NEW ZEALAND
TE ARA TIKA O TE HAUORA HAPORI
MEDICAL JOURNAL

PUBLISHED BY:
PMA PASIFIKA MEDICAL ASSOCIATION Group

Vol. 138 | No. 1617 | 27 June 2025

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EDITORIAL

The bravado is not worth a brain injury: rethinking Run It Straight

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MEDICAL JOURNAL

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Publication information

published by the Pasifika Medical Association Group

The *New Zealand Medical Journal* (*NZMJ*) is the principal scientific journal for the medical profession in New Zealand. The *Journal* has become a fundamental resource for providing research and written pieces from the health and medical industry.

The *NZMJ*'s first edition was published in 1887.
It was a key asset of the New Zealand Medical Association (NZMA) up until July 2022.

It is owned by the Pasifika Medical Association Group (PMAG).

The PMAG was formed in 1996 by a group of Pasifika health professionals who identified a need for an association with the purpose of "providing opportunities to enable Pasifika peoples to reach their aspirations".

ISSN (digital): 1175-8716

Editorial Board

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published by the Pasifika Medical Association Group

Further information

ISSN (digital): 1175-8716
Publication frequency: bimonthy
Pubication medium: digital only

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nzmj.org.nz/contribute

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Auckland 1060
New Zealand

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Subscription rates for 2025

Individual		Institute	
New Zealand	Free	New Zealand	$680
International	Free	International	$700

New Zealand rate includes GST. No GST is included in the international rate.

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The bravado is not worth a brain injury: rethinking Run It Straight

Sarah Logan, Rachel Lauchlan, Christopher Wakeman

A young man died in Palmerston North after taking part in a dangerous activity called “Run It Straight”, where two people sprint at each other and try to tackle as hard as they can. This isn’t a sport—it’s a high-risk game that can cause serious brain injuries, especially in young people whose brains are still developing. We are warning that concussions and long-term brain damage can result from these hits. Organisers say they want to “give back to the community”, but these events don’t raise money for good causes—they just promote harmful behaviour. As trauma clinicians, we are calling for urgent action to ban these events, remove the videos online and protect our young people from further harm.

Outcomes in patients with rib fractures following implementation of the RIB-IMPROVE rib fracture guideline

Matthew J McGuinness, Lauren K Staveley, Eleanor F C Wilding, Olivia A Ray, Anita M Semmons, Cavaghn H Prosser, William Fleischl, Nejo Joseph, Wee Choen Ang, Christopher Harmston

Rib fractures are a common presentation with significant morbidity and mortality. This study investigated the implementation of an evidence-based rib fracture guideline for all patients admitted to Whangārei Hospital with a rib fracture. This study showed an almost 50% reduction in the rate of pneumonia after implementation of this guideline. This study highlights the effectiveness of a multidisciplinary guideline in the management of patients with rib fractures.

Aotearoa New Zealand cochlear implant programmes equity audit: addressing disparities and equity for Māori with severe and profound hearing loss

Pat Tuohy, Neil Heslop, Jill Mustard, Phil Bird, Holly Teagle, Robert Gunn

Hearing impairment is a significant issue for around a third of older adults worldwide and is associated with a range of negative social and cognitive issues. In New Zealand we do well in our services for deaf infants and children with early diagnosis and medical and educational support. However, only a small proportion of adults with hearing loss are identified and offered adequate treatment. For those with severe hearing loss, a cochlear implant can usually assist the person to regain adequate hearing for safety and social interaction. In light of the Health and Disability system’s obligations under Te Tiriti o Waitangi, this study examined whether cochlear implant services are being provided equitably to Māori. We found that Māori clients are assessed and treated at least as promptly as non-Māori, even when higher need is taken in to account.

Pembrolizumab-related toxicity in patients with advanced melanoma

Florence de Roo, Amritpreet Singh, Eric Zheng, Alvin Tan, Annie N M Wong

New Zealand has one of the highest rates of melanoma in the world. Pembrolizumab is a medication that has revolutionised the treatment of melanoma, with some people receiving this medication surviving long term despite advanced cancer at diagnosis. Patients receiving pembrolizumab for melanoma generally tolerate the treatment well; however, a variety of side effects can develop. To date, this is the first study looking at the rates of these side effects and how these are managed in a New Zealand setting.

Evaluating the safety and effectiveness of bariatric surgery performed by a trainee or fellow in a low-volume New Zealand centre

Preekesh S Patel, James Jin, Rowan French

Weight loss surgery is one of many tools to treat obesity and the problems that occur because of obesity (which can impact every body system). Weight loss surgery in New Zealand is limited within the public sector due to funding and could possibly impact the training experiences of surgeons in training. Our review of 250 patients shows that weight loss surgery can be performed safely and with good results even within a smaller weight loss surgery unit, regardless of if the operation is performed by a consultant surgeon or a surgeon in training under supervision. This could promote weight loss surgery teaching in smaller units to allow appropriate teaching and training.

Clustering of community-acquired pneumonia in hospitalised adults in the Christchurch Region: association with socio-economic deprivation

Nicole Crequer, Cate McCall, Anna Swanson, Emma Vlasiuk, Stephen T Chambers, Anitra C Carr

Multiple social and environmental factors contribute to the risk of community-acquired pneumonia (CAP); thus, predicting communities at increased risk is difficult. The aims of this study were to determine the geographical distribution of adults with CAP requiring hospitalisation in Christchurch, and to examine the association between CAP and socio-economic and area deprivation. Hotspots of adult CAP requiring hospitalisation were unevenly distributed across Christchurch City. The group with highest deprivation had CAP rates 1.6-fold higher than the least deprived group. CAP patients identifying as Māori or Pacific were significantly younger, and a higher proportion were resident in areas of highest socio-economic deprivation.

Urgency vs triage prioritisation: appropriateness of referrer-rated urgency of referrals to a public dermatology service

Jessica Yi Han Aw, Israa Al-Manji, Amanda Oakley

We looked at 1 month of referrals from general practitioners (GPs) and community nurses to our public dermatology service. By comparing the referral urgency—assigned by the GP/nurse—with the triage priority, assigned by two dermatologists based on the diagnosis or disease severity, we could determine the appropriateness of the assigned urgency. We found many referrals had an inappropriately low urgency, including most melanoma referrals. Māori and Pacific patients were under-represented overall, but there was no significant over-representation in referrals with inappropriate urgency. Streamlining referrals remains a multifaceted issue where prioritisation could be improved by using artificial intelligence to identify melanoma and severe skin diseases.

"Levelling up" the gender pay gap for Asian women academics in medicine and health sciences

Lillian Ng, Emma Sadera, Roshini Peiris-John, Stuti L Misra, Joanna Ting-Wai Chu, Ashwini Datt, Rachel Simon-Kumar

The gender pay gap for academic women of Asian ethnicity at The University of Auckland is 33.5%. Medicine has a hierarchy and this viewpoint serves to raise consciousness and shift the status quo. The authors of this paper are Asian women academics at various career stages contributing to scholarly dialogue on concerns on reasons why Asian diaspora women do not advance in medicine and health sciences. Gender bias is recognised as a widespread problem that occurs more widely in other institutions but Asian women fare worse than all other groups, facing a "double jeopardy" of gender and racial bias. We discuss what institutions can do and be in terms of accountability, transparency and having a strategic response to ensure women of colour are valued and retained in academia.

Emergency management in a regional setting of a paediatric patient with penetrating injury of the hard palate from a metal drinking straw

Jacob Arahill-Whitham, Hitesh Tailor, Dean Ruske

We present a case of a child who presented to a regional centre with a hard palate penetrating injury from a metal drinking straw. The patient was transferred to a tertiary centre where the foreign body was removed in the operating room without complication.

The bravado is not worth a brain injury: rethinking Run It Straight

Sarah Logan, Rachel Lauchlan, Christopher Wakeman

The tragic death of a 19-year-old man in Palmerston North during a casual game of "Run It Straight" has cast a stark spotlight on a dangerous and growing phenomenon in Aotearoa New Zealand. Marketed as a test of strength, toughness and masculinity, this backyard tackle challenge is neither a sport nor harmless fun—it is a ritualised, high-risk physical collision that poses an unacceptable threat to life and wellbeing. As trauma clinicians, we call for urgent action to end this hazardous practice and prevent future tragedies.

What Is Run It Straight?

At its core, Run It Straight is simple and brutal: two participants—often young men—sprint directly at each other with full force, colliding head-on without helmets, pads or any attempt to evade. There is no tactical finesse or scoring system—rather, it is a test of dominance through bodily impact. Videos of these collisions, frequently shared on social media, celebrate the moment someone is knocked unconscious or left unable to get up.

Events are now being promoted as community entertainment or fundraisers, with spectators paying to watch unregulated impact. Some gatherings are formalised with cash prizes and promotional materials aligned to those of combat sports. Disturbingly, a number of prominent rugby figures have lent their support on social media, inadvertently granting credibility to a behaviour that has now proven lethal.

The medical reality: engineered for injury

As trauma clinicians, we warn unequivocally: Run It Straight is a mechanism for significant acute and long-term injury. From a pathophysiological perspective, we are particularly concerned about the risks of traumatic brain injury (TBI) and neurodegeneration. Repetitive collisions of this kind increase the likelihood of chronic traumatic encephalopathy, a progressive degenerative brain disease observed in athletes across multiple high-impact sports.[1] Even a single concussive blow can cause permanent cognitive, emotional and behavioural impairment—particularly in adolescents and young adults whose brains are still developing.[2]

Chronic TBI has been extensively described in boxers and in other contact sports, where the accumulation of sub-concussive impacts over time leads to cognitive decline, memory loss, mood disorders and parkinsonism.[3] The parallels to Run It Straight are clear: deliberate, repeated impacts to the head in unregulated environments without medical oversight.

