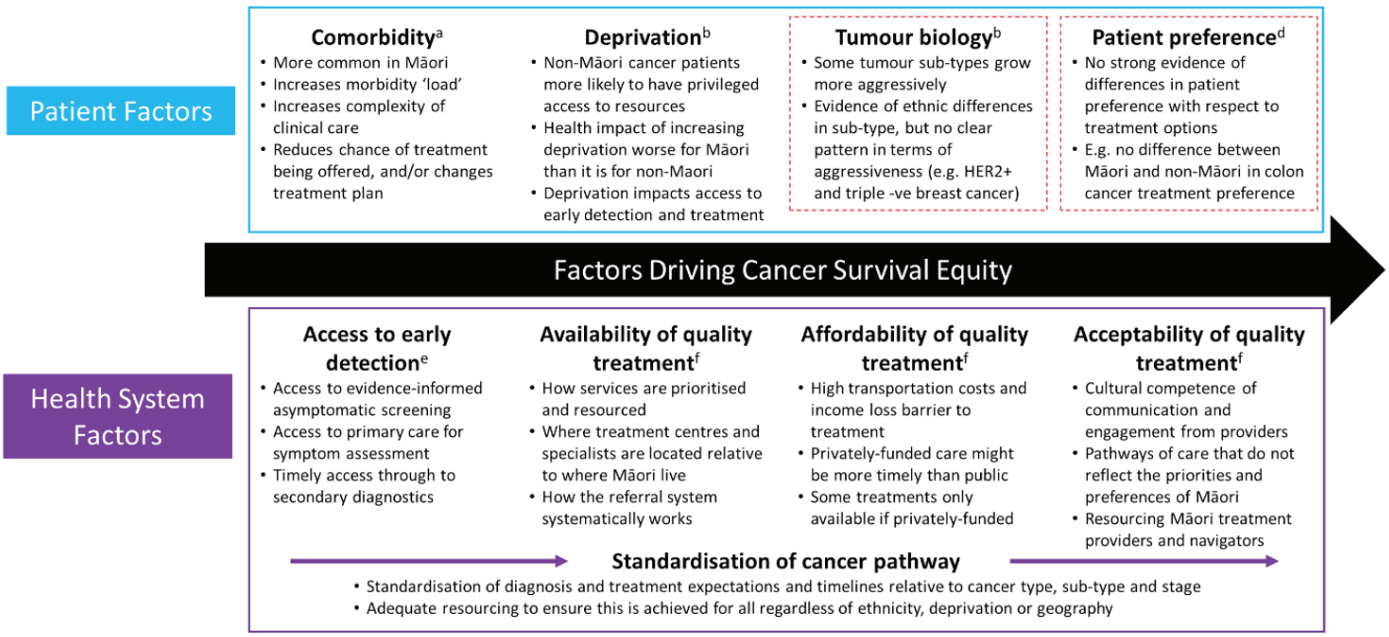
The factors that drive this survival disparity are numerous and varied. In Figure 2, we present a framework for understanding the proximal factors that are likely to be driving this disparity, separated into patient factors and health system factors. It is important to note that these factors are ultimately driven by upstream determinants, including colonisation, historical traumas and institutionalised racism—operating through complex pathways resulting in higher levels of poverty, unemployment, adverse housing conditions and other more proximal drivers of poor outcomes among Māori.[4–7] While these upstream determinants are ultimately responsible for inequities in health outcomes for Māori, it is useful to focus on the proximal (eg, system-level) factors in order to specifically focus on addressing inequities in cancer survival.

As highlighted in Figure 2, a crucial proximal driver of cancer survival is access to and through cancer services, from early diagnosis through to best-practice treatment and support; and it follows that disparities in access along this continuum will result in disparities in outcomes.[12] In the presence of finite resources, our services have been moulded over time to achieve the greatest outcomes for the greatest proportion of patients—which means that our system operates in a way that favours our majority New Zealand European population. It is therefore somewhat unsurprising that a system designed to suit the majority might be complicit in driving inequitable outcomes for the minority. If we accept that inequities are unfair and avoidable, then we need a well-resourced and focused approach to eliminating these inequities for Māori. Closing this gap will require significant action and sustained resourcing; but first, it requires an aspirational objective to enable collective ownership and navigation.

What is our goal?

At the Cancer Care at a Crossroads conference, the sector widely accepted a tabled goal to achieve **equity in cancer survival between Māori and non-Māori New Zealanders by the year 2030.** This goal was tabled and discussed at the conference following a panel of Māori cancer leaders, who reviewed the history of cancer control in New Zealand and its impact on Māori and also discussed survival inequity, racism and Matauranga Māori models in cancer care.

Figure 2: Framework highlighting the proximal factors driving disparities in cancer survival between Māori and non-Māori.



Boxes with dashed lines indicate factors with limited or conflicting evidence.
[a]Sarfati et al., 2016.[8] [b]Woods et al, 2006.[9] [c]Lawrenson et al, 2017 and 2018.[10,11] [d]Hill et al, 2013.[12] [e]WHO, 2017; Jeffreys et al, 2009.[13,14] [f]Meheus et al, 2019.[15]

Setting a 2030 deadline is aspirational; however, that does not mean it is not realistic. Firstly, setting a target requires that we reliably **measure** and report equity in cancer survival between Māori and non-Māori. In doing so, we acknowledge the survival gap exists, and demonstrate the extent of the problem. Secondly, setting a time target in the near future highlights that resolving this disparity is urgent, and enables us to **benchmark** our progress toward this objective as we go—indicating whether efforts to resolve the disparity are being effective, or whether greater effort is required. It also places **accountability** on Government and the wider sector to achieve the objective within a finite timeframe, rather than some unspecified future point. Finally, a timeframe encourages us to band together and **do something now**—not to allow our focus to be drawn elsewhere, but rather to begin to take the steps required to achieve this goal.

How are we going to get there?

It is imperative that the actions taken to achieve equity in survival for Māori must focus on the system, not the individual. Evidence on disparities in cancer outcomes in New Zealand all support the contention that they largely arise from systems failure, rather than on actions (or inactions) on the part of individuals.[12] It is also worth noting that there is no one correct approach to addressing disparities in survival, and that efforts will necessarily be multi-faceted. The recommended areas of action below should be considered a starting point; many other actions are possible and necessary to achieve this goal. The likely criticisms of these actions, and the Equity by 2030 goal more generally, are addressed in the Appendix.

Patient factors

As noted in the framework presented in Figure 2, there are multiple patient-level factors that likely contribute to the inequities in cancer survival experienced by Māori. These patient-level factors are strongly related to the environmental and structural contexts within which people are living—contexts that tend to differ significantly between Māori and non-Māori New Zealanders. Socioeconomic status, relative deprivation, education and health literacy are all factors for which non-Māori New Zealanders (particularly the majority New Zealand European population) tend to be at a substantial advantage compared to the Māori population.

One of the consequences of these high-level factors is that more advantaged groups generally tend to have lower rates of many long-term conditions. This means that more disadvantaged groups who develop cancer are also more likely to have co-existing conditions, or comorbidities. As highlighted in Figure 2, comorbidity increases morbidity load on the patient, increases the complexity of clinical care and reduces the likelihood of the patient being offered best-practice treatment for their cancer. Māori cancer patients are more likely to have comorbidity than non-Māori cancer patients: for example, 26% of Māori stomach cancer patients have diabetes mellitus compared to 15% of non-Māori patients,[16] while 51% of Māori liver cancer patients have hypertension compared to 25% of non-Māori patients.[17]

This appears to be an untenable problem that can only be circumvented by preventing comorbidity in the first place (an important objective). However, of more immediate consequence to achieving equity in cancer survival by 2030 is the striking evidence that there is systematic under-treatment of cancer patients with comorbidity—and that if treated, those with comorbidity have better outcomes.[18] The key implication of this is that the reticence to treat patients with comorbidity for fear of doing harm is leading to a systematic under-treatment of Māori cancer patients. Sarfati et al[19] examined receipt of adjuvant chemotherapy among colon cancer patients with Stage III disease (for whom this therapy is generally indicated), and found that nearly 85% of those without comorbidity (Charlson score: 0) received this chemotherapy compared to only 19% of those with severe comorbidity (Charlson score: 3+). However, the authors also found that giving chemotherapy to the group with the most severe comorbidity reduced their excess mortality compared to those without comorbidity by 66%.[19] In a study of patients with TNM stage I-III liver or stomach cancer, adjusting for differences in the comorbidity burden between Māori and non-Māori patients accounted for a third of the survival difference between the two groups (cancer-specific age, sex, site and stage-adjusted hazard ratio, 1.33; plus comorbidity, 1.23).[20]

To facilitate an understanding of a treatment gap, we must have an ability to measure treatments received according to cancer stage. This requires renewed investment in information systems and data collection to ensure accuracy of stage at diagnosis (further expanded on below), and of treatment received. Combined with ethnicity and comorbidity data, these data can help us to understand more about the extent to which cancer patients with comorbidity are being undertreated in New Zealand. This analysis will not be straightforward, but will result in a clearer understanding of the extent to which our survival disparity is being driven by systematic under-treatment of Māori due to comorbidity. The very generation of this evidence will help inform clinicians about the impact of treatment on patients with comorbidity, and over time would result in improvements in care. Perhaps most crucially, we need to resource our system to provide the integrated and well-coordinated services that would be required to maximise the safety of treating patients who might previously have been overlooked for treatment, rather than the present single-discipline focused approach.[8]

An additional patient factor that may contribute to survival disparities between Māori and non-Māori is differences in the biology of tumours typically experienced by these populations. There is some evidence from the breast cancer context that Māori and Pacific women are more likely to have HER2+ breast cancer than non-Māori/non-Pacific women.[10,11] However, the same study observed that Māori and Pacific women are also less likely to have triple-negative breast cancer, which has a poorer prognosis than other forms of breast cancer—with the authors noting that any differences in tumour biology between Māori and non-Māori are likely to have a marginal contribution to survival disparities. Research into any discovered differences in patterns of disease could also be valuable at a biological level in terms of understanding cancer aetiology.

Early diagnosis

There are three key areas of action that need to occur with respect to early diagnosis: 1) ensuring good stage data, 2) ensuring barriers to early diagnosis and access to primary care are addressed and 3) ensuring equitable screening programmes.

Ensuring good stage data

There is evidence that, for some cancers, Māori are more likely than non-Māori to be diagnosed with more advanced disease, including lung, breast, prostate and cervix.[2,21,22] By contrast, for several cancers—including those for which survival outcomes are poorer for Māori, such as stomach, liver, kidney and ovarian cancers—there is some evidence that there is no difference between Māori and non-Māori in terms of stage of disease at diagnosis.[2,16,17] However, there are limitations to the data upon which many of these observations have been made—limitations driven by the way in which staging data is collected and reported nationally, which result in a large proportion of cancers remaining unstaged on our cancer registry.[23] Such limitations will need to be overcome as a matter of urgency (at least for our priority cancers, but more systemically over time), which will require initiatives such as facilitation of centralised reporting of clinical staging data. Such initiatives are currently underway at the Ministry of Health.

Ensuring barriers to early diagnosis and access to primary care are addressed

Outside of screening programmes, early detection of cancer often occurs within primary care—meaning that achieving equitable access to affordable and acceptable primary care services is important for achieving equitable early detection for Māori.[4] There is evidence that Māori are more likely than non-Māori to have their cancer detected following symptomatic presentation to a hospital emergency department[24]—indicating disparities in access to earlier symptom detection in primary care. The current government has increased subsidies to general practice in order to reduce consultation costs to patients, with the aim of improving access to primary care. However, the fact that general practice is not free at point of delivery is likely to remain a barrier for some patients.

Addressing barriers to accessing high-quality primary care for Māori patients includes initiatives that increase whānau awareness about cancer and facilitate

empowered engagement with primary care (eg, the *Kia ora E Te Iwi* programme). At a systems level, building capacity and expertise of Māori primary care providers and their models of care will also cut-through the cultural barriers that may be preventing equitable access to and through primary care services.