In Aotearoa New Zealand, approximately 36,000 people sustain a TBI each year, with around 20% attributed to sports and recreational activities.[4] The consequences of these injuries ripple far beyond the moment of impact. Families bear the burden of long-term care. Communities lose promising young lives to preventable disability or death. The healthcare system—already under strain—must absorb the financial and workforce costs of treating what are ultimately avoidable injuries.

The ethical implications

The rise of Run It Straight has reignited debate about the ethics of unregulated, high-risk collision sports in Aotearoa New Zealand. While physical challenge can foster resilience and teamwork, deliberately encouraging forceful, unprotected collisions for entertainment or status raises serious ethical concerns.

Organisers have claimed these events "give back" to the community[5]—but this is misleading. Unlike legitimate fundraisers, Run It Straight events do not donate proceeds to charitable causes. There is no meaningful community benefit to justify the significant risk of brain or spinal injury. The narrative of service is a veneer, one that distracts from the real costs.

This is also a cultural issue. Run It Straight taps into outdated ideals of masculinity, where strength is proven through pain and dominance.

2025 Jun 27; 138(1617). ISSN 1175-8716
https://www.nzmj.org.nz/

Young men are pressured to earn respect through violence, and injury is glorified as a badge of honour. We must dismantle this idea. Real mana is not shown through unregulated impact, but through insight and true sport tactics, and lies in caring for oneself and others. Giving back to the community should never come at the cost of our young people's lives or long-term health.

A call for immediate action

We cannot afford another preventable death. We therefore call on:

- regulatory bodies and local councils to suspend permits for organised Run It Straight events and consider classifying them as unregulated combat sports subject to disciplinary and legal review.
- schools and sports clubs to explicitly ban the practice, educate young people on its dangers and promote safer alternatives for physical challenge.
- role models in rugby and league to withdraw public endorsements and speak out against this trend.
- social media companies to flag or remove content that glorifies this dangerous activity under existing community safety guidelines.
- public health educators to launch targeted campaigns that communicate the real risks of unprotected head and neck impacts.

A path forward

Aotearoa New Zealand stands at a critical juncture. Will we continue to tolerate high-risk spectacles like Run It Straight, or will we prioritise the safety and wellbeing of our communities?

Physical challenge can build resilience and connection, but not at the cost of serious injury or death. Entertainment should not come with a risk of paralysis. We must reject any activity where harm is the objective. Run It Straight is not a sport. It is a dangerous spectacle that has already claimed a young life. Its continued promotion is medically indefensible and ethically unjustifiable.

As trauma clinicians, we witness the aftermath. We speak with grieving families. We know the names behind the numbers.

Let this be the last death.

COMPETING INTERESTS
CW is chair of the RACS New Zealand Trauma Committee. RL takes part in the Acute Care Rōpū, an advisory group for the National Trauma Network.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/the-bravado-is-not-worth-a-brain-injury-rethinking-run-it-straight

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Outcomes in patients with rib fractures following implementation of the RIB-IMPROVE rib fracture guideline

Matthew J McGuinness, Lauren K Staveley, Eleanor F C Wilding, Olivia A Ray, Anita M Semmons, Cavaghn H Prosser, William Fleischl, Nejo Joseph, Wee Choen Ang, Christopher Harmston

ABSTRACT

AIM: A rib fracture guideline was implemented at Whangārei Hospital with the aim of improving the care of patients and mitigating the risk of preventable additional morbidity. The aim of this study was to assess the impact of this guideline on the management and outcomes of patients.

METHODS: A single centre retrospective audit was performed comparing patients with rib fractures pre and post the implementation of the RIB-IMPROVE guideline. The primary outcome of interest was pneumonia. Patients with an abbreviated injury score (AIS) head or abdomen >2 were excluded. Binomial logistic regression was conducted for the primary outcome with adjustments for clinically plausible variables.

RESULTS: There were 418 patients identified, 241 in the pre-guideline and 177 in the post-guideline group. There was no difference in age, sex, ethnicity, number of rib fractures, injury severity score (ISS) or local anaesthetic block placement. The pneumonia rate was 13% vs 7% comparing the pre- and post-guideline groups, respectively. After adjustment for age, sex and ISS, the relative risk of developing pneumonia was 0.52 comparing the post- with the pre-guideline group (p=0.04). No statistical difference in secondary outcomes was seen, including the length of stay, 30-day readmission rate or 30-day mortality rate.

CONCLUSION: This study found that the risk of pneumonia was decreased by almost half after implementation of the RIB-IMPROVE guideline at Whangārei Hospital. This study highlights the effectiveness of a multidisciplinary guideline in the management of patients with rib fractures.

Rib fractures are common in hospitalised trauma patients and are the most common clinically significant thoracic injury, occurring in approximately 10% of hospitalised trauma patients.[1,2] In Aotearoa New Zealand 58% of major trauma patients sustain thoracic injuries, and of these 79% have one or more rib fracture.[3]

The pain from rib fractures and associated underlying pulmonary pathology may lead to impaired gas exchange, which increases the risk of pneumonia and respiratory failure.[4] Multiple interventions have been shown to decrease this pneumonia rate and the subsequent associated mortality. The associated mortality rate ranges from 3% to 13%, and as high as 20% in elderly patients.[4,5] Mortality in young patients with rib fractures is generally attributed to associated injuries; however, in the elderly, mortality is often directly related to the subsequent respiratory failure and pneumonia.[6]

A quality improvement project with the aim of improving care of patients with rib fractures led to the implementation of the RIB-IMPROVE guideline at Whangārei Hospital (Te Tai Tokerau, Aotearoa New Zealand). This guideline was created with multidisciplinary consultation and evidence from a local Whangārei Hospital study, a prospective national study, a hospital staff survey and international evidence.[7,8] The guideline consists of two sections: part one focusses on early risk stratification, adequate analgesia including local anaesthetic blocks, early pain team review and risk-stratified intensive care involvement; part two focusses on ward-based cares including mobilisation, physiotherapy, respiratory exercises, oxygen therapy, venous prophylaxis and early escalation in a deteriorating patient. The guideline was placed in the documents section in the emergency department (ED) and on the surgical ward, and education sessions at the time of

implementation of the guideline were undertaken with the doctors and nurses using the guideline.

The aim of this study is to investigate the impact of implementing the RIB-IMPROVE guideline on management and outcomes of patients with rib fractures at Whangārei Hospital. We hypothesised an improvement in the outcomes in patients with rib fractures would be found.

Methods

Study design

A single-centre retrospective audit was conducted comparing patients with rib fractures before and after the implementation of the RIB-IMPROVE guideline at Whangārei Hospital. The guideline includes a one-page document that is placed in the clinical notes of each patient (Appendix 1) and the main guideline document (Appendix 2). The RIB-IMPROVE guideline was implemented on 31 January 2022. The pre-implementation group data were extracted from admissions between 1 June 2020 to 31 January 2022, and the post-guideline group data were extracted from admissions between 1 February 2022 to 31 July 2023.

Setting

Whangārei Hospital is the largest hospital in Te Tai Tokerau, Northland. It serves as a secondary referral centre for four regional hospitals and has the only acute general surgical service. Between January and December 2024 there were 49,587 presentations to Whangārei ED; of these, 152 were for major trauma (injury severity score [ISS] >12). Prior to implementation of the rib fracture guideline on 31 January 2022, there was no rib fracture guideline at Whangārei Hospital. No structured treatment pathway existed for these patients; however, there was good access to the pain team and physiotherapist on request by the treating team.

Outcomes

The primary outcome of interest was radiological -confirmed pneumonia rate. For the purpose of this study a diagnosis of pneumonia required radiological confirmation by a consultant radiologist. The secondary outcomes of interest were 30-day mortality rate, length of stay (LOS) and 30-day readmission rate. Further data points collected were age, sex, ethnicity, mechanism of injury, number of rib fractures, ISS, presence of bilateral rib fractures, pulmonary contusions, haemothorax, pneumothorax or flail chest. Further data points collected relating to management included chest drain placement, intubation, intensive care (ICU) admission, local anaesthetic block placement and admitting team.

Eligibility criteria

Patients were included in the study if they were admitted to Whangārei Hospital with blunt thoracic trauma and one or more radiologically proven rib fractures. Patients were excluded if they were injured secondary to penetrating trauma, discharged directly from ED without inpatient admission, intubated for an indication other than thoracic trauma, sustained thoracic trauma secondary to cardiopulmonary resuscitation or had a delayed admission more than 48 hours after injury. Patients aged 16 or younger were excluded, given the management strategies differ in the paediatric population and the risk of developing pneumonia is significantly lower than adults. Patients with an abbreviated injury score (AIS) >2 in the head or abdomen were excluded to remove the impact of polytrauma on management and outcomes of rib fractures in this study.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows (Version 28.0. Armonk, NY: IBM Corp). Descriptive statistics were calculated for all variables. Non-normally distributed data were tested with a Mann–Whitney U test and described as median and interquartile range (IQR). Nominal data were tested using Chi-squared test. Normally distributed data were tested with a Student's *t*-Test and described as mean and standard deviation (SD). Univariate analysis was used to describe associations between demographics, injury characterises and primary and secondary outcomes. Binomial logistic regression for pneumonia using clinically plausible risk adjustment variables as fixed effects was performed. The model was adjusted for group, age, sex and ISS. Odds ratios (OR) were calculated with 95% confidence intervals (CI). Adjusted OR was converted to adjusted relative risk (RR) as suggested by Grant et al. using the equation RR=OR/(1−p0+[p0×OR]), where p0 is the baseline risk.[9] Secondary analysis of pneumonia rate stratified by age <45, 45–65 and >65 as adopted by the guideline was performed.

Ethical considerations

An out-of-scope Health and Disability Ethics Committee letter was applied for and received (ref 17905). Locality approval has been granted

by Whangārei Hospital. Guidance was given by the Whangārei Hospital Māori Health Directorate. There was no funding for this study.

Results

Demographics and injury characteristics

A total of 418 patients were identified: 241 in the pre-guideline group and 177 in the post-guideline group. There was no difference in age (p=0.07), sex (p=0.36), ethnicity (p=0.37), number of rib fractures (p=0.84) or ISS (p=0.85) between groups. Road traffic crash (RTC) was the most common mechanism of injury in both groups. As seen in Table 1, 15% of patients had bilateral rib fractures, 27% had pulmonary contusions, 21% had a haemothorax, 32% had a pneumothorax and 12% had a flail chest.

Patient management

No difference was found in the rate of chest drain placement (p=0.73), rib plating (p=0.93), intubation (p=0.12), ICU admission (p=0.09) or local anaesthetic block placement (p=0.91) between groups (Table 2). The majority of patients in both groups were admitted under general surgery.

Primary outcome

The pneumonia rate in the pre-guideline group was 13% compared with 7% in the post-guideline group (p=0.06). The RR of developing pneumonia was 0.52 comparing the post- with the pre-guideline group after adjustment for age, sex and ISS (p=0.04). In the adjusted model, age (p=0.02) and ISS >15 (p=0.02) were significantly associated with pneumonia, with an RR of 1.02 and 1.94 respectively as seen in Table 3.

Table 1: Demographics and injury characteristics in the pre- and post-implementation phases of the RIB-IMPROVE guideline (n [%]).

	Pre **n=241**	**Post** **n=177**	**Overall** **n=418**
Age (years), *median (IQR)*	59 (28–74.5)	62 (38–74.5)	61.5 (48–74.25)
Sex			
Female	88 (37%)	57 (32%)	145 (35%)
Male	153 (63%)	120 (68%)	273 (65%)
Ethnicity			
NZ European	129 (54%)	110 (62%)	239 (57%)
Māori	76 (32%)	45 (25%)	121 (29%)
Other	46 (15%)	22 (12%)	58 (14%)
Mechanism of injury			
Road traffic crash	92 (38%)	58 (33%)	150 (36%)
Fall <1m	68 (28%)	45 (25%)	113 (27%)
Fall >1m	36 (15%)	37 (21%)	73 (17%)
Other	40 (17%)	32 (18%)	72 (17%)
Assault	5 (2%)	5 (3%)	10 (2%)
Rib fractures, *median (IQR)*	3 (2–6)	3 (2–5)	3 (2–6)
Bilateral rib fractures			
Yes	39 (16%)	24 (14%)	63 (15%)

Table 1 (continued): Demographics and injury characteristics in the pre- and post-implementation phases of the RIB-IMPROVE guideline (n [%]).

No	202 (84%)	153 (86%)	355 (85%)
Pulmonary contusion			
Yes	68 (28%)	44 (25%)	112 (27%)
No	173 (72%)	133 (75%)	306 (73%)
Haemothorax			
Yes	49 (20%)	37 (21%)	86 (21%)
No	192 (80%)	140 (79%)	332 (79%)
Pneumothorax			
Yes	77 (32%)	57 (32%)	134 (32%)
No	164 (68%)	120 (68%)	284 (68%)
Flail chest			
Yes	31 (13%)	19 (11%)	50 (12%)
No	210 (87%)	158 (89%)	368 (88%)
ISS, *median (IQR)*	10 (9–14)	11 (9–14)	10 (9–14)

IQR = interquartile range; ISS = injury severity score.

Table 2: Clinical management of rib fractures in the pre- and post-implementation phases of the RIB-IMPROVE guideline (n [%]).

	Pre	Post	Overall
Chest drain			
Yes	37 (15%)	25 (14%)	62 (15%)
No	204 (85%)	152 (86%)	356 (85%)
Rib plating			
Yes	3 (1%)	2 (1%)	5 (1%)
No	238 (99%)	175 (99%)	413 (99%)
Intubation			
Yes	2 (1%)	5 (3%)	7 (2%)
No	239 (99%)	172 (97%)	411 (98%)
ICU admission			
Yes	35 (15%)	16 (9%)	51 (12%)
No	206 (85%)	161 (91%)	367 (88%)

Table 2 (continued): Clinical management of rib fractures in the pre- and post-implementation phases of the RIB-IMPROVE guideline (n [%]).

Local block			
Yes	46 (19%)	33 (19%)	79 (19%)
No	195 (81%)	144 (81%)	339 (81%)
Admitting team			
General surgery	184 (76%)	141 (80%)	325 (78%)
Orthopaedics	30 (12%)	21 (12%)	51 (12%)
General medicine	21 (9%)	12 (7%)	33 (8%)
Other	6 (2%)	3 (2%)	9 (2%)

ICU = intensive care unit; local block = local anaesthetic block placed for pain relief.

Table 3: Univariate and binary logistic regression analysis for pneumonia.

	Univariate analysis			**Multivariate analysis**		
Variables	OR (95% CI)	RR	p-value	OR (95% CI)	RR	p-value
Group	0.52 (0.26–1.02)	0.55	0.06	0.48 (0.24–0.96)	0.52	0.04
ISS >15	1.96 (0.99–3.87)	1.73	0.05	2.26 (1.11–4.59)	1.94	0.02
Sex	0.86 (0.45–1.63)	0.88	0.65	0.93 (0.48–1.82)	0.94	0.84
Age	1.02 (1.0–1.04)	1.02	0.03	1.02 (1.004–1.04)	1.02	0.02

OR = odds ratio; CI = confidence interval; RR = relative risk; ISS = injury severity score.

An increasing pneumonia rate with age was seen in the pre-guideline and post-guideline groups. The pneumonia rate in the pre-guideline group was 8.5%, 15.9% and 14% compared with 0%, 4.5% and 12.5% in the post-guideline group in patients aged <45, 45–65 and >65, respectively.

Secondary outcomes

Although an improvement was seen in all secondary outcomes, there was no statistical difference in the LOS (p=0.55), 30-day readmission rate (p=0.56) or 30-day mortality rate (p=0.32) between groups, as seen in Table 4. Readmission, mortality and LOS increased with advancing age, in a similar fashion to the pneumonia rate, as seen in Appendix Table 1.

Discussion

This study found that the risk of pneumonia after implementation of the RIB-IMPROVE guideline at Whangārei Hospital decreased by almost half. No statistically significant difference in 30-day readmission rate, 30-day mortality rate or LOS was found.

Improvements in clinical care were targeted across the full spectrum of a patient's journey in the hospital from ED to the ward. It is therefore likely that the decreased pneumonia rate found is multifactorial. This underpins the importance of standardised multidisciplinary care, which, in this guideline, included adequate analgesia prescribed for all patients, early pain team review, risk-stratified intensive care involvement, early mobilisation, physiotherapy, respiratory exercises, oxygen therapy, venous prophylaxis and early escalation in a deteriorating patient or a patient who was unable to take a deep breath or cough. The importance of standardised multidisciplinary care has been consistently shown across many areas of medicine.[10,11] Despite an increase in the perceived anaesthetic block

Table 4: Primary and secondary outcomes.

	Pre	Post	Overall	p-value
Pneumonia				0.05
Yes	32 (13%)	13 (7%)	45 (11%)	
No	210 (87%)	164 (93%)	374 (89%)	
LOS (days), *median (IQR)*	5.0 (2.9–8.7)	4.9 (2.8–8.2)	4.9 (2.8–8.5)	0.55
30-day readmission rate				0.56
No	218 (90%)	163 (92%)	381 (91%)	
Yes	23 (10%)	14 (8%)	37 (9%)	
30-day mortality rate				0.32
No	235 (98%)	175 (99%)	410 (98%)	
Yes	6 (2%)	2 (1%)	8 (2%)	

LOS = length of stay; IQR = interquartile range.

rate at Whangārei Hospital, no difference was found in this study. It is, however, possible that improved timeliness of blockade was a factor, as evidence suggests an increased rate of respiratory complications if the block is placed after 48 hours.[12]

Multiple prior studies have shown similar results to this study. These have included a decreased ICU LOS, hospital LOS and pneumonia rate.[4,13–20] These studies have all been retrospective observational cohort studies. Four prior studies have investigated the implementation of a rib fracture guideline on patient outcomes. This study aligns with the findings of the COMBAT guideline from Counties Manukau, Te Whatu Ora – Health New Zealand, which found a decrease in lower respiratory tract infections from 27% to 14%. This study compared 85 patients in a pre-guideline implementation group with 86 patients in the post-guideline implementation group. It also found a trend towards reduced LOS.[16] A multidisciplinary clinical pathway targeting patients greater than 45 years of age with more than four rib fractures demonstrated a reduction in pneumonia from 18% to 5%. This study compared 150 patients with a historical control group of 150 patients and also found a decrease in mortality from 13% to 4%, a decrease in hospital LOS and decreased mechanical ventilator–dependent days.[13] The ChiP Protocol, an early activation protocol for isolated blunt chest trauma, demonstrated a reduction in the rate of pneumonia by 4.8% when comparing 546 patients equally divided between pre- and post-implementation groups. The study also demonstrated increased pain team, trauma team and physiotherapy review.[14] And finally, Sahr et al. demonstrated a reduced hospital and ICU LOS after the introduction of a rib fracture triage protocol in the elderly.[15]

This study is limited by its retrospective nature and sample size. The relatively small sample size potentially obscures clinically relevant differences between the pre- and post-guideline groups. No difference in secondary outcomes were found, which may have been statistically significant with a larger sample size. The post-guideline group was collected directly after implementation. This may have given insufficient time for the guideline to take effect, thereby limiting the difference in outcomes seen in this study. The strict criteria utilised to define pneumonia in this study may have excluded some patients with pneumonia diagnosed only clinically without radiological confirmation. Patients with pre-existing respiratory infections were not excluded, which may have led to an overestimation of the pneumonia rate in both groups. This study excluded patients with significant head or abdominal trauma; therefore, these findings are not necessarily generalisable to all trauma patients. Despite the limitations of this

study, it demonstrates clinically useful findings that are likely generalisable to a large number of provincial centres throughout Aotearoa New Zealand.