Additional initiatives to improve early diagnosis such as streamlined access to secondary care are likely to benefit all patients, not just Māori. Initiatives such as haematuria or rectal bleeding clinics, or lung fast track clinics for abnormal chest x-rays are used in many but not all centres. Having clear pathways for high-risk symptom clusters could facilitate earlier detection. An equity-focused approach would involve initially focusing on improving early diagnostic pathways for symptom clusters related to disease types prevalent in Māori.

Ensuring equitable outcomes in current screening programmes

Improving access to screening will increase the proportion of cancers detected at an early stage and will inevitably lead to an improvement in cancer survival. Encouragingly, recent data have demonstrated that Māori women diagnosed with screen-detected breast cancer have the same clinical outcome as non-Māori, highlighting that equity can be achieved following diagnosis, and reinforcing the need to achieve screening parity (these findings are further discussed later).[25] Recent improvements in access equity have been observed for the BreastScreen Aotearoa programme, with Māori participation at 65% as of 2016; however a further 3,063 Māori women aged 50–69 need to be screened each year just to achieve the same screening rate as the New Zealand European population.[26] Given the number of Māori women who die each year of breast cancer—combined with the fact that Māori breast cancer patients are more than 40% more likely to die of their cancer than European/Other patients[2]—continual improvements in breast screening access for Māori (beyond just achieving screening rate parity with New Zealand European women) must be sought. Practical advice for achieving this is provided in the latest BreastScreen Aotearoa Programme Monitoring Report.[26] Our burgeoning bowel screening programme is certain to save Māori lives, but must also take lessons from BreastScreen Aotearoa and elsewhere to maximise Māori access to the programme and through subsequent diagnostics and treatment.[27–29] Encouragingly, some centres have achieved equitable screening rates between Māori and non-Māori, again highlighting that equity is achievable with sustained and focused efforts. The incorporation of a self-testing option for HPV screening is a positive initiative that may result in improvements in HPV screening access for Māori[30] (currently 64% of women aged 25–69 compared to 81% for New Zealand European[31]); although it should be noted that cervical cancer is not among the biggest cancer killers of Māori.[2]

Beyond our current screening programmes, we must consider the practicality and net benefit of other targeted screening options. For example, if we agree that lung cancer is a priority in terms of addressing survival equity, then we must begin to consider what characteristics a targeted lung cancer screening programme might have—including what the downstream ramifications of such a programme are, not least of which will include an assessment of surgical, radio-oncological and pharmaceutical capacity and availability. Such a programme would need to minimise operational costs and maximise screening participation among Māori in order to maximise effectiveness. A pilot lung cancer screening study is currently in development in the Auckland region, with the findings of this pilot study potentially crucial to the future of lung cancer screening in New Zealand.

Consistent, high-quality care

Achieving consistent, high-quality care involves multiple steps along the cancer care pathway, from early detection (which includes primary care and screening access); timely best-practice treatment with clear guidelines and tumour standards (secondary and tertiary services); high-quality data collection, analysis, reporting and feedback mechanisms; and wrap-around services to ensure patients and their whānau are economically and emotionally supported throughout the journey (which includes partnership with NGOs). Presently, evidence

in colorectal cancer demonstrates that Māori experience inequities at multiple points along the treatment pathway, which may also be true for other cancer types.[33] Therefore it is evident that a suite of interventions will be required to achieve treatment equity, underpinned by careful monitoring. Radiation treatment is already only provided at six public cancer centres, and other complex services and treatments are being provided centrally or at a few centres. These are invariably located in metropolitan centres, which means that rural communities may be structurally disadvantaged from accessing certain treatments. The impact of this must be monitored and mitigation strategies such as transport and accommodation assistance will need to be provided appropriately, and in a form that meets the needs of Māori communities.

Setting equity-focused treatment guidelines, monitoring them, and improving the system

As recently recommended by a group of world experts convened by the International Agency for Research on Cancer (IARC): *"…progress in reducing social inequalities in cancer outcomes should be monitored, regularly reported on and used to introduce improvements".*[34] Our sector, led by the Ministry of Health, are currently developing tumour standards and indicators of quality of care for a number of key cancers (including bowel and lung), with additional pan-cancer standards and indicators that will overarch all tumour groups. These standards and indicators provide an opportunity to incorporate specific factors that indicate equity in access to best-practice standards of care, which can then be monitored over time to assess progress toward equity. This important opportunity could be missed if a clear pathway for quality improvement does not follow monitoring, or if quality improvement efforts are ad hoc. Again, strong central leadership will be required.

In the context of inequities in survival outcomes between Māori and non-Māori cancer patients, standardisation of access to best practice care matters. Māori women with breast cancer have poorer survival outcomes than European/Other women with breast cancer;[2] however, it has recently been reported that Māori women who are diagnosed with their cancer through the BreastScreen Aotearoa screening programme have the same (if not better) survival outcomes as non-Māori women diagnosed through the programme.[25] The drivers of this significant achievement are likely to be multifaceted; but the most likely central driver is standardisation of the clinical pathway for patients diagnosed through the breast cancer screening programme, attached to well-organised and well-resourced monitoring and quality improvement processes. We must strive toward achieving this for all tumour streams: setting minimum standards for the level of care that is required in order to achieve the greatest possible survival benefit, and then ensuring that all New Zealanders have equal access to that standard of care. Taking this approach, while simultaneously collecting good data and making adjustments to system structure and resource as required, is a crucial means by which we will be able to achieve survival equity for Māori.

In order to achieve survival equity we must do whatever it takes to ensure that Māori have equitable access to and through best-practice cancer services. This will require a flexible and innovative cancer services system that focuses on patient and whānau needs, and learns what is required in order to reach and treat them. It will require a commitment from our society to the principal that achieving equity in survival will involve a disproportionate allocation of resources to ensure that we all enjoy the same access to best-practice care. As stated by Reid and Robson, equity *"is an ethical concept…it does not necessarily mean that resources are equally shared; rather, it acknowledges that sometimes different resourcing is needed in order that different groups enjoy equitable health outcomes"*.[35] Finally, the achievement of this goal will also require ongoing strong Māori leadership. Whether asserted through individuals or representative groups, Māori must continue to monitor progress toward survival parity and hold the Government to account when inaction is observed or a change in approach is required. As well as providing accountability, Māori leaders in the cancer sector must be enablers of the systemic change required to achieve equitable outcomes for

Māori—from the development of effective solutions to areas of need at various points along the care pathway, to the leadership required to ensure prioritisation and execution of these solutions.

Conclusions

New Zealand stands at the junction of a critical philosophical choice: whether, in good conscience, to accept the existence of preventable inequities in cancer survival for its indigenous population, or to invest whatever resource is required to close the gap. Māori shoulder an inequitable burden of cancer incidence and mortality in New Zealand, which is driven largely by preventable exposures such as tobacco; but Māori also suffer poorer survival outcomes once they have cancer, which reflects a health system that is working better for some groups of New Zealanders than it is for others. However, this inequity is not inevitable: by taking steps such as understanding and dismantling the barriers to early diagnosis, understanding the extent of under-treatment of patients with comorbidity, and establishing consistent, high-quality standards of care that are enacted without exception, we have the collective power to overcome this problem—and to improve cancer outcomes for Māori, and for all New Zealanders.

Appendix

Addressing criticisms of the Equity by 2030 goal

In the presence of enduring and substantial differences in the likelihood of death following a cancer diagnosis, achieving survival equity for Māori should not be a difficult concept to support. As a society, New Zealanders have a strong sense of fairness; and what we seek here is a commitment to achieving cancer outcomes for our indigenous population that resemble those that are already being achieved by our majority European population, with a reasonable timeframe attached to this commitment in order to incentivise immediate progress.

However, there are some potential criticisms of this goal that are worthy of discussion. Some of these are addressed below.

Criticism #1: Focusing on achieving survival equity for Māori is racist.

Programmes that are directed at eliminating inequities between groups, such as affirmative action programmes in US colleges, frequently attract criticism. There remains reluctance by some to accepting and implementing interventions that are directed primarily toward specific ethnic groups, such as Māori. This approach is often labelled 'race-based' or outright racist, since it directs resource and/or opportunity toward one ethnic group over others with the objective of improving outcomes for that one group. Somewhat paradoxically, this approach is often considered to be inequitable—an unfair allocation of opportunity based on a person's ethnicity. Critics perceive one group as 'getting more' than them, with the implication that it is to their own detriment or expense.

However, this view is entirely untenable when we take into consideration two key factors: firstly, the strong patterning of survival inequity by ethnicity in New Zealand, whereby Māori are much less likely to survive their cancer even after adjusting for differences in factors such as deprivation and comorbidity.[36] The patterning of survival outcomes observed for Māori provide an important public health opportunity: to understand the factors that are collectively contributing to poorer outcomes for this population group, and then to tackle them. Rather than being racist, initiatives that target Māori cancer outcomes represent a means by which to improve health outcomes for a substantial minority of the New Zealand population—and by improving systems to achieve optimal outcomes for disadvantaged groups, everyone stands to benefit.

Secondly, the importance of The Treaty of Waitangi cannot be understated: our founding document guarantees equal opportunity to our Māori population to participate in partnership with the Crown (including the equal opportunity to good health). The principles of The Treaty require the Crown to take active measures to restore balance in situations where Māori have been disadvantaged;[37] there are few better examples of this imbalance than in cancer survival.

Criticism #2: Focusing on achieving survival equity for Māori will leave other disadvantaged groups behind.

Inequity occurs over multiple axes, of which ethnicity is but one. It can be argued that prioritising initiatives that aim to improve outcomes for Māori do so at the peril of other groups, such as Pacific New Zealanders, those of all ethnic groups living in socioeconomic deprivation and those living in rural and/or geographic isolation.

However, taking this view presumes that initiatives aimed at improving outcomes for Māori will not result in improvements for other cancer populations—which they almost certainly will. Just as a rising tide lifts all boats, so too will the initiatives required to achieve survival equity for Māori lead to an overall improvement in care for non-Māori. As mentioned above, achieving survival equity for Māori will require us to set strong minimum standards of care access, and to devote the resource that is required to achieve these standards. It will require us to develop a system that monitors quality of care, communicates more effectively with patients and their whānau, and integrates and coordinates cancer and comorbidity care. It will require us to justify why some patients get treated and other patients do not. In short, when it comes to improving cancer survival outcomes, what is good for Māori is good for everyone.

Criticism #3: In order to achieve equity in cancer outcomes for Māori we should be focusing on prevention, not survival.

Striving for survival equity must be part of wider suite of initiatives, aimed at achieving equity in cancer incidence, mortality and survival for Māori. Achieving equity in cancer *incidence* must be driven by prevention—by renewing our commitment to Smokefree 2025, and taking wider systemic approaches to chronic infections, obesity, alcohol and diabetes control. Achieving equity in cancer *mortality* is entwined with these prevention efforts: even if we were to completely eradicate tobacco from New Zealand tomorrow, we are still likely to observe an inequity in lung cancer mortality between Māori and non-Māori for the next half-century and beyond.

On the other hand, achieving equity in cancer survival is a pressing short- to medium-term objective—one that will be acutely sensitive to systemic change in cancer care priorities, starting with those outlined in this paper. Prevention is, of course, the key to ultimately achieving equity in Māori health outcomes overall: but it will not help us to achieve equity in cancer survival.

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Taking BMI off the table

Lucy Carey

ABSTRACT

Four year-olds in New Zealand are offered a B4 School Check, during which they have their BMI percentile calculated and BMI category flagged—essentially diagnosing children as underweight, healthy weight, overweight or obese. The obese child is then referred onwards for treatment. It is assumed that parents need to be told which BMI category their child falls into so those with a child in the overweight or obese categories will be motivated to make healthy lifestyle changes. There are two fundamental problems with this:

- BMI is flawed
- A targeted approach like this is potentially harmful

In this paper, the current limitations of using BMI categories to essentially diagnose obesity are examined, recent research is discussed which calls into question the very idea of telling parents their child is obese, and an inclusive, universal approach is proposed instead.