This study found that after implementation of the RIB-IMPROVE guideline at Whangārei Hospital, the risk of pneumonia decreased by almost half. This study highlights the effectiveness of a multidisciplinary guideline in the management of patients with rib fractures.

COMPETING INTERESTS
The authors have no disclosures to make.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/outcomes-in-patients-with-rib-fractures-following-implementation-of-the-rib-improve-rib-fracture-guideline

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Appendix

Appendix Table 1: Primary and secondary outcomes stratified by age.

	Pre-guideline			Post-guideline		
	Age <45	**Age 45–65**	**Age >65**	**Age <45**	**Age 45–65**	**Age >65**
Pneumonia	5 (8.5%)	13 (15.9%)	14 (14%)	0 (0%)	3 (4.5%)	10 (12.5%)
Readmission	2 (3.4%)	4 (4.9%)	17 (17%)	2 (6.7%)	4 (6%)	8 (10%)
Mortality	0 (0%)	1 (1.2%)	5 (5%)	0 (0%)	0 (0%)	2 (2.5%)
LOS	4.2 (2.5–7.6)	4.8 (3.0–8.9)	6.0 (3.0–10.0)	4.6 (2.5–6.9)	4.9 (2.8–8.1)	5 (2.7–8.8)

LOS = length of stay.

Appendix 1: RIB-IMPROVE guideline for patients notes

NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora A Rohe O Te Tai Tokerau

RIB-IMPROVE

Affix Patient Label Here

Name: *NHI:*

Address:

DOB: *Age:* *Telephone Number:*

Management Guideline for Patients with Rib Fractures

This guideline outlines a multidisciplinary bundle of care for patients with acute rib fractures.

These patients must be risk stratified prior to leaving the Emergency department. Further management on the ward is highlighted in the overleaf.

Please tick one risk category

	Low risk ☐	Medium risk ☐	High risk ☐
R Risk stratify patients	< 3 rib fractures and age < 45 with no significant respiratory co-morbidities	< 3 rib fractures and age ≥ 45 with no significant respiratory co-morbidities	Any patient you are worried about FiO2 ≥ 0.3 (NP > 3L O2/min) and unable to maintain Sats ≥ 94% ≥ 3 isolated rib fractures ≥ 2 isolated rib fractures if patient has significant cardiorespiratory co-morbidities Flail chest, sternal fractures or significant pulmonary contusions Patients requiring immediate trauma surgery Uncontrolled pain
I Intensive care consultation	No routine ICU discussion required unless clinically concerned.	Discuss with ICU if clinically concerned + PAR team review	Contact ICU registrar for review + PAR team review and consideration of high flow nasal prongs (HFNP) Consider referral to general surgery for rib fixation
B Background analgesia and pain team review	Background analgesia • Paracetamol 1g QID • Ibuprofen 400mg TDS; or Celecoxib 200mg BD • Tramadol 50-100mg q4-6h/PRN (Max 400mg) • Sevredol 10-20mg q1h/PRN • + laxatives Laxsol 2 tab BD • + antiemetics Ondansetron 4mg Q8h/ PRN	Background analgesia + pain team discussion for possible PCA/ketamine infusion +/- regional block	Background analgesia + pain team review for possible PCA or ketamine infusion and early consideration of regional aneathetic block • Reduce opioid dose in elderly • Avoid NSAIDs in CKD • If CrCl <30mL/min, caution morphine use and consider discussion with pain service/anaesthetists or renal physicians

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RIB-IMPROVE: A Management Guidelines for Acute Rib Fractures

Appendix 1 (continued): RIB-IMPROVE guideline for patients notes.

NORTHLAND DISTRICT HEALTH BOARD Te Poari Hauora Ā Rohe O Te Tai Tokerau **RIB-IMPROVE**	Affix Patient Label Here *Name:* *NHI:* *Address:* *DOB:* *Age:* *Telephone Number:*

I **Initiate early**	Initiate standardised package of care on the ward as soon as possible Early referral to pain team to optimize background analgesia and consideration of regional block
M **Mobilise**	Mobilise day one unless other injuries dictate Position patients with head elevated to ≥ 30 degrees
P **Physiotherapy referral**	**Contact ward physiotherapist (#9390) or after hours (via switchboard)** After hours review if concerned with sputum retention
R **Respiratory exercises**	Encourage patients to follow deep breathing exercise sheet Minimum 3 – 4 deep breaths per half hour Brace chest with a pillow or towel when coughing
O **Oxygen therapy**	Treating team to prescribe oxygen target Early use of HFNP +/- oxygen to achieve above target PAR team and treating team review if raising O2 requirement
V **Venous thromboprophylaxis**	All patients should have TEDs/SCDs and clexane unless contraindicated
E **Early escalation to:** ICU #8101 PAR #9545 Pain Team (in hours) #1384 Anaes (after hours) #9767	**Criteria for ICU review at any stage** FiO2 ≥ 0.4 and trending upwards Worsening clinical state Uncontrolled pain Any patient you are worried about **Criteria for pain team review at any stage** Inability to take deep breath Inability to cough Uncontrolled pain Issues with regional catheters

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RIB-IMPROVE: A Management Guidelines for Acute Rib Fractures

Appendix 2: RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures

RIB-IMPROVE

A Management Guideline for patients with Acute Rib Fractures

Northland District Health Board

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora Ā Rohe O Te Tai Tokerau

Table of Contents

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora Ā Rohe O Te Tai Tokerau

1 Background:

This multidisciplinary guideline highlights the management of patients with rib fractures secondary to blunt thoracic trauma.

Rib fractures are a painful injury that are associated with significant mortality. The mortality typically ranges from 3% to 13% but can reach as high as 20% in elderly patients.(1, 2) Over 40% of patients presenting with major trauma in New Zealand sustain thoracic injuries with rib fractures being the most commonly encountered thoracic injury.(3-5) A patient with rib fractures presents to the Emergency Department on average every two days in the Whangārei hospital.(6) These patients potentially suffer from a myriad of respiratory complications including hypoxia, acute respiratory distress syndrome (ARDS), atelectasis, empyema pneumonia and respiratory failure.(1)

Three main issues underpin the pathogenesis of these complications: (1) hypoventilation due to frequent and extreme pain; (2) impaired gas exchange secondary to underlying damaged lung parenchyma; and (3) altered ventilatory mechanics commonly due to flail segments. It is important to address these issues early and effectively to prevent the time-sensitive development of respiratory complications. This has led to the development and implementation of multidisciplinary rib fracture pathways by many institutions worldwide.

Clinical management guidelines are associated with decreased mortality, hospital length of stay, duration of mechanical ventilation, Intensive Care Unit (ICU) admission rates and pneumonia rates (7-9). Guidelines always include a section on pain management and have found earlier optimization of pain control, earlier access to specialist pain service, increased use of regional analgesia and reduced rates of uncontrolled pain and morphine consumption (9-11).

Ten rib fracture guidelines (eight from Australasian hospitals) were examined in the development of this guideline. The COMBAT guideline, developed at Middlemore Hospital, New Zealand, deserves special mention. This is a multidisciplinary package of care focusing on early patient mobilization, oxygen therapy, breathing exercises and timely reviews by ICU, Acute Pain Service (APS) and physiotherapy. An audit comparing outcomes from 2014 to 2017 found better utilization of the APS and increased use of regional analgesia, although no differences of morbidity and mortality were observed (12). These guidelines, although useful, are limited in generalizability and are tailored specifically to hospital structure, available resources and the patient population of each specific region.

It was therefore important that guidelines specific to the Whangārei Hospital be developed. A preliminary staff survey of 36 nurses from ward 3 and 4 and the Emergency Department (ED), where patients with rib fractures are commonly managed, supported the development of this guideline. There was unanimous agreement from responders that a rib fracture guideline should be instituted. Of the total responders 36% felt unsupported in managing rib fractures and 69% expressed concern that patients with rib fractures were not offered adequate pain relief. Further issues raised included the lack of clear referral processes, no standardized analgesic regime and the lack of education surrounding regional catheter management.

It is anticipated that implementation of this guideline will facilitate a standardized delivery of care to patients with rib fractures, address the specific barriers listed above, improve adherence to evidence-based practices (EBPs) and improve clinical outcomes.