All four-year-olds in New Zealand are offered a B4 School Check—a health and development check which aims to identify and address any concerns before children start school, eg, a hearing problem. As part of the check, children have their height and weight measured and body mass index (BMI) calculated.[1]

Children will fall into one of the BMI categories. Whether they are called the green, orange and red categories or the healthy, slightly unhealthy and very unhealthy categories, they come to the same thing: underweight, healthy weight, overweight or obese. The process of categorising children in this way essentially diagnoses obesity based solely off BMI. This is not limited to the B4 School Check—the use of BMI to diagnose obesity is encouraged with children and adults of all ages when they visit their general practice team.[2,3] Aside from the issues that may arise with singling children out as obese in this way, BMI itself has many limitations[4–6] when used to diagnose obesity in individuals and is only considered to be a "rough guide" by the World Health Organization.[7]

Nick Trefethen, Professor of Numerical Analysis at the University of Oxford, summarised many of the limitations of BMI in an opinion piece he wrote, stating that "the body-mass index that you (and the National Health Service) count on to assess obesity is a bizarre measure. We live in a three-dimensional world, yet the BMI is defined as weight divided by height squared. It was invented in the 1840s, before calculators, when a formula had to be very simple to be usable. As a consequence of this ill-founded definition, millions of short people think they are thinner than they are, and millions of tall people think they are fatter".[8]

His mathematical viewpoint of the limitations of BMI is backed up by scientific studies comparing BMI cut-offs for underweight, normal weight, overweight and obesity with more accurate measures of body fatness and health. A 2016 study compared blood pressure, lipids, glucose, insulin resistance and C-reactive protein with BMI categories in 40,420 adult participants from the National Health and Nutrition Examination Survey. The authors concluded that nearly half of 'overweight' and 29% of 'obese' individuals were metabolically healthy, and over 30% of 'normal weight' individuals were metabolically unhealthy. In the US this equates to an estimated 75 million adults misclassified.[9]

As for children, a 2015 systematic review and meta-analysis analysed data from 53,521 patients aged four to 18 years and concluded that the ability of the BMI formula to identify those with higher levels

of body fat was only 73%; meaning that 27% of children with high fat levels were not correctly identified using BMI.[10]

The inaccuracy of BMI is also compounded for Pasifika, Māori and Asian children. A 2010 study of 1,676 five- to 16-year-old girls from schools in Auckland compared BMI with percentage body fat in different ethnicities and concluded that Pacific Island and Māori BMI thresholds should be raised by approximately 1.5 and 0.6kg/m^2 respectfully, and South and East Asian BMI thresholds lowered by 3.3 and 1.1kg/m^2 respectfully, to account for the relative fat to fat-free mass ratios in girls of those ethnicities. The authors also stated that further research was needed in boys of different ethnicities as well.[11]

Along with the inaccuracy of the BMI tool to correctly identify body fatness and metabolic health in individuals, the very concept of alerting parents to the BMI or weight status of their child has been called into question by recent research.

It is well established that parents inaccurately perceive their children to be of a healthy weight and much focus has been on correcting their perceptions so that they will be motivated to engage in healthier behaviours.[12,13] However, highlighting the child's overweight or obese BMI category to the parent has now been shown to possibly add to the problem.

A 2016 study of 3,557 Australian children and their parents found that when parents perceive their child to be overweight, the child was actually more likely to gain more weight throughout childhood. This finding was independent of the actual weight of the child.[14]

Although further research is required to understand how this works, one hypothesis is that this is because parents restrict their child's food intake, thereby creating feelings of deprivation and food obsession. A 2012 study in 126 mothers and 102 fathers of four- to six-year-old children in Ohio found that parental concern about their child being overweight was related to higher restrictive feeding practices[15] and restrictive feeding is known to produce additional weight gain.[16]

Furthermore, a large study of 47,417 children six to 17 years old in China found that parents who perceived their child to be a healthy weight (irrespective of their actual weight) were more likely to prepare breakfast for the child, exercise with them, set aside time for their exercise and restrict screen time, while they were less likely to have soft drink for the child.[17] These findings call into question the very idea that parents should be corrected in their assumptions that their children are of a healthy weight.

The limitations of BMI and the potential harm of labelling children as overweight and obese presents health professionals working at the coalface of childhood obesity with an opportunity. Height and weight data could still be collected at the B4 School Check, and thus obesity tracked using BMI on a population level where errors tend to cancel themselves out, but at the individual level we could remove the BMI component from the B4 School Check.

Instead, a universal approach could be utilised. Every family, regardless of the size of their child, could have a conversation with the health professional about healthy living. In this way, a problem-focused approach becomes solution-focused by talking about the healthy behaviours we know make a big difference to families—adequate sleep,[18] restricting and monitoring screen time,[19] cooking at home,[20] eating meals together as a family,[21] following the division of responsibility when feeding children,[22] encouraging child-led play,[23] etc. Families who want further support in a particular area could then be offered an appropriate referral. This approach disregards size and focuses on wellbeing. The talking points are mainly self-reported and subjective, and they are less simply measured than BMI, but they are also far more meaningful in everyday life.

Competing interests:
Nil.

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New Zealand minimum dataset for a standard transthoracic echocardiogram

Kerryanne Johnson, Helen Walsh, Alex Sasse, Mark Davis, Belinda Buckley, Sally Greaves, Andrew To

The Cardiac Society of Australia and New Zealand (CSANZ) ensures the high quality of cardiac care across Australasia and provides a range of guidelines pertaining to the provision care and training. This New Zealand guideline was ratified on 13 June 2019 and should be considered in conjunction with other Australasian guidelines for Training and Performance in Adult Echocardiography ratified by the Cardiac Society of Australia and New Zealand board on 30 November 2012, available at http://www.csanz.edu.au/wp-content/uploads/2014/12/Adult_Echo.pdf and the New Zealand Guidelines for Adult Echocardiography 2015: The Cardiac Society of Australia and New Zealand.[1]

The last 10 years have seen substantial developments in ultrasound technology and a change in what constitutes a standard transthoracic echocardiogram.[1] Its portability and ability to provide real-time information regarding cardiac structure and function, as well as its accessibility has resulted in this being the most widely used imaging modality for assessment of cardiac structure and function.

The requirement for a standard minimum echo dataset has been well established with published guidelines within Europe, the UK as well as in the US.[2–4] This not only ensures that all studies are of an acceptable quality, it reduces the chance of pathology being missed and facilitates comparisons with previous studies across sonographers throughout the country and potentially worldwide.

It is recognised that not all echocardiograms, in some clinical situations, require a complete dataset and that this should be predominantly performed outside of urgent clinical situations. Furthermore, it is acknowledged there are certain situations when a focused study may be more appropriate, particularly if there has been a complete study within the last two years, during which period a significant change is considered less likely.

Aims

These guidelines are a group consensus for which the purpose is to define what is considered a complete standard imaging dataset and measurements, to create uniformity nationwide and moreover to provide a template against which studies can be audited as part of quality control recommendations. Included in the guidelines are recommendations regarding reporting and procedures to maintain quality within departments. Disease-specific guidelines can be found elsewhere and are not the focus of this guideline. Minimum requirements for stress echocardiography, contrast echocardiography and transoesophageal echocardiography will not be covered in this document.

The performance of an acceptable echocardiogram requires an appropriate environment to allow this to occur and should include a suitable area with sufficient space for hand washing, patient changing and for reporting. There should be access to equipment to allow the measurement of height, weight and blood pressure and appropriate examination couches with pull-outs to assist in obtaining optimal images.

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Adequate time per study will be dependent on the level of experience of the sonographer, but a recommended time would be 45–60mins,[4] to acquire a complete study and for reporting, with additional time allocated for more complicated cases.

Recommended imaging protocol

The recommended standard views of a complete examination detailed below (Table 1). This includes the structures of interest within that view and the minimum measurements required. It is recommended that, if Doppler data cannot be obtained, a screen is recorded to demonstrate that this was attempted. Quantitative measurements should be provided whenever possible as evidence for conclusions made where images are of good enough quality, to allow an acceptable level of reproducibility.

Global longitudinal strain obtained from 2D speckle tracking imaging has a growing evidence base with clinical utility, particularly in the monitoring of patients undergoing cardio-toxic chemotherapy, prognostication in heart failure and for diagnosis of cardiomyopathies, and so should be performed in laboratories with capable equipment and the bullseye map recorded.

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable).

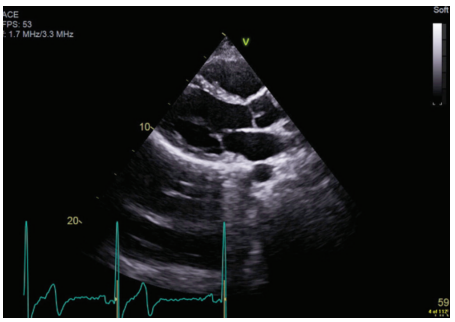
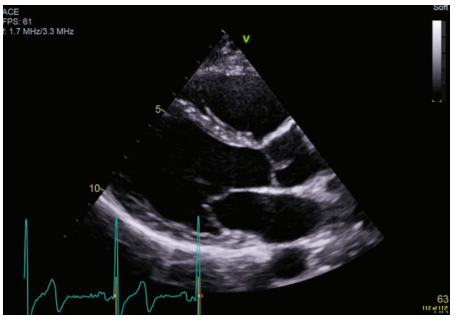
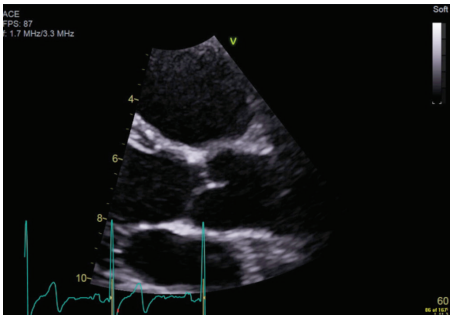
	View	Attention to	Perform/measure
1	PLAX increased depth		
		Pericardial space	
2	PLAX left ventricle		
		LA MV LV LVOT AV IVS RV	**LV EDD** LV ESD LV EF (Teicholtz) LA Dimension **IVS end diastole** **PWd diastole**
3	PLAX zoomed AV		
		AV	Aortic annulus diameter **LVOT diameter** **Aortic SOV diameter** **STJ diameter** **Colour Doppler**

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Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

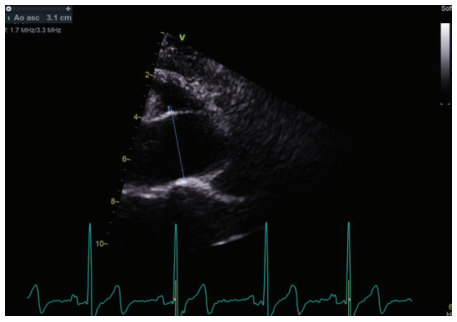
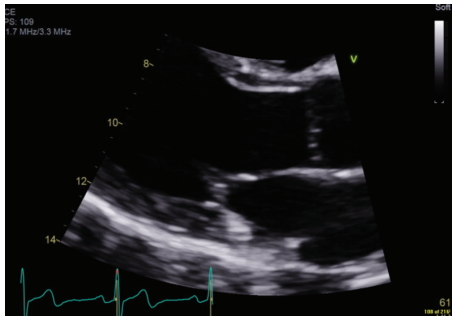
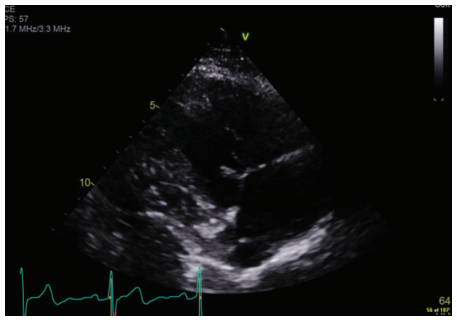
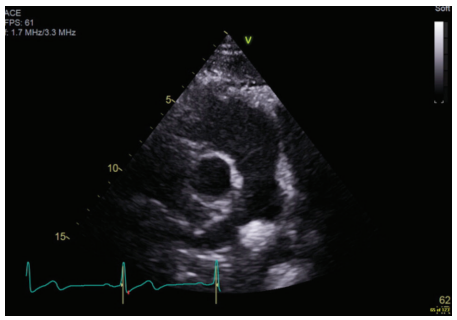
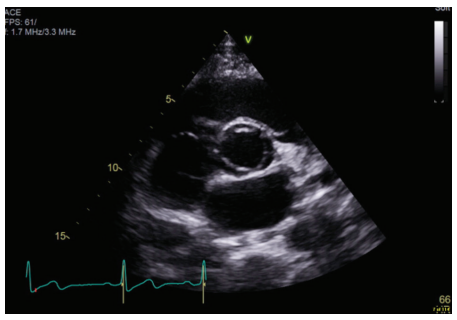
4	PLAX zoomed ascending aorta		
		Asc Aorta	**Asc aorta diameter**
5	PLAX zoomed MV		
		MV LA	**Colour Doppler**
6	PLAX RV inflow		
		RA TV RV	**Colour Doppler** **CW - Vmax** Vmax
7	PSAX RVOT focus		
		AV RA RVOT PV PA PA branches	**Colour Doppler** **PV CW –V max** PR PW -VTI **CW PRend** RVOT PW -VTI
8	PSAX, AV focus		
		AV LA RA RVOT TV PV IAS	

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

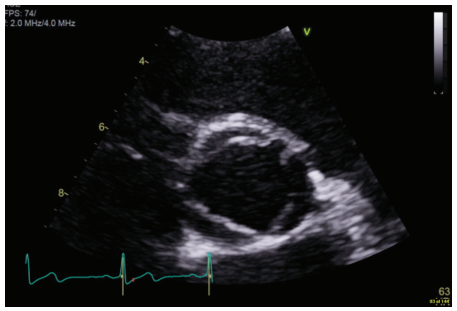
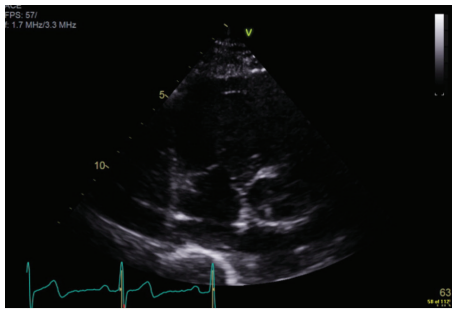
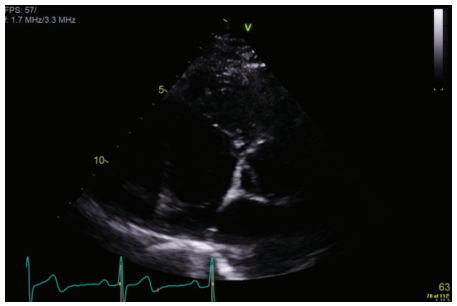
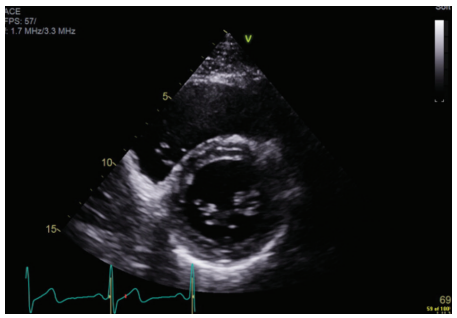
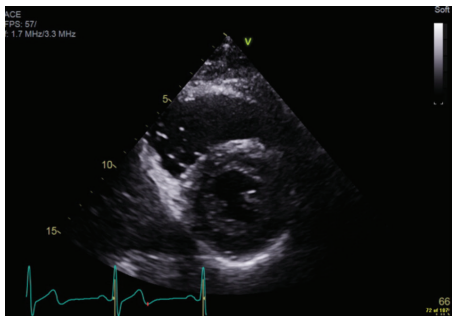
9	PSAX, AV zoom		
		AV (NCC/LCC/RCC)	**Colour Doppler**
10	PSAX TV focus		
		RA TV RV	**Colour Doppler** **CW RVSP**
11	PSAX IAS		
		LA RA IAS	**Colour Doppler**
12	PSAX, LV level MV		
		RV IVS AMVL PMVL LV	Colour Doppler
13	SAX, LV mid ventricle		
		Papillary muscles RV IVS LV	

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

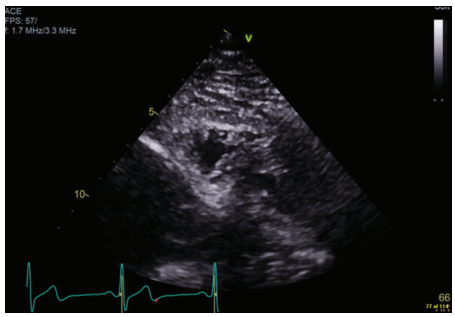
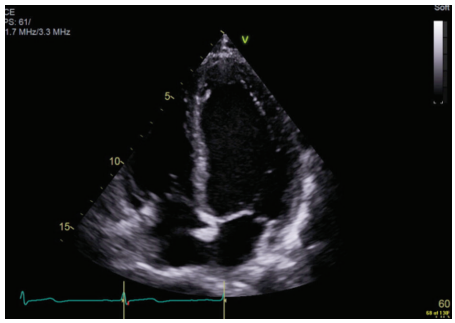
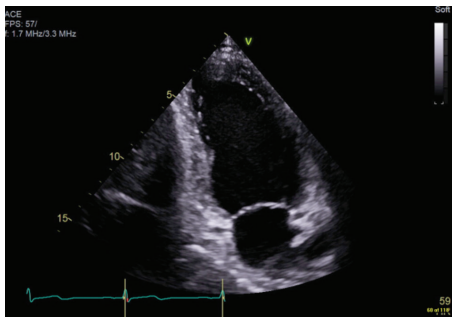
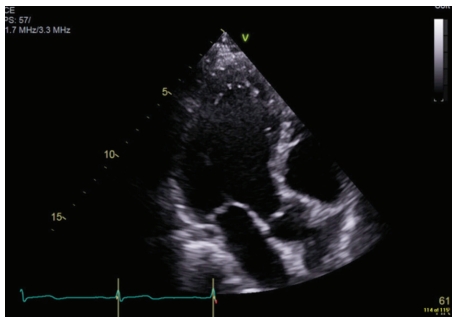
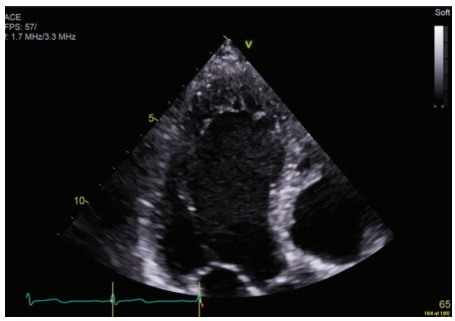
14	SAX, LV apex		
		LV apex	
15	Apical 4C		
		MV LV IVS RV TV RA IAS PVeins	**LA volume** **Colour Doppler MV** **MV PW E, A, DT,** **Lateral TDI é** **Septal TDI é** **PVeins PW S/D/ a reversal** **Valsalva** MV CW MS VTI MR CW VTI/Vmax
16	Apical 2C		
			**Colour Doppler** **LA volume**
17	Apical long-axis		
		LA MV LV LVOT AV	**Colour Doppler MV and AV** AV CW V max/VTI
18	Apical long axis reduced depth LV		
		LV RWMA	*LV GLS *3D volumes

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

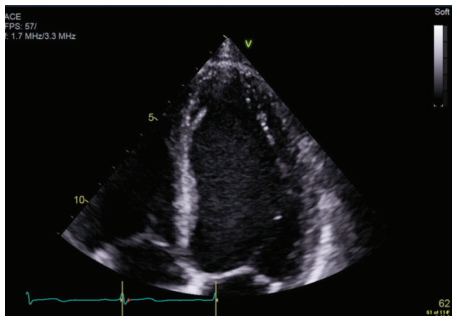
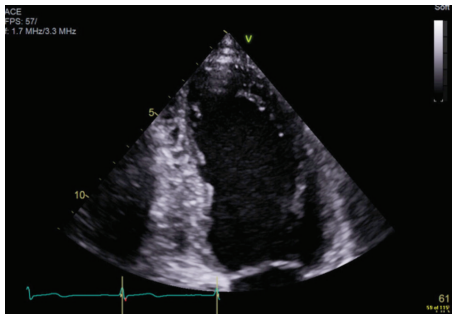
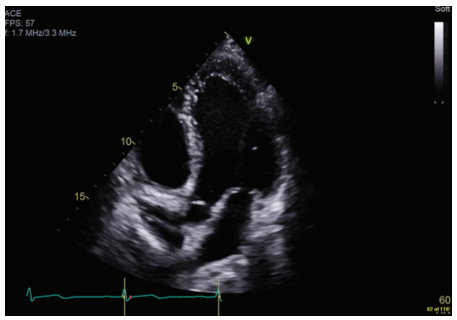
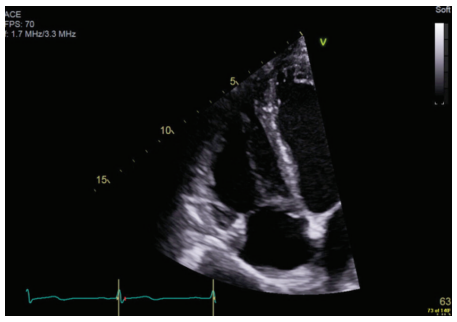
19	Apical 4C LV reduced depth		
		LV RWMA	LV EDV LV ESV LV EF (Simpsons) *LV GLS *3D volumes/EF
20	Apical 2C LV reduced depth		
		LV RWMA	LV EDV LV ESV LV EF (Simpsons) *GLS *3D Volumes
21	Apical 5C		
		LA MV LV IVS LVOT RA RV	**Colour Doppler – AV /LVOT** **LVOT PW Vmax/VTI** **AV CW Vmax/VTI**
22	Apical 4C posterior/RV tilt		
		RA TV RV	**Colour Doppler TV** **TV CW Vmax RVSP** **RV TAPSE** **RV ś** RA area RAV RV base and mid diameter RV length

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

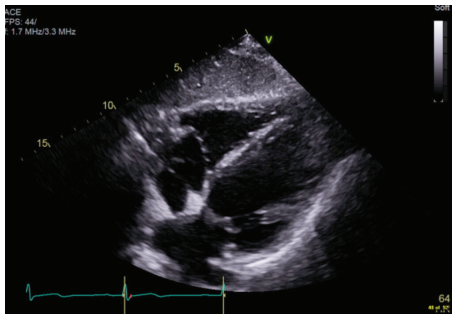
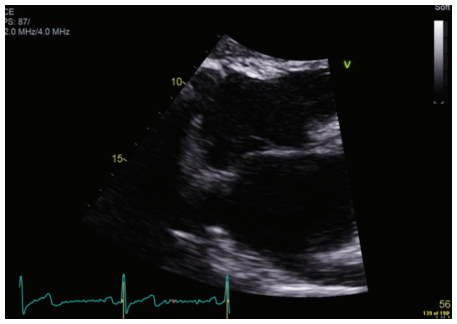
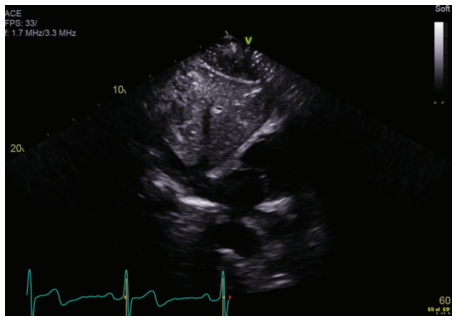
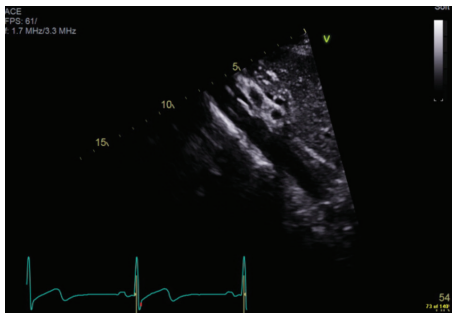
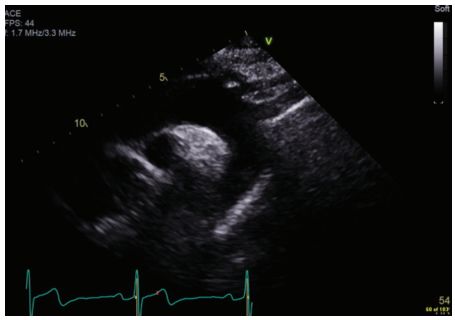
23	Subcostal 4C		
		LV MV RV TV IAS IVS RA LA Pericardium	
24	Subcostal 4C IAS Zoom		
		IAS	**Colour Doppler IAS**
25	Sub-costal long axis		
		IVC Hepatic veins	**Colour Doppler** **Hepatic veins** **Hepatic vein PW** **IVC dimension** IVC sniff (M Mode)
26	Subcostal abdominal aorta		
		Abdominal aorta	**Colour Doppler** **PW**

Table 1: Recommended minimum dataset and measurements (those in bold are minimum acceptable) (continued).