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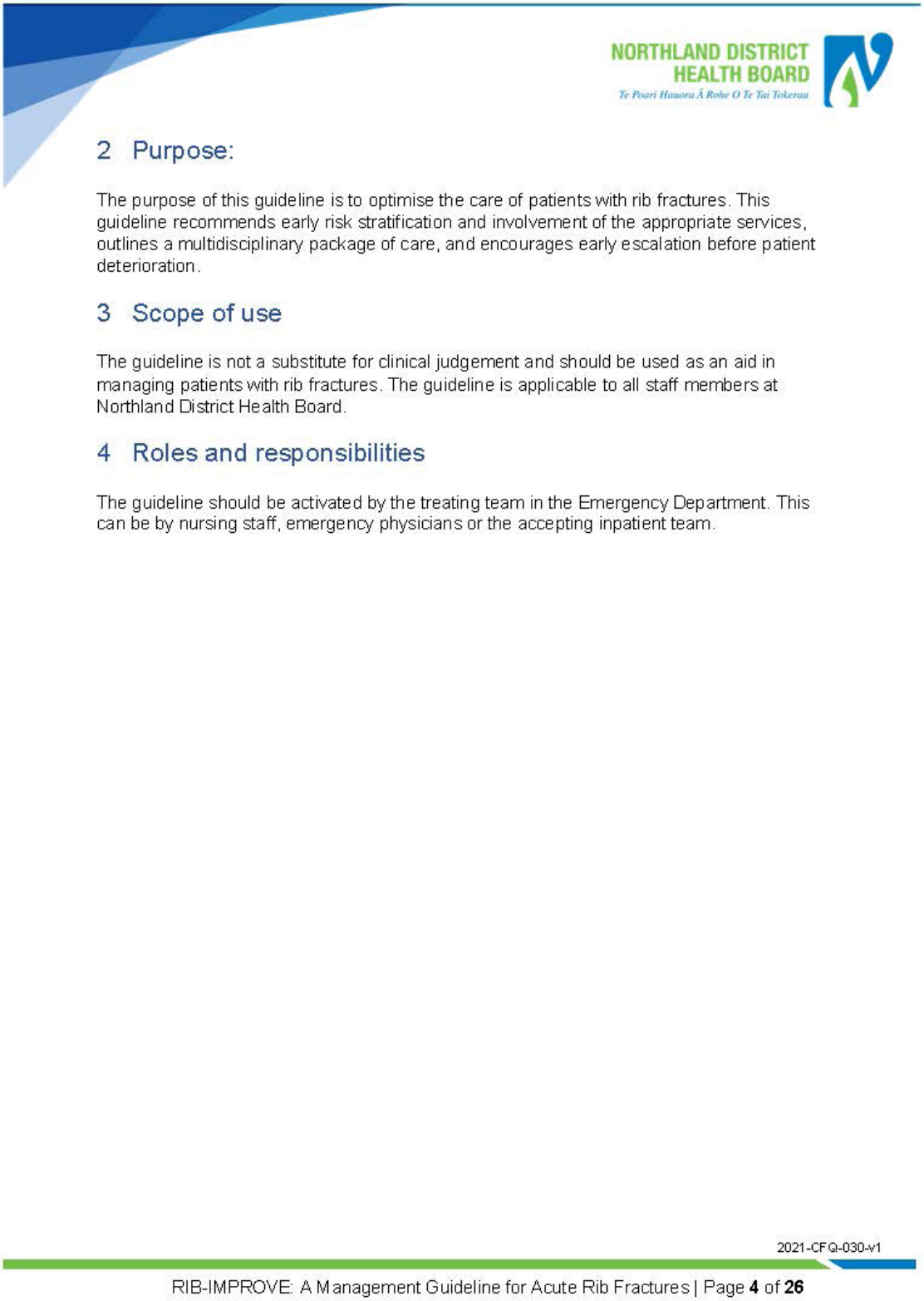
Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.



NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora Ā Rohe O Te Tai Tokerau

2 Purpose:

The purpose of this guideline is to optimise the care of patients with rib fractures. This guideline recommends early risk stratification and involvement of the appropriate services, outlines a multidisciplinary package of care, and encourages early escalation before patient deterioration.

3 Scope of use

The guideline is not a substitute for clinical judgement and should be used as an aid in managing patients with rib fractures. The guideline is applicable to all staff members at Northland District Health Board.

4 Roles and responsibilities

The guideline should be activated by the treating team in the Emergency Department. This can be by nursing staff, emergency physicians or the accepting inpatient team.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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5 Guideline Overview

The RIB-IMPROVE guideline can be found on pages 16-17. It is these two pages that should be included in the patient notes.

The guideline should be initiated in the Emergency Department (ED) for all patients with rib fractures who will be admitted to the ward. It can be initiated by nursing staff, emergency physicians or the accepting inpatient team.

The RIB-IMPROVE guideline consists of two parts:

(1) **R**isk stratify patients
Intensive care consultation
Background analgesia and pain team review

(2) **I**nitiate early
Mobilize
Physiotherapy referral
Respiratory exercises
Oxygen therapy
Venous thromboprophylaxis
Early escalation to ICU, PAR, and APS

The first part of this guideline (RIB) must be initiated prior to the patient leaving ED with appropriate referrals having already been made based on their identified risk and pain relief charted. Patients do not need to be kept in ED whilst awaiting review from the Intensive Care Unit (ICU) or from the pain team.

The second part of this guideline (IMPROVE) details the further management on the ward. This section should be initiated and co-ordinated by the treating registered nurse in consultation with the treating inpatient team and ward physiotherapist. Finally, in collaboration with the relevant departments, the criteria for early escalation to ICU, Patient at Risk (PaR) team, and/or to the pain team are described.

6 Risk Stratification

The RIB-IMPROVE guideline stratifies patient risk as low, medium or high. The relevant criteria were developed in collaboration with ICU and are primarily based on a comprehensive literature review and outcomes from a two year retrospective audit at Northland District Health Board (NDHB).

There is strong evidence that elderly patients, usually defined as 65 and older, have worse outcomes and a higher mortality rate compared with younger patients with rib fractures. There is, however, evolving evidence to suggest the inflection point for adverse outcomes starts at a younger age.(13-24) A two year retrospective audit of isolated thoracic injury at NDHB supports the literature suggesting worsening outcomes in patients 45 and older. At NDHB, patients 45 and older had significantly higher rates of pneumonia compared to patients younger than 45. This is the key difference stratifying patients from low to medium risk. Patients with less than three rib fractures who are younger than 45 are at very low risk of complication. This risk increases moderately if a patient is between 45 and 65 years old.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Patients with three or more rib fractures have consistently been shown to have worse outcomes then patients with less than three rib fractures. This risk increases in a non-linear fashion with each additional rib fracture further increasing the risk.(25, 26) A significant number of rib fractures should also alert the treating clinician to the possibility of associated injuries - rib fractures can be considered a marker of injury severity.(27)

Cardiopulmonary co-morbidities have been demonstrated to increase a patient's risk of adverse outcomes.(15, 22) This includes chronic obstructive pulmonary disease, asthma, obstructive sleep apnoea and cardiac disease. Patients with significant underlying co-morbidities should therefore be treated as being at high risk of adverse outcomes.

Flail chest is defined as three or more consecutive fractured ribs with two or more fractures on each. The term flail refers to the paradoxical inward movement of the discontinuous segment of chest wall on inspiration. Patients with flail chest are at significantly greater risk of respiratory failure and therefore should be treated as being at high risk and ideally monitored in a High Dependency Unit (HDU)/ICU setting. Flail segments have been shown to have an increased risk of mortality with flail chest alone carrying a mortality rate of 13-17%.(28, 29). Patients with flail chest should also be considered for surgical stabilisation as this has been shown to improve outcomes in multiple meta-analysis.(30-39) This is discussed further below.

Sternal fractures and pulmonary contusion should be triaged as high risk. Sternal fractures are independently associated with increased mortality and are associated with a higher risk of adverse outcomes.(29, 40) Pulmonary contusions can lead to impaired respiration and subsequent hypoxia and predispose patients to acute respiratory distress syndrome, respiratory failure, pneumonia and death.(101, 103)

A patient with early evidence of acute respiratory failure warrants a review by ICU. A patient is deemed "high risk" if they are unable to maintain an oxygen saturation ≥ 94% while breathing an FiO2 ≥ 0.3 (NP > 3L O2/min). This cut off was reached in consultation with NDHB ICU department. Other parameters to consider are a high respiratory rate and arterial blood gas findings including a respiratory acidosis, low PaO2 and high PaCO2.

7 Intensive care consultation

Many patients with rib fractures are at high risk of deterioration and adverse outcomes therefore ICU level care is often appropriate and has been shown to improve patients outcomes.(41, 42) Around the world, some hospitals routinely admit patients with more than three rib fractures to ICU level care for observation however there is evidence to suggest this is overly cautious and can be safely relaxed without an increase in morbidity or mortality.(1, 42-44) Any patients deemed to be high risk on triage should be reviewed by the on call ICU registrar and a clinical decision made regarding appropriateness for ICU level care.

The PaR team should be notified of any patient in the medium or high risk group who is being admitted to the ward.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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8 Background analgesia and pain team review

8.1 Current guideline recommendations

All opioid-naïve adults with normal renal and hepatic function, and without known drug allergies or adverse reaction, should be prescribed:

1. Paracetamol 1g QID
2. Ibuprofen 400mg TDS; or Celecoxib 200mg BD
3. Tramadol 50-100mg Q4-6h/PRN (max 400mg)
4. Sevredol 10-20mg Q1h/PRN
5. Bowel regimen, eg Laxsol 2 tab BD
6. Antiemetics, eg Ondansetron 4-8mg Q8H/PRN

Other considerations:

Persistent pain, inability to deep breathe or cough despite above	Consult with the Pain Team (or Anaesthetics after hours) for: - PCA and/or - Ketamine infusion and/or - Regional analgesia
Renal impairment (CrCL <30mL/min)	Avoid NSAIDs Caution morphine use Consult with the Pain Team for consideration of fentanyl or methadone
Obesity	Caution excessive opioid use given risk of respiratory depression
Elderly	Regular paracetamol is safe Reduce NSAID dose Review patients' regular medications for potential interactions, particularly avoiding "triple whammy" (NSAID + ACEi + Diuretic) Reduce opioid dose Caution tramadol use
Opioid tolerant patients	Expect high opioid requirement Consult with the Pain Team as regional analgesia could be useful
Increased risk of GI bleeding	Consider celecoxib over ibuprofen. Also note that celecoxib is contraindicated in unstable ischaemic heart disease/ recent MI or stroke, active GI bleeding, congestive heart failure (NYHA II-IV) or severe hepatic impairment. (45)

8.2 Systemic analgesia

Early institution of effective multimodal analgesia alleviates patient suffering and may reduce the incidence of pulmonary complications.(28, 46) Regular reviews should ensure that all patients are able to deep breathe, cough, participate in chest physiotherapy and mobilize.(47-49)

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

Opioid analgesia has long been considered standard practice for patients with rib fractures. Parenteral opioids should be offered to all patients with rib fractures as baseline. Patients classified as being at medium or high risk should be considered for a Patient Controlled Analgesia (PCA). A Cochrane review found that postoperative patients receiving PCA reported better pain scores and higher satisfaction compared to parenteral opioids.(50) Relying on systemic opioids alone, however, comes with an increased incidence of opioid related side effects, for example cough suppression, delirium, sedation and respiratory depression.(48)

This guideline emphasises a multimodal analgesic approach as it offers the benefit of reducing opioid consumption and therefore reducing the risk of associated adverse effects. A brief overview of the evidence base follows.