27	Suprasternal		
		Ascending aorta Aortic arch Descending aorta	**Colour Doppler descending aorta** **Descending aorta PW** **Descending aorta CW**

PLAX – parasternal long axis, PSAX – parasternal short axis, LA – left atrium, MV – mitral valve, LV – left ventricle, LVOT – left ventricular outflow tract, AV – aortic valve, IVS – inter-ventricular septum, RV – right ventricle, EDD – end diastolic dimension, ESD – end systolic dimension, EF – ejection fraction, PWd-posterior wall in diastole, STJ-Sinotubular junction, Asc A- ascending aorta, RVOT – right ventricular outflow tract, PV – pulmonary valve, PA – pulmonary artery, RA – right atrium, SOV sinus of valsalva, PSAX – parasternal short axis, IAS – inter-atrial septum, NCC-non coronary cusp, LCC-left coronary cusp, RCC – right coronary cusp, AMVL – anterior mitral valve leaflet, PMVL – posterior mitral valve leaflet, PVeins – pulmonary veins, EDV – end diastolic volume, ESV – end systolic volume, CW – continuous wave, Vmax – maximum velocity, PW – pulsed wave, VTI – velocity time integral, Prend – pulmonary regurgitation end velocity, RVSP – right ventricular systolic pressure, DT – deceleration time, TDI – tissue Doppler imaging, S – systole, D – diastole, GLS – global longitudinal strain, 3D – 3 dimensional, TAPSE – tricuspid annular plane systolic excursion, RV – right ventricle, IAS – inter-atrial septum, IVC-inferior vena cava, 4C – 4 chamber, 5C – 5 chamber, 2C – 2 chamber, 3C – 3 chamber, TV – -tricuspid valve, RWMA – regional wall motion abnormalities, NCC – non coronary cusp, LCC – left coronary cusp, RCC – right coronary cusp, RAV – RA volume.
*GLS and 3D volumes—is recommended when resources are available and there is moderate or more valvular disease, when there is screening for or presence of LV dysfunction, including monitoring of cardio-toxic agents[5] and cardiomyopathies, PR – pulmonary regurgitation.

3D left ventricular volumes and ejection fraction should be measured in laboratories that have capable equipment, in those undergoing evaluation of valve disease and in those requiring monitoring of left ventricular function, since this improves measurement reproducibility and correlates closely with MRI.[6]

Reporting

Reports should contain all the key measurements and comments on all structures listed in Table 1, in addition to the height, weight and blood pressure of all patients. Physicians interpreting echocardiograms should preferably have advanced cardiology fellowship training in echocardiography, and in centres where this is not possible a quality assurance programme is recommended.[1]

Physicians should be allowed sufficient time to assess all cardiac structures and the performance of all measurements. The time required will depend on complexity, equipment used, the report generated and the experience level of the sonographers and physician.

A summary should be provided with clinical correlation and comparisons made with previous studies when appropriate.

All reports should where possible include a log of name, date and time of all who re-access or modify the electronic report for future reference.

Quality and assurance

Performance of a good-quality echocardiogram will depend on regular participation in quality control and continued professional development to maintain competency. Quality improvement programmes are particularly important and should be performed; and are essential in centres where all echocardiograms are not reported by an imaging cardiologist.

Recommendations include

Audits of a percentage of complete studies both as a department and individually. Annual individual reviews of 5–10 studies per sonographer to quantify the adherence to imaging protocols. In centres where sonographers perform in isolation, it is recommended they are invited to participate in regional quality assurance programmes.

Competing interests:
Nil.

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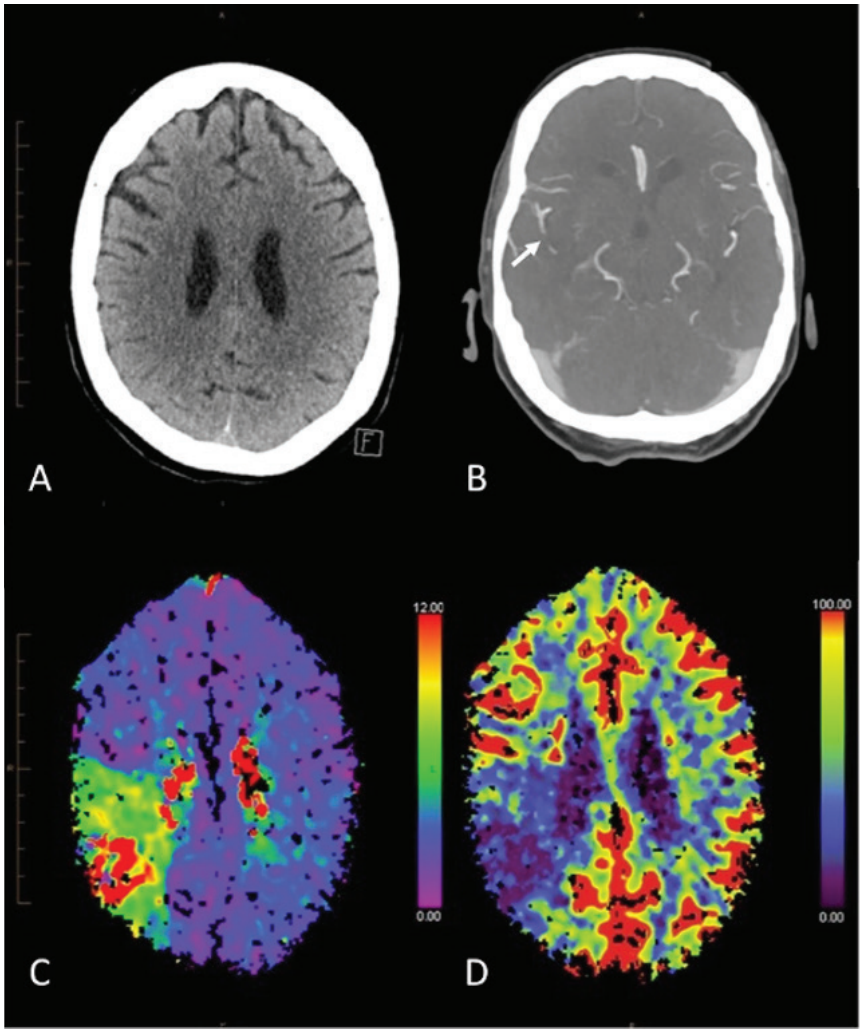
Cerebral embolisation in bacterial endocarditis

James Beharry, Wayne Collecutt, Josh Martin, John N Fink, Teddy Y Wu

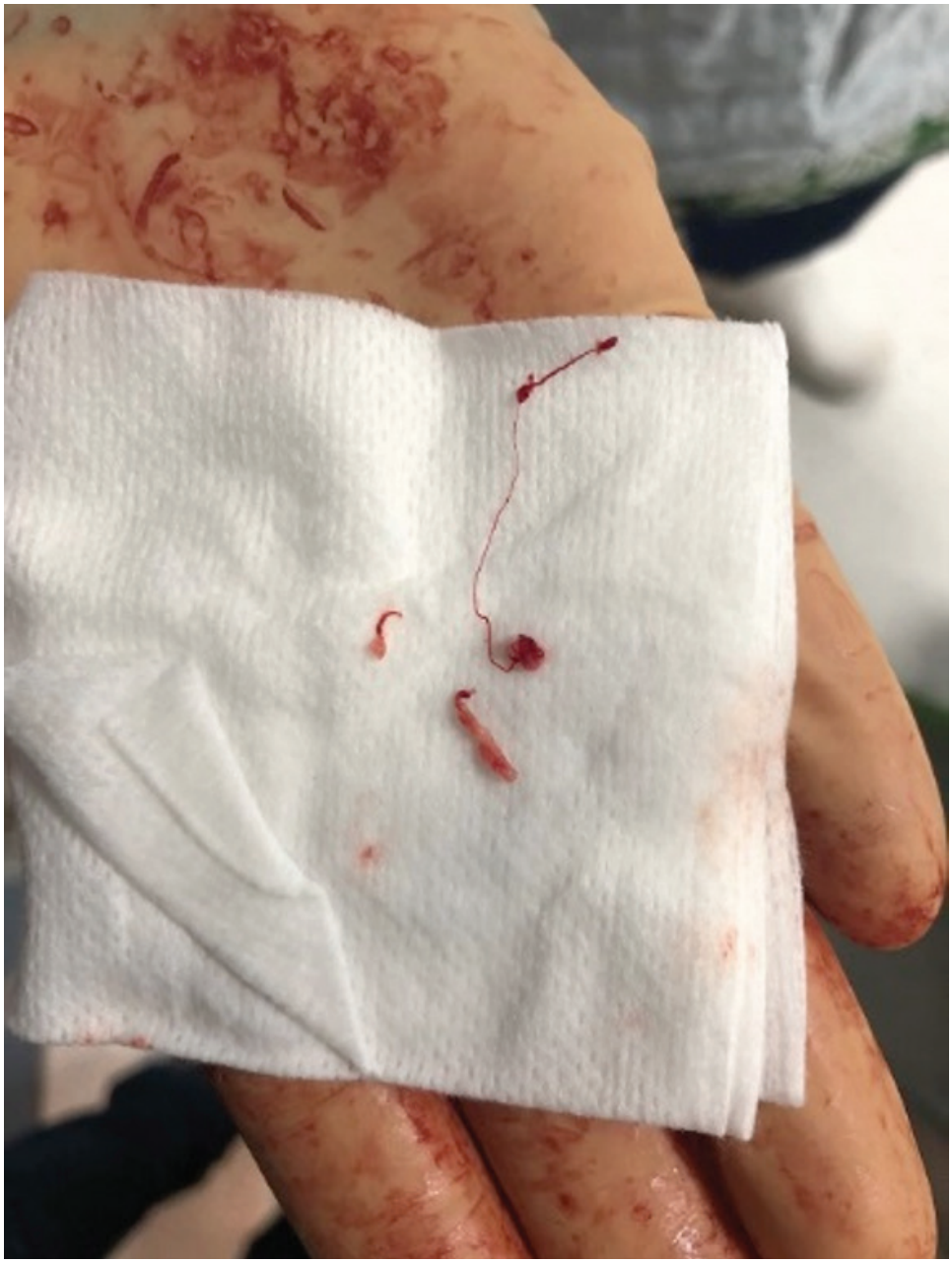
A 77-year-old woman receiving antibiotic treatment for a recent group-B streptococcal bacteraemia was admitted with subacute bilateral cerebellar infarctions and dyspnoea. The day following admission she developed left hemiplegia, gaze palsy and left hemi-neglect with a National Institutes of Stroke Scale (NIHSS) score of 15. Multi-modal computed tomography demonstrated a right middle cerebral artery M2 segment occlusion with a corresponding perfusion defect (Figure 1). A 5mm cylindrical, pale yellow, rubbery material was retrieved via endovascular thrombectomy (Figure 2). Transoesophageal echocardiogram demonstrated mitral valve vegetations

Figure 1: Baseline computed tomography findings.