Paracetamol is an effective analgesic for acute post-surgical pain which reduces opioid consumption, reduces nausea and vomiting and has few adverse effects.(51)

Nonsteroidal anti-inflammatory drugs have proven efficacy in patients with rib fractures.(52, 53) A small observational study in patients with rib fractures showed the use of an NSAID improved pain scores and lowered opioid requirement with a trend to lower hospital length of stay.(52) A second observational study showed the use of an NSAID decreased the incidence of pneumonia and decreased duration of ICU stay.(53) Neither study showed an increase in adverse outcomes during the relatively short duration of use.

Ketamine has been shown in two randomised controlled trials (RCTs) to lower opiate consumption in patients with rib fractures, but only in patients with more severe injuries (Injury Severity Score > 15) regardless of age.(54, 55) In addition, a systematic review of 15 RCTs on the efficacy of ketamine for post-thoracotomy pain found ketamine has efficacy in reducing acute pain with a reduction in report pain scores, greater pain relief at rest and with movement and a favourable side-effect profile.(56)

Tramadol, although a weak opioid, activates non-opioid systems involved in pain inhibition via its α-2- agonistic and serotoninergic activity. A systematic review of 14 studies investigating the efficacy of tramadol for postsurgical pain found a limited but significant morphine-sparing effect but found no improvement in pain scores or reduction in opioid-related side effects(57).There are no studies in patients with rib fractures specifically comparing tramadol to systemic opiates.

Gabapentin use has been investigated by one RCT of 40 patients with rib fractures which found gabapentin had no added benefit to a multimodal analgesic regime. (58)

8.3 Regional analgesia

A referral to the Pain Service for a patient who is medium or high risk can be considered for regional analgesia. This would be either an epidural or a myofascial plane block (in the erector spinae or serratus anterior plane) and catheter infusion of local anaesthetic

8.3.1 Thoracic epidural

Epidural analgesia is a well-established technique for providing analgesia for patients with rib fractures. It involves placement of a catheter in the epidural space followed by administration of local anaesthetic, providing bilateral and multilevel dermatomal analgesia for several days. Multiple studies have demonstrated this modality to be effective in pain control but without conclusive evidence of improvement in morbidity or mortality.(59-62)

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

Regardless, a multimodal analgesic regime tailored to patient values and preference is recommended. This is supported by a commonly referenced guideline published by the Eastern Association for the Surgery of Trauma (EAST) and Trauma Anaesthesiology Society (TAS). This guideline conditionally recommends thoracic epidural analgesia over non-regional modalities, however the authors acknowledge this recommendation is based off very low-quality evidence and places a high value on patient values and preferences for analgesia.(2)

8.3.2 Fascial plane blocks

Single-shot fascial plane blocks, such as the serratus anterior and rhomboid-intercostal blocks, are occasionally performed in ED as a temporary analgesic solution. The erector spinae block with catheter insertion is the preferred technique by ICU and Anaesthesia to provide analgesia for several days, and hence will be described in greater detail below.

The erector spinae block (ESB) is performed under ultrasound guidance, as seen in Figure 1, to inject local anaesthetic into the plane between the erector spinae muscle and transverse process.(63) This block was only recently described in 2016 by Forero et al for thoracic neuropathic pain, but has since been used successfully for chest trauma analgesia.(64) A single retrospective study has been published thus far which found improved spirometry in the first 24 hours and reduced pain scores up to 72 hours in patients with rib fractures receiving ESB.(48)

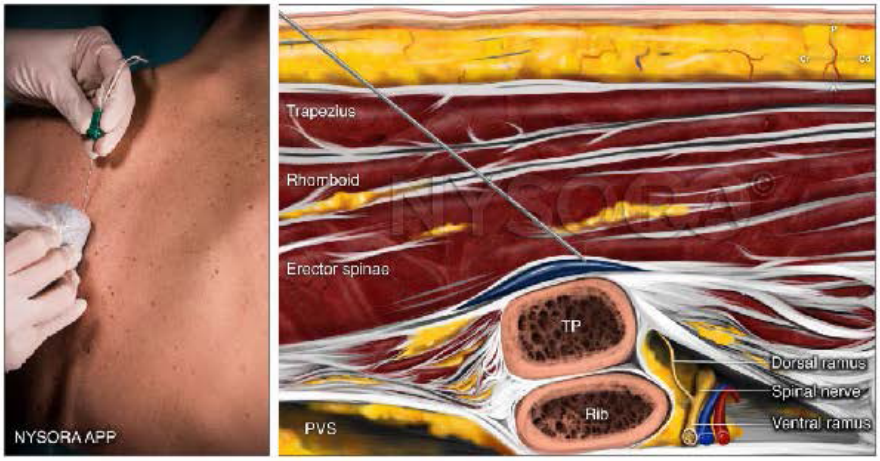

Figure 1. Relevant anatomy for placement of USS guided Erector Spinae block.
Reproduced with permission from New York School of Regional Anaesthesia. Nysora.com

The exact mechanism of action of ESB remains unclear however cadaveric and radiological studies suggest extensive cephalocaudal spread of local anaesthesia facilitated by the thoracolumbar fascia and possible extension into paravertebral and epidural spaces. However, the extent of such spread is unreliable which may explain its variance in analgesic effect.(65-67) Nonetheless, effective blockade of both the dorsal and ventral rami of 3 to 5 spinal nerves can be expected, which makes it suitable for patients with rib fractures.(68) Its efficacy is likely to be improved with delivery of high volume local anaesthesia regularly. Current NDHB protocol recommends programmed boluses of 20mL Ropivacaine 0.2% every 2 hours. The safe daily dose for patients receiving local anaesthesia for several days is

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

unclear however these patients will be reviewed on a regular basis by the pain service.(69)

ESB is technically simple and safe. Correct placement of the needle can be confirmed by a bony endpoint and the needle remains well away from the pleura and epidural space.(63) It is rarely contraindicated. It is thought to be safe to perform in coagulopathic patients although this has been a subject of contention. The superficial location of the needle placement, the ability to compress the injected site and the lack of proximity to neuraxial structures makes it theoretically safer than epidural analgesia. Further research is required to understand its true safety profile.(70)

9 Initiate early

The standard package of care should be initiated at the earliest possible stage. Early administration of background analgesia is crucial. Early referral to the pain team should be considered if pain relief is not well optimized.

10 Mobilise

Mobilise day 1 unless other injuries dictate. If a patient has difficulty mobilising then the patient should be referred to the ward physiotherapist.

Position patients with head elevated to ≥ 30 degrees and patients at the top of the bed unless other injuries preclude.

11 Physiotherapy referral

Physiotherapy is crucial for patients with rib fractures and patients should be educated early on correct deep breathing and coughing techniques. A patient pamphlet on deep breathing/ coughing techniques as well as the Active Cycle Breathing Technique (ACBT) is provided on page 20 of this guideline.

Contact ward physiotherapist (#9390) or after hours (via switchboard).

After hours review if concerned with sputum retention. Contact ward physiotherapist (#9390) or after hours (via switchboard)

12 Respiratory exercises

Patients should be encouraged to deep breath and cough with correct technique. Minimum 3 – 4 deep breaths per half hour. Brace chest with a pillow or towel when coughing. A patient education pamphlet has been developed to facilitate this.

ACBT should only be initiated by a physiotherapist. ACBT involves a repeated cycle of relaxed diaphragmatic breathing followed by slow and deep breaths, thoracic expansion exercises and forced expiration techniques. A single clinical trial found reduction in pain scores from day three but without improvement in rates of pulmonary complications.(71)

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora Ā Rohe O Te Tai Tokerau

If at any stage deep breathing or coughing is impaired due to pain, the pain team should be contacted.

13 Oxygen therapy

The treating team should prescribe an oxygen target on the Early Warning Score chart and oxygen to meet this target. If a patient has a rising oxygen requirement to maintain adequate oxygen saturations the patient should be reviewed by the PAR team and treating team. High-flow nasal prong therapy (HFNP) provides high oxygen flow and increased end-expiratory pulmonary pressure.(72) Although unproven in patients with rib fractures it has been suggested that HFNP may decrease the risk of subsequent respiratory complications and respiratory failure.(73) HFNP should be considered early to achieve appropriate oxygenation in patient with rib fractures.

14 Venous thromboprophylaxis

All patients should have TEDs/SCDs and clexane unless contraindicated.

Refer to NDHB "Anticoagulation and antiplatelet perioperative management for elective surgery guideline" for anticoagulation guidance for epidural insertion and removal.