Panel A: Non-contrast computed tomography at time of neurological deterioration demonstrating no early ischaemic change. Panel B: Computed tomographic angiography showing right middle cerebral artery M2 segment occlusion. Panel C/D: Perfusion imaging displaying prolonged Tmax (Panel C) and reduced cerebral blood flow (Panel D) in the right middle cerebral artery territory.

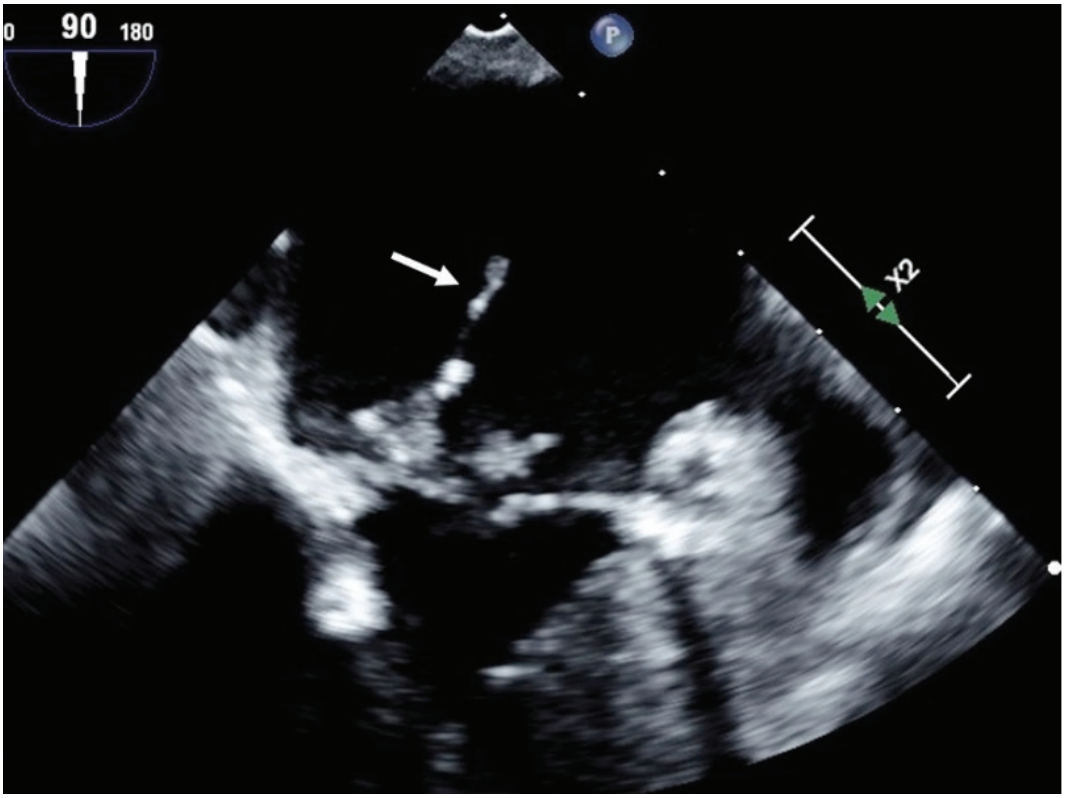
Figure 2: Embolised material from native mitral valve bacterial endocarditis.



(Figure 3). She was then treated with high dose intravenous penicillin. 24-hour NIHSS score was 1. Despite neurological improvement, she experienced progressive cardiac decline due to severe heart failure and died 13 days after her stroke.

Neurological sequelae are a common occurrence in patients with infective endocarditis, and approximately 30% of patients with bacterial endocarditis present with neurological complications, most of which are cerebral embolic events. Intravenous thrombolysis is the standard treatment within 4.5 hours of acute ischaemic stroke, but systemic thrombolysis is contraindicated in this setting due to higher rates of haemorrhagic transformation.[1] In patients presenting with bacterial endocarditis and embolic occlusion of a proximal intracranial vessel, endovascular thrombectomy appears to be a safe and effective reperfusion strategy.[2]

Figure 3: Transoesophageal echocardiogram image of mitral valve vegetations (arrow).



Competing interests:
Nil.

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A case of orf

Christo Creffier, Amanda Oakley

Orf virus disease is an uncommonly diagnosed contagious cutaneous zoonotic viral infection predominantly affecting the epidermis. We describe a typical case.

Case report

A 17-year-old female farm worker presented in early spring with a tender nodule on her left index finger. She noticed the lesion appear after docking lambs approximately five days previously.

On examination, there was a 1x1cm firm erythematous nodule on the radial aspect of the left index finger distal to the metacarpophalangeal joint. It was not fluctuant and there was no surrounding cellulitis. Punch biopsy showed mixed inflammatory infiltrate in the papillary dermis. The epidermis contained numerous enlarged keratinocytes with homogenous eosinophilic cytoplasmic inclusions. A swab was positive for orf virus by polymerase chain reaction performed at LabPlus Waikato. Outcome was unknown, as she failed to attend a follow-up appointment.

Figure 1: Macroscopic appearance of orf virus disease of the left index finger showing appearances of a raised, erythematous, nodule on the radial aspect of the left index finger.

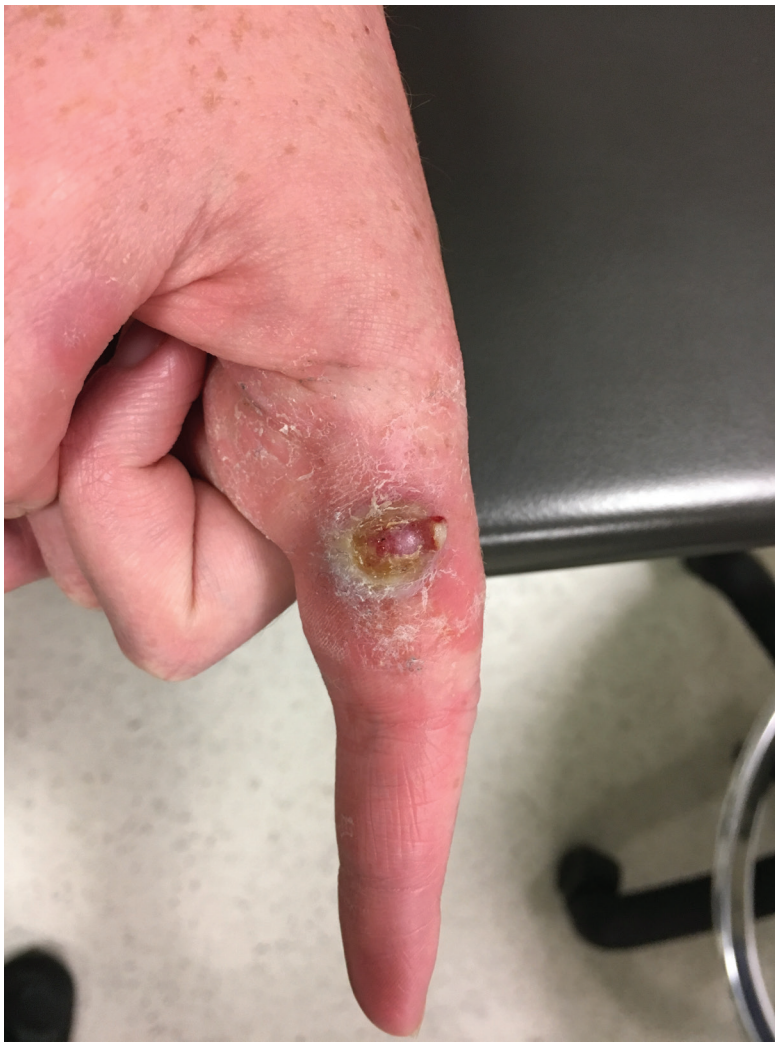


Figure 2: Histological appearance of orf virus disease with direct view of pale cytoplasmic nuclear evacuation demonstrated by arrow A. There is also some intracytoplasmic and intranucleur inclusion typical of the virus as demonstrated by arrow B.

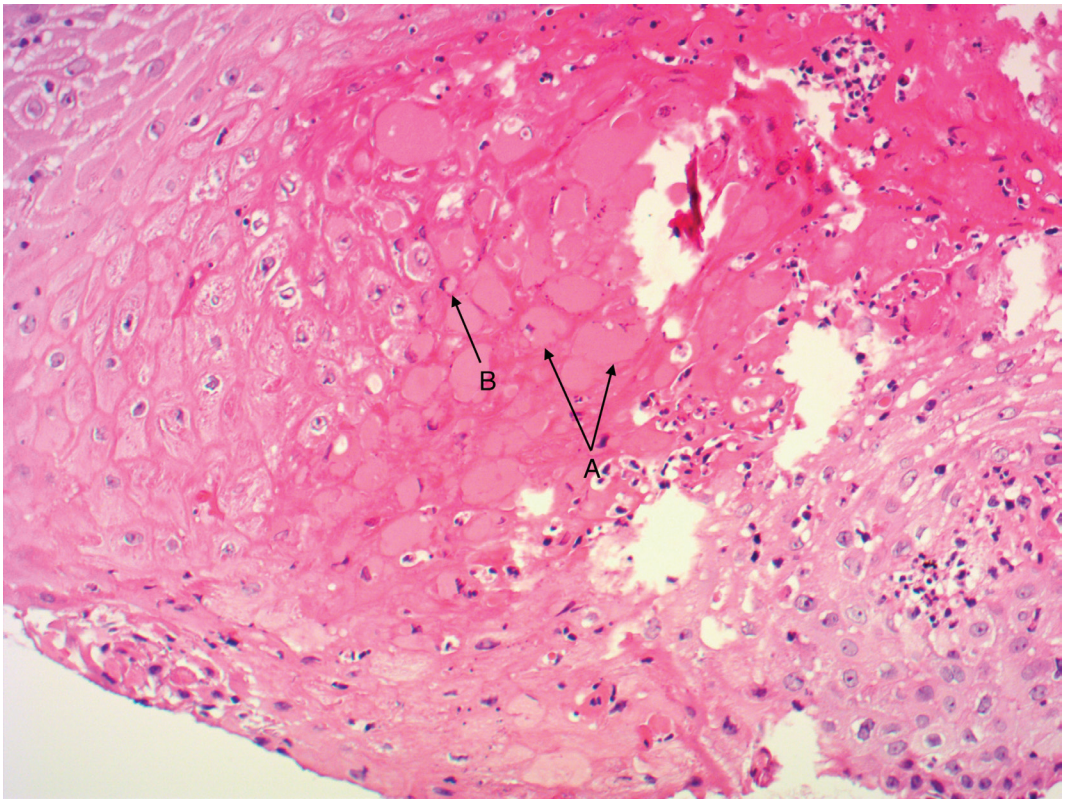
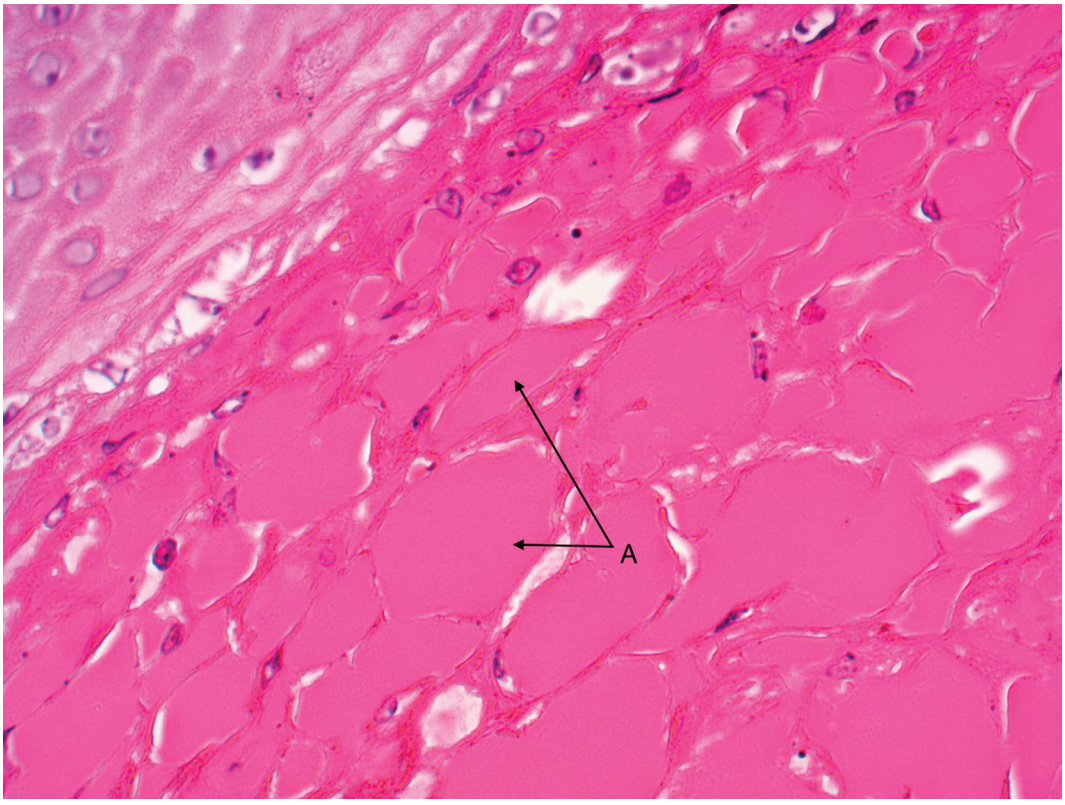


Figure 3: Histological appearance of orf virus disease with evidence of pale cytoplasmic nuclear evacuation as seen by arrow A.



Discussion

Orf is uncommon and is mainly diagnosed in rural communities in spring and early summer. Farmers, their families, shearers, slaughterers and butchers are at the greatest risk of developing orf if they are in close contact with sheep and goats (and rarely, other farm animals), untreated wool or the vehicles or buildings in which the animals have been housed. Only nine cases of orf were documented in New Zealand over the last 10 years but as the disease is well known in the rural community, it is likely that many incidences of the infection do not present to medical attention.[1]

Parapox virus infection is highly prevalent among sheep in New Zealand and can be difficult to eradicate once it enters a flock. A live vaccine is available to farms carrying the disease but, as immunity only lasts a few months, reinfection is common.[2] Current management includes quarantine of the affected sheep and goats, with care made to avoid harsh environments to reduce the risk of cuts and abrasions.

The causative agent is an epitheliotropic DNA parapoxvirus.[3] Sheep and goats develop a 'scabby mouth' with a 'contagious pustular dermatitis' around the mouth, nose and teats, which is transmitted to other animals via direct contact through cuts and abrasions. The developing symptoms vary depending on the location of the infection, but generally orf is painful and can lead to anorexia and starvation.[4] The virus invades a damaged epidermis and replicates in follicular epithelium with a typical viral response involving of CD4+ helper cells and CD8+ cytotoxic T cells, antibodies and interferons.[3]

In humans, orf presents as a reddish-blue, targetoid, flat-topped, blood-tinged, 2–5cm nodule, which is on the hand in 95% of cases; other sites include forearms and face.[4] Immunocompetent humans may also develop a mild fever, lymphangitis and lymphadenopathy. Complications include secondary bacterial infection and reactive erythema multiforme. However, the disease is usually self-limiting, resolving in six weeks without scarring.

Orf virus disease is not notifiable to the Medical Officer of Health, as it is a relatively minor infection and is not transmitted from human to human.[5] Orf virus disease may be under diagnosed and under-reported given the large population of sheep and goats in New Zealand. While orf is self-limiting, the secondary effects of bacterial infection are important to recognise, especially for clinicians who work in a rural setting.

Competing interests:
Nil.

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On the health effects of radiofrequency radiation

Robin Kelly

As a concerned general practitioner of 38 years standing, I have been following the ongoing debate about the potential harm to patients of both existing non-ionising radiofrequency radiation (RFR), and the potential impact of the coming fifth generation (5G) roll-out. I am one of the many physicians and scientists around the world who adopt the precautionary principle into our professional lives, following such luminaries as Hippocrates ("primum non nocere –first, do no harm") and Benjamin Franklin ("An ounce of prevention is worth a pound of cure").

The recent exchange between Dr Sue Pockett[1] and Professors Elwood and Wood[2] reveals stark differences of opinion held by academics on this subject. Indeed, the professors Elwood and Wood are highly critical of those who select and represent data inappropriately to further their argument that non-ionising radio frequency radiation (RF-R) is harmful beyond its thermal effects. 'Confirmation bias' and 'cherry-picking' are phrases that are generally used to describe this phenomenon.

Most physicians following this debate are aware of the large whole animal studies by the US National Toxicology Program (NTP) in conjunction with the National Institute of Environmental Health Sciences (NIEHS), the results of which were published in 2018. Elwood and Wood, in the section Whole Animal Studies p67,[2] thoughtfully give a link to a webpage clearly detailing the peer-reviewed findings of these studies: https://ntp.niehs.nih.gov/results/areas/cellphones/index.html.

To quote this webpage:

"The NTP studies found that high exposure to RFR (900 MHz) used by cell phones was associated with: clear evidence of tumors in the hearts of male rats. The tumors were malignant schwannomas. Some evidence of tumors in the brains of male rats. The tumors were malignant gliomas. Some evidence of tumors in the adrenal glands of male rats. The tumors were benign, malignant or complex combined pheochromocytoma."

However, Elwood and Wood precede this link with this statement: "Recently, the most extensive studies yet have shown some possible cancer increases in male rats with lifelong exposure".[2]

It appears that Elwood and Wood have interpreted 'clear evidence of tumors' as 'some possible cancer increases.' As no further explanation is given, the readers are left wondering whether this is a gross oversight, reflects a criticism or even a conscious denial of the conclusions stated on the NTP webpage to which they have been personally directed. The process of peer-review is explained thus on this page:

"The final conclusions represent the consensus between NTP and a panel of external scientific experts who thoroughly reviewed the draft NTP technical reports at a public meeting in March 2018. The results are based on NTP's four categories of evidence that a substance may cause cancer: clear evidence (highest), some evidence, equivocal evidence, no evidence (lowest)."

Concerned independent scientists and physicians around the world[3] cite this study, together with similar findings from the Ramazzini Institute study,[4] as further evidence that the WHO's International Agency for Research on Cancer (IARC) should consider revising their conclusions on the carcinogenic potential of RFR in humans.

Competing interests:
Nil.

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Animal studies of exposures to radiofrequency fields

J Mark Elwood, Andrew W Wood

We thank Dr Kelly for his interest in our paper on health effects of radiofrequency fields, and we agree that the animal studies by the US National Toxicology Program (NTP) are important. However, the interpretation is by no means simple. The studies in rats assessed lifetime exposure to two modulations of 900MHz radiofrequency fields (RF), GSM and CDMA, each at three dosages.[1] The lowest dose was 1.5W/kg, designed to be similar to the maximum dose allowed by standards, and higher doses of 3 and 6W/kg were used. Earlier studies showed 10W/kg to be often lethal, due to heating effects. Many types of tumours were assessed. There was a significant increase in a very specific tumour, cardiac malignant schwannoma, in male rats, with exposure to the highest dose, 6W/kg of GSM or CDMA, with no increase with exposures at the other two doses. There were no significant increases in female rats, or in male or female mice.[2] Cardiac schwannoma are exceedingly rare in humans: 18 cases were reported worldwide up to 2018.[3] The logic in studying them is that they may be analogous to vestibular schwannoma (acoustic neuromas) in humans, as they have similar histology. But schwannoma occur at many sites in rats, and another logical comparison is with the incidence of all malignant schwannoma; but the NTP studies showed no significant increases in total schwannoma, or in schwannoma specific to any other site, even in male mice with the highest RF dose used. Brain lesions, malignant glioma and glial cell hyperplasia, are more clearly analogous to human brain tumours; there were no statistically significant excesses in any dose category either male or female rats, or in mice.

Several difficulties in interpretation exist. A striking result is that in the control group of 90 male rats, only 28% survived through the two years of the experiment, compared to 48–68% in the six exposure groups. As each exposure group was compared to this same control group, this difference affects every comparison. A different statistical method was used in the 2018 report, compared to the 2016 results,[4] to partially adjust for this. The NTP conclude that this survival difference was due to a lower rate of kidney disease in RF exposed animals, which they say could be a protective effect.

A key issue is that of performing many statistical tests. Very many outcomes were assessed. Statistical significance was based on a P=<0.05 criterion, but one-sided, and no adjustment for multiple testing was done. Over 200 endpoints were assessed, each in two sexes, two modulations and three dosages: over 1,000 comparisons, so many 'significant' results would occur by chance. The focus of the NTP methods is to identify possible harmful agents, while accepting frequent false positives, on the basis that the findings will be checked by further research. In the rat studies, there were several other positive results; there were also 'significant' *decreases* in pituitary and mammary adenomas in some groups of animals. The NTP reports results in their summary often ignoring statistical tests; for example in their summary they say "tumours of the brain were also considered to be related to exposure" although there were no significant results for GSM, and only one 'significant' trend test for CDMA, at P=0.04.

There were significantly increased risks of pheochromocytoma at the lower two dose levels of GSM in male rats and at the lowest dose of CDMA in females; but there were no increases at the highest exposures, and no dose-response.

It is usual practice in interpreting animal carcinogenesis studies for application to humans to require animal evidence from at least two species,[5] so the NTP used both rats and mice. The results for mice exposed

to 1900MHz GSM and CDMA at 5, 10 and 15W/kg showed no excesses of either brain tumours or schwannoma (even specifically cardiac).[2]

The NTP studies were reviewed by 13 scientists on behalf of the International Commission on Non-Ionising Radiation Protection, ICNIRP.[6] They note that the NTP study involved "many thousands of statistical comparisons", and repeat the criticisms noted above; they write that "It is therefore not possible to determine whether any of the results are due to RF exposure, as opposed to chance", and that the results should be treated as exploratory only. They point out that the RF exposures at which effects were seen are 75 times higher than the whole body exposure restriction of RF for the general public, and they note that there was no thermal control in the study, so that an increase in body core temperature rise was likely to be substantial and there could have been thermal effects. The NTP itself notes RF at the highest dose used caused increases in subcutaneous body temperatures in rats, but not in mice.[7]

In contrast, Hardell and Carlberg[8] argue that the NTP studies are supportive of a carcinogenic effect on glioma and acoustic neuroma in humans. Melnick[9] has also defended the studies.

Results on brain and heart tumours, but not yet on other outcomes, are also available from studies of lifelong exposures to rats from the Ramazzini Institute in Italy.[10] These used GSM at 1.8 GHz, at three dosages, 0.001, 0.03 and 0.1W/kg, all much lower than those used by the NTP, and closer to the dosages of human exposure. No significant increases in meningeal tumours or in glial hyperplasia or malignant tumours were seen. There was a statistically significant excess of cardiac schwannoma in male mice at the highest exposure dose (0.1W/kg), with no significant excesses at lower doses or in females; for both sexes combined, there were no significant increases and the highest rate was at the lowest dose used. The increase in cardiac schwannoma at 0.1W/kg is in contrast to the NTP results, which showed no significant increases at two much higher dosages, whereas the single NTP result of an increase was seen at 60 times higher dose.

Thus there are many issues involved in the interpretation of the NTP and Ramazzini animal studies. There are contrasting opinions on what the results mean, and particularly in their relevance to humans. So, in our article we cited the studies but were cautious in interpreting them. Dr Kelly has usefully drawn attention to these important studies; but they are not simple to interpret.

Competing interests:
Nil.