Seek advice from Pain Service (#1384) or Anaesthesia (#9767) if an anticoagulated patient is to have an erector spinae catheter.

15 Early escalation

If a patient is thought to be deteriorating or has inadequate pain control this should be escalated early to the appropriate team.

Criteria for ICU review at any stage
FiO2 ≥ 0.4 and trending upwards
Worsening clinical state
Uncontrolled pain
Any patient you are worried about

Criteria for pain team review at any stage
Inability to take deep breath
Inability to cough
Uncontrolled pain
Issues with regional catheters

Important numbers for reference

ICU	#8101
PAR	#9545
Pain Team (in hours)	#1384

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RIB-IMPROVE: A Management Guideline for Acute Rib Fractures | Page **11** of **26**

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Anaesthetics (after hours)	#9767
General Surgery Registrar	#9666

16 Surgical stabilising of rib fractures

Surgical stabilisation of rib fractures (SSRF) can be considered for some patients with rib fractures however overall < 1% of patients are appropriate. Multiple meta-analyses support the role of SSRF in patients with flail chest.(30-39) Flail chest is defined as three or more consecutive fractured ribs with two or more fractures on each. The term flail refers to the paradoxical inward movement of the discontinuous segment of chest wall on inspiration and this paradoxical movement can cause respiratory compromise in some patients. Flail segments have been shown to have an increased risk of mortality with flail chest alone carrying a mortality rate of 13-17%.(28, 29) The evidence for SSRF in patients without flail chest but with multiple rib fractures is evolving and therefore these patients should be evaluated on a case-by-case basis.(74)

The indications for SSRF are outlined below. If a patient meets any of the criteria below, General Surgery advice should be sought.

Indications:
Flail segments affecting ≥3 ribs (i.e ≥6 individual fractures) of lateral aspect ribs between 4 – 9 with:

- Patient on ventilator / failure to wean secondary to ventilatory mechanics failure (not contusions alone)
- Not on a ventilator but acute respiratory insufficiency despite optimal analgesia, physiotherapy, oxygen supplementation etc.

Also consider in:

- Significantly displaced, bi-cortical, rib fractures, not flail, resulting in > 50% reduction in Forced Vital Capacity despite analgesia
- ≥3 Rib fractures, not just flail, pain uncontrolled and with splinting with hypoexpansion despite pain team input, epidural etc.
- Unstable fractures with bi-cortical offset and soft tissue interposition between ends
- Significant chest wall deformity likely to result in long-term respiratory compromise
- "Fix on way out" if flail segment and performing a thoracotomy for another reason

Timing:

- Consider likely patients on presentation but ideally within <1 week. Median at other centres 5 days post injury. Unusually to have to do at presentation.

Contraindications:

- Ventilator requirement due to severe pulmonary contusions or ribs fractures and ventilation for another reason e.g. head injury.
- Severe Osteoporosis

Relative contraindications:

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RIB-IMPROVE: A Management Guideline for Acute Rib Fractures | Page **12** of **26**

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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- Age > 75
- Posterior fractures within 2.5 cm of transverse process
- Comorbidities, for example COPD, frailty
- Anterior fractures within 2.5cm of costochondral junction

Work-up and management:
- CT chest for planning with 3D reconstruction

17 Discharge planning

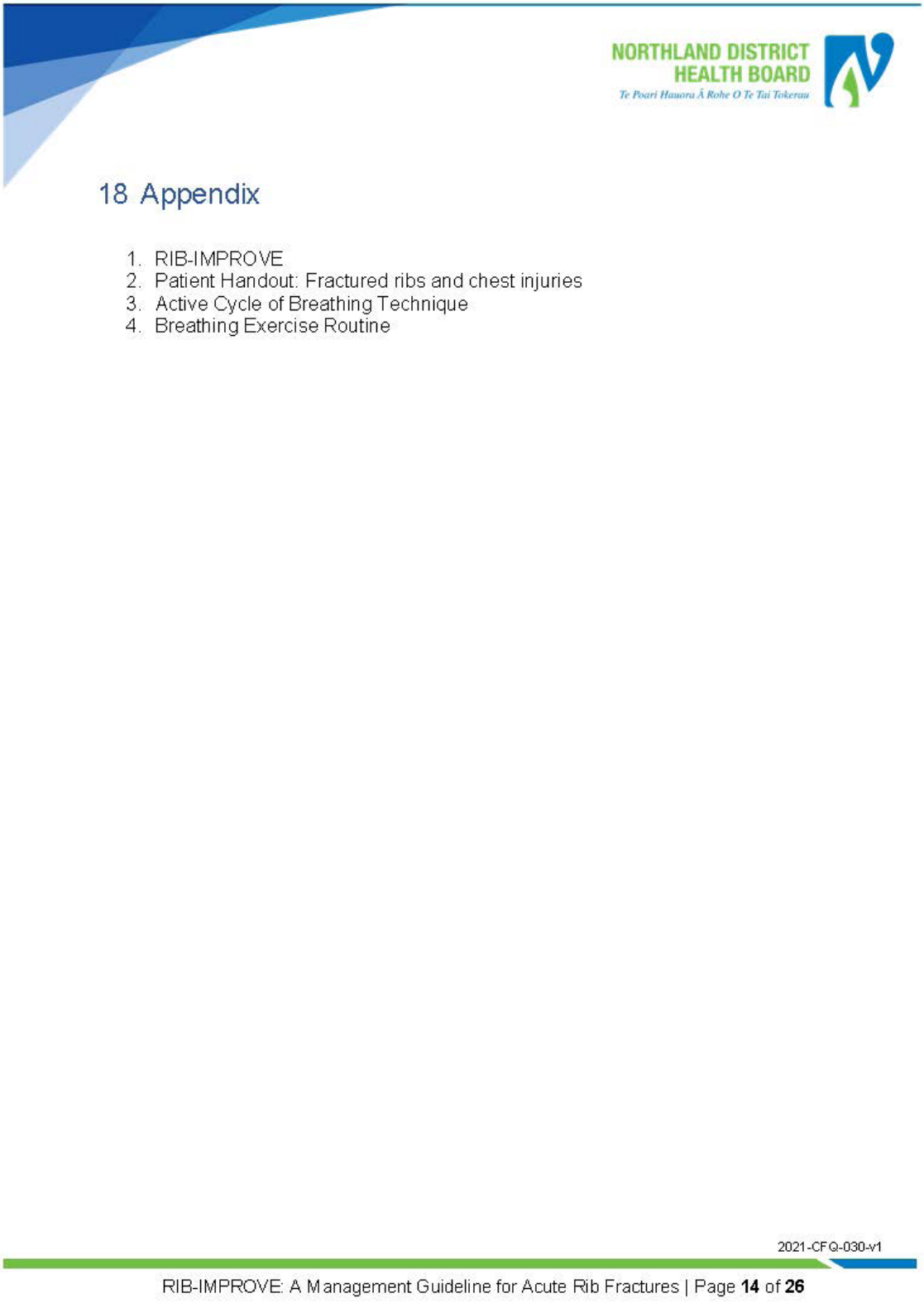
Prior to discharge, all patients should be seen by the ward physiotherapist. The patient handout, found on pages 18-19 should be printed out and given to the patients by the physiotherapist as it requires explanation.

All patients should be discharged with an appropriate prescription for background and PRN analgesia. The treating team, physiotherapist or nursing staff should discuss return advice including to return to hospital if the patient:

- Develops a fever, chills or shakes.
- Experiences severe or uncontrolled pain.
- If breathing becomes difficult or the patient develops increased shortness of breath or chest tightness.
- Has an inability to take a deep breath, cough or mobilise due to pain.

No specific follow up for patients with rib fractures is required.

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.



Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

NORTHLAND DISTRICT HEALTH BOARD
Te Poari Hauora A Rohe O Te Tai Tokerau

RIB-IMPROVE

Affix Patient Label Here

Name: NHI:

Address:

DOB: Age: Telephone Number:

Management Guideline for Patients with Rib Fractures

This guideline outlines a multidisciplinary bundle of care for patients with acute rib fractures.

These patients must be risk stratified prior to leaving the Emergency department. Further management on the ward is highlighted in the overleaf.

Please tick one risk category

	Low risk ☐	Medium risk ☐	High risk ☐
R Risk stratify patients	< 3 rib fractures and age < 45 with no significant respiratory co-morbidities	< 3 rib fractures and age ≥ 45 with no significant respiratory co-morbidities	Any patient you are worried about FiO2 ≥ 0.3 (NP > 3L O2/min) and unable to maintain Sats ≥ 94% ≥ 3 isolated rib fractures ≥ 2 isolated rib fractures if patient has significant cardiorespiratory co-morbidities Flail chest, sternal fractures or significant pulmonary contusions Patients requiring immediate trauma surgery Uncontrolled pain
I Intensive care consultation	No routine ICU discussion required unless clinically concerned.	Discuss with ICU if clinically concerned + PAR team review	Contact ICU registrar for review + PAR team review and consideration of high flow nasal prongs (HFNP) Consider referral to general surgery for rib fixation
B Background analgesia and pain team review	Background analgesia • Paracetamol 1g QID • Ibuprofen 400mg TDS; or Celecoxib 200mg BD • Tramadol 50-100mg q4-6h/PRN (Max 400mg) • Sevredol 10-20mg q1h/PRN • + laxatives Laxsol 2 tab BD • + antiemetics Ondansetron 4mg Q8h/ PRN	Background analgesia + pain team discussion for possible PCA/ketamine infusion +/- regional block	Background analgesia + pain team review for possible PCA or ketamine infusion and early consideration of regional aneathetic block • Reduce opioid dose in elderly • Avoid NSAIDs in CKD • If CrCl <30mL/min, caution morphine use and consider discussion with pain service/anaesthetists or renal physicians