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The projected burden of knee osteoarthritis in New Zealand: healthcare expenditure and total joint provision

David Gwynne-Jones, Gary Hooper

We commend Wilson and Abbott on their paper highlighting the projected burden of knee osteoarthritis in New Zealand.[1] Their projections are worrying and match our previous findings.[2–4] However, we have concerns regarding the accuracy of their figures, the clinical implications and their conclusions. They underestimate the demand as the model does not allow for patients who need bilateral TKR and does not appear to include unicompartmental replacement (UKR), which is also performed for knee OA.

In 2013, 7,419 knee replacements were performed in New Zealand (6,694 TKR and 725 UKR), of which osteoarthritis was the diagnosis of 95%.[5] Therefore, the baseline number performed for OA was 7,048 rather than 5,070 used in their model. By 2017 there were 9,352 knee replacements (8,298 TKR and 1,054 UKR), so the burden for OA of approximately 8,884 is already well in excess of 5,770 in their model. It has already surpassed the 8,613 projected by Hooper et al for 2026[2] and is fast approaching the projections of Wilson and Abbott for 2038. The numbers performed in 2017 were 54% higher than Wilson and Abbott's estimate, so extrapolating from this the total burden could approach 14,000 TKR/UKR annually by 2038 or an increase of almost 7,000 from 2013.

They also modeled the effect of rising rates of obesity on projected numbers of patients needing TKR. Obesity has a major impact on a wide range of other orthopaedic conditions. Procedures are more complex, take longer and have higher complication rates. We fully concur with their conclusion that public health measures are needed to reduce population obesity rates. However, there will be a lead time of many years before we are likely to see any effect on demand for TKR.

While they state in their introduction that there are capacity constraints, they do not expand on this in the discussion. The average orthopaedic surgeon in New Zealand performs 36 TKR per year. This increases to 41 per year if UKR is also included.[5] To perform the additional 4,000 procedures predicted by Wilson and Abbott would potentially need a further 100 orthopaedic surgeons or an increase of 50% on the 206 surgeons who performed knee arthroplasty in 2013. In addition, there will be a need for more supporting staff (anaesthetists, nurses, physiotherapists, etc) and infrastructure (beds, operating facilities and surgical time).

In the discussion they state that "effective, low cost, early interventions such as exercise therapy, can alleviate symptoms, improve quality of life and reduce the need for costly treatment, such as TKR, later in the disease course." They conclude that without these changes the number of TKRs will increase by 4,000 by 2038 with a subsequent increase in the fiscal burden.

We agree that a more coordinated approach and effective non-operative treatment, including exercise therapy, has an important role in all patients with knee OA. However, the two papers they cite add

little to support the statement that TKR can be reduced in New Zealand by non-operative measures. The study by Teoh et al[6] is from Australia, which has a very different healthcare system and access thresholds to New Zealand. The MOA study from New Zealand only has follow-up to two years by which time 35% of patients had already undergone hip or knee replacement.[7] A recent study has shown that it may be possible to delay surgery for five years in up to 50% of patients who initially did not qualify for TKR with an individualised non-operative programme.[8] However, while they avoided surgery, they had no clinically relevant improvement.

Exercise therapy may be cost-effective in the short term, but TKR, while expensive up front, has been shown to be highly cost-effective with gains lasting many years.[9] The 18-year survival of a TKR in New Zealand is 92.3%, so for the majority of patients it is one procedure that will last their lifetime.[5]

The healthcare burden of knee OA and other musculoskeletal conditions will continue to grow. Robust modeling is important to help inform long-term funding decisions but should include a clinical perspective in order to be relevant and credible. Public health initiatives to reduce obesity are essential but the demand for TKR will continue to rise. We need to plan for this from both economic and workforce training perspectives. Unless adequate provision is made for TKR, the inevitable consequence will be rising threshold scores for publicly funded surgery, explicit rationing and increasing numbers of patients being declined surgery.[4]

Competing interests:
Nil.

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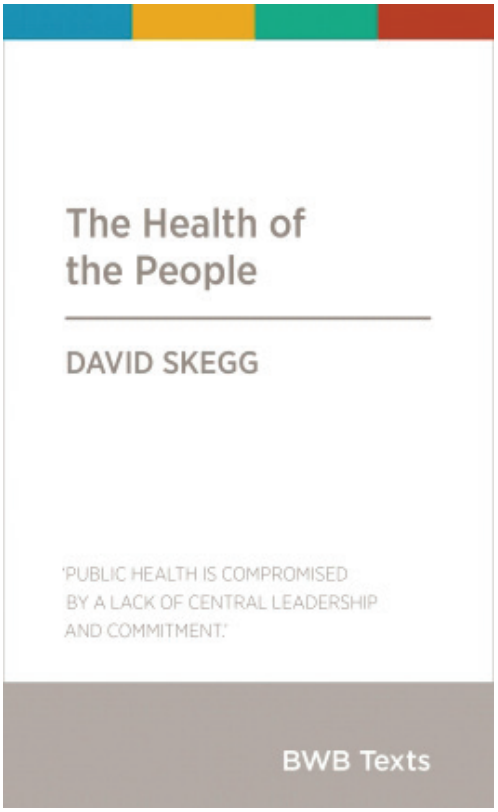
The Health of People

Frank Frizelle



David Skegg. Published by Bridget Williams Books, Mar 2019. ISBN 9781988545585. Contains 144 pages. Price NZ$14.99

This small paperback book is an account of where New Zealand public health is today. It also explores why this is and where we might go. Professor Sir David Skegg provides the devastatingly clear view of the past that only an educated participant in its history can provide, and he doesn't hold back in his criticism. It is clear he believes that the New Zealand public health sector is compromised by the lack of central leadership and commitment.

The book starts with a current event that demonstrates this impotence of the present leadership, by reviewing the report in the Havelock north water quality inquiry into the outbreak of campylobacter infection. He quotes from the report, which concluded that there was a widespread systemic failure among water suppliers, but also a complete failure of leadership and stewardship by the Ministry of Health.

Skegg explains what public health does and why it is important, then goes on to look at various issues in an interesting and hard-hitting manner. For example, in regard to colorectal cancer, he states:

"Given the high risk carried by New Zealanders, one might expect that we would be in the vanguard of efforts to apply screening methods that had been shown to be effective. Sadly, this is far from the case. … (the) real scandal is that all New Zealanders living outside the Waitemata district have been waiting for so long (over 20 years) for access to organised screening."

Skegg explores the reasons why public health policy has failed and discusses the undue influence of tobacco, alcohol and food lobbyists with politics. He is scathing in his comments about some politicians and the influence that lobbyists have on them.

He outlines the rise and fall on the Public Health Commission (PHC), an independent body that looked at public health policy, but who ran afoul of the smoking, alcohol and food lobbyists. He also proves the role of certain politicians whose actions (spurred on by the lobbyists) were involved in the destruction of the commission. This chapter provides a great insight into the forces that create the world we live in and gives insight to why political parties promise one thing in opposition and don't deliver when in power.

The last part of the book looks at how we might improve things; ie, where to from here. However, the shadow of past political shenanigans with the PHC and the inability of politicians to deal with powerful lobbyists (not just the tobacco, alcohol and food industry, but also pharma and dairy industry), suggest that any real progress in this direction may well be glacial.

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Association of habitual glucosamine use with risk of cardiovascular disease

Glucosamine is widely used by subjects with osteoarthritis and joint pain in the belief that it mitigates symptoms. Whether it is effective is debatable. This prospective cohort study in the US assesses whether its habitual use may diminish the risk of cardiovascular disease (CVD) events.

There were 466,039 participants without CVD at baseline. Information about their supplement use was obtained by a questionnaire. Enrolment was from 2006 to 2010 and follow-up was to 2016. At a median follow-up of seven years, the results showed that glucosamine use was associated with a significantly lower risk of total CVD events and similar findings for CVD death, coronary heart disease and stroke.

It was concluded that habitual use of glucosamine supplements to relieve osteoarthritis might also be related to lower risk of CVD events.

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Vitamin D supplementation and prevention of type 2 diabetes

Apparently observational studies suggest there is an association between low vitamin D levels and the development of type 2 diabetes.

In this study, 2,423 subjects who met criteria for prediabetes were randomised to receive vitamin D supplements or placebo regardless of their baseline serum vitamin D levels. The dose of the vitamin was 4,000 IU per day.

At a median follow-up of 2.5 years it was found that vitamin D supplementation did not result in a significantly lower risk of diabetes than placebo.

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Septoplasty with or without concurrent turbinate surgery versus non-surgical management for nasal obstruction in adults with a deviated septum

Septoplasty for correction of a deviated nasal septum is apparently the most commonly performed ENT operation in adults. Apparently doubts about its merits have arisen, hence this trial performed in the Netherlands.

Two hundred and three appropriate patients were randomised to either receive the surgical or non-surgical treatment. At 12 months follow-up the results favoured the surgical procedure. The benefit was sustained at 24 months.

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A Case of Haemorrhagic Disease of the New-Born

By THOMAS H. HORRAX, M.D., Edin

TOMMY LOST HIS FAITH., Sunday school Teacher: Why, Tommy, lam surprised to hear you say that ' you don't believf. our. prayers are answered. . . . ; Tommy : Well, the anrfelsy brought a new baby to our house last week; and y. all the time I had been prating for a goat. (Observer, 12 February 1910). Alexander Turnbull Library, Wellington, New Zealand. /records/27564073

Although there have been numerous cases of this disease successfully treated of late years, the suddenness of onset, the urgent need of treatment, and the high mortality give a more than ordinary interest to the case.

The child was born on 2nd March, 1917. The birth was normal and the child a healthy-looking female. Parents healthy and with no haemorrhagic history. At 7 a.m. on 4th March, about 40 hours after birth, there was vomiting of stomach contents mixed with blood, and the free passage of clotted blood per rectum. Again at 11 a.m., from then until 4.30 p.m., there was haematemesis and large clots of blood per rectum.

During the day adrenalin, m. 1. of a 1 in 1000 solution in a teaspoonful of cold sterile water was given by the mouth, but in most cases was returned, plus quantities of blood. Per rectum it was tried, but with the same result—returned with large quantities of blood. After each haemorrhage saline was given subcutaneously to counteract the loss of fluid, as the child was blanched, collapsed, and seemingly in extremis. Fortunately, during the night the bleeding became less and vomiting ceased. Adrenalin was

given three-hourly during the night and was retained, as also was a teaspoonful of mother's milk and a teaspoonful of water given every hour. At 5.30 a.m. on 5th March haematemesis and blood per rectum, and again at 7.30 a.m. Baby profoundly collapsed and all the improvement of the night lost. As during the next three hours there was no more bleeding, milk and water was tried again by the mouth and was retained. This was given hourly throughout the day and saline subcutaneously once. The quantity of milk and water was increased through the day to half an ounce, and although the child vomited twice there was no blood. The colour improved, and in the afternoon baby was put to the breast and sucked vigorously. At 6 p.m. haematemesis and blood per rectum started again, being very profuse and the child rapidly becoming dangerously collapsed. By this time I had secured three doses of coagulose, a haemostatic ferment from horse serum, prepared by Messrs. Parke Davis. The first dose was given subcutaneously at 7.30 p.m. At 10 p.m. clotted blood was passed per rectum, but was not of the bright red colour of previous evacuations. At 10.30 p.m. the second dose of coagulose was given. Through the night two teaspoonfuls of mother's milk were given every hour. Vomited once, but no blood. At 5.30 a.m. on 6th March baby passed a small motion with some dark blood mixed with it. At 7 a.m. passed a normal motion. At 9.30 a.m. the third dose of coagulose was given, and from this on the child improved. Colour and vigour improved, and, being put to the breast, she sucked strongly.

The improvement after the first dose of coagulose was most marked. There was no more red fresh blood vomited, and the blood in the two motions subsequent to the injection of coagulose showed signs of having been in the bowel for some time. In a few hours a case which was to all appearances hopeless became a normal, vigorous baby. Up to the time the family left the district there was no return of any bleeding.

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