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RIB-IMPROVE: A Management Guidelines for Acute Rib Fractures

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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RIB-IMPROVE

Affix Patient Label Here

Name: *NHI:*

Address:

DOB: *Age:* *Telephone Number:*

I **Initiate early**	Initiate standardised package of care on the ward as soon as possible Early referral to pain team to optimize background analgesia and consideration of regional block
M **Mobilise**	Mobilise day one unless other injuries dictate Position patients with head elevated to ≥ 30 degrees
P **Physiotherapy referral**	**Contact ward physiotherapist (#9390) or after hours (via switchboard)** After hours review if concerned with sputum retention
R **Respiratory exercises**	Encourage patients to follow deep breathing exercise sheet Minimum 3 – 4 deep breaths per half hour Brace chest with a pillow or towel when coughing
O **Oxygen therapy**	Treating team to prescribe oxygen target Early use of HFNP +/- oxygen to achieve above target PAR team and treating team review if raising O2 requirement
V **Venous thromboprophylaxis**	All patients should have TEDs/SCDs and clexane unless contraindicated
E **Early escalation to:** ICU #8101 PAR #9545 Pain Team (in hours) #1384 Anaes (after hours) #9767	**Criteria for ICU review at any stage** FiO2 ≥ 0.4 and trending upwards Worsening clinical state Uncontrolled pain Any patient you are worried about **Criteria for pain team review at any stage** Inability to take deep breath Inability to cough Uncontrolled pain Issues with regional catheters

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RIB-IMPROVE: A Management Guidelines for Acute Rib Fractures

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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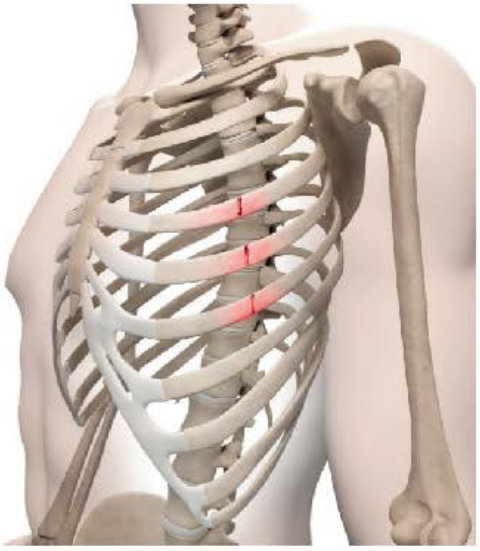
Te Poari Hauora Ā Rohe O Te Tai Tokerau

Rib fractures and chest injuries



The thoracic (chest) cage is made up by 12 ribs on each side.

Ribs are important as they help with breathing and coughing. When your ribs are broken, it causes a lot of pain which makes it hard for you to breathe and can put you at risk of chest infections.

Good pain control will prevent this.

What to expect

The pain is often worse in the first week following the injury but will gradually improve. The amount of pain felt will depend on the extent of your injury. Most injuries/fractures will heal within 4 to 6 weeks however it can sometimes take longer to become pain free.

Treatment

Most rib fractures are treated conservatively (without surgery). Pain relief is the most important treatment. It is natural to want to avoid the pain however if it is stopping you from deep breathing, coughing, and moving then you need to seek medical advice to improve your pain management. Without adequate pain relief you are at a higher risk of developing complications such as chest infections.

With good pain relief, you should be able to:

1. Deep breathe
2. Cough
3. Mobilise

If you are unable to, seek medical advice.

✓ Things you SHOULD DO:

Take regular pain relief: as prescribed by your doctor, seek help if it's not enough.

Deep breathing exercises: as detailed below.

Supported cough: as detailed below.

Mobilise: Stay active by going for walks and staying out of bed during the day. Aim to complete your everyday activities as much as possible, i.e., walking, making drinks or food.

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RIB-IMPROVE: Patient Discharge Handout

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Things you should AVOID:

Avoid smoking: It increases your chances of a chest infection.

Avoid lifting, pulling or pushing: it makes the pain worse for 4-6 weeks.

Avoid contact sport: for at least 6 weeks.

Do not lie down for long periods: This increases your risk of chest infections.

Activities and exercises

The following exercises will help you perform stronger coughs and deep breathing. Performing these regularly can prevent you from having chest infections and lung collapse (atelectasis).

Supported Cough
To make coughing more comfortable, hold your hand, a towel or a pillow firmly over the painful area. Then take a medium sized breath in, pull pillow into the chest and cough (if you have posterior rib fractures, brace against the back of the chair or bed).

Deep breathing exercises
Every half hour take 3 to 4 deep breaths - in via your nose, once your lungs are full hold the air for 2-3 seconds, then let the air out gently via your mouth.

Try and keep your shoulders and upper chest relaxed. Try and keep your shoulders and neck relaxed.

Further instructions:

_____
_____
_____
_____
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_____

Seek medical help if you:

- Develop a fever, chills or shakes
- Experience severe or uncontrolled pain
- If your breathing becomes difficult, you develop increased shortness of breath or chest tightness.
- You are unable to take a deep breath, cough or mobilise due to pain

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RIB-IMPROVE: Patient Discharge Handout

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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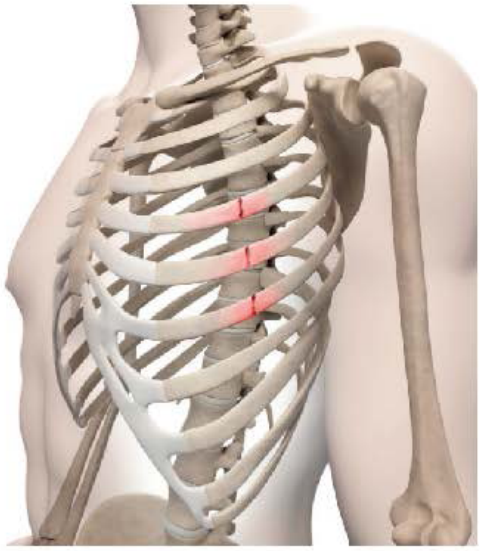
Ngā whatinga rara me ngā wharanga tārāuma



Hangaia ai te anga tārāuma ki ngā rara 12 kei ia taha.

He mahi nui tō ngā rara ki te āwhina i te hā me te maremare. Ka whati ana ō rara, ka mamae rawa, nā ka uaua te hā, ā, ka mate pea koe i te pokenga tārāuma.

Mā te pai o te whakamatua mamae e aukati ai tēnei.

Ngā āhuatanga ka pā mai pea

I te nuinga o te wā he mamae rawa i te wiki tuatahi whai muri i te wharanga engari ka pai haere. Mā te āhua o te wharanga e tohu i te nui o te mamae. Ka pai haere te nuinga o ngā wharanga/whatinga i roto i te 4 ki te 6 wiki, heoi anō ka roa rawa te hekenga o te mamae i ētahi wā.

Maimoatanga

Ka āta whakamaimoatia te nuinga o ngā whatinga rara (kore poka). Ko te whakamāmā i te mamae te maimoatanga nui rawa. Tōna tikanga ka hiahia koe ki te pare i te mamae engari ki te aukatihia te hā hōhonu, te maremare, me te neke me whai i ngā tohutohu hauora ki te whakapai ake i tō whakamatua i te mamae. Ki te kore koe e whai rongoā mamae ka nui te tūraru ki a koe kei mate koe i ētahi atu māuiui pērā i te pokenga tārāuma.

Ina he pai te rongoā mamae, ka āhei koe ki te:

1. Hā hōhonu
2. Maremare
3. Neke

Ki te kore, me whai tohutohu hauora.

✓ Ngā mea ME MAHI:

Kainga te rongoā mamae: pērā i tā te tākuta i whakarite ai, me rapu āwhina ki te kore e rahi.

Hei mahi hā hohonu: kei raro nei e whakamāramahia ana.

Āwhinatia te maremare: kei raro nei e whakamāramahia ana.

Me neke: Kia kaha ki te neke i tō tinana mā te hīkoi haere, ā, kaua e noho ki tō moenga i waenganui rā. Me kaha ki te whakaoti i āu mahi o ia rā i ngā wā katoa, pērā i te hīkoi, te mahi inu, kai rānei.

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RIB-IMPROVE: Patient Discharge Handout

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Ngā mea KIA KAUA E MAHI:

Kaua e kai paipa: Ka piki ake te tūponotanga ka mate i te pokenga tārāuma.

Kaua e hiki, kukume, pana rānei: ka kino ake te mamae mō te 4-6 ngā wiki.

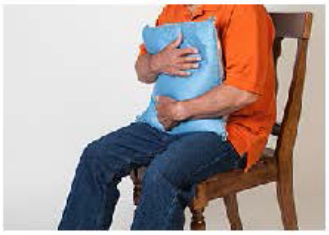
Kaua e purei hākinakina pā tinana: mō te 6 wiki nui ake rānei.

Kaua e takoto mō te wā roa: Ka piki ake te tūponotanga ka mate i te pokenga tārāuma.

Ngā ngohe me ngā mahi

Mā ēnei mahi e āwhina i a koe ki te whakakaha i tō maremare me te hā hōhonu. Mā te mahi haere i ēnei mahi e aukati i te mate pokenga tārāuma me te poka o ngā pūkahukahu (atelectasis).

Te āwhina i te maremare
Kia māmā ake te maremare, me kaha te pupuri i te wāhi mamae mā te ringa, mā te tāora, mā te pera rānei. Kātahi ka hā āhua waenganui nei te nui, puritia te pera ki te uma, ka maremare (ina he whatinga rara o waho āu, me kaha whakawhirinaki atu ki te tuara o te tūru, o te moenga rānei).



Ngā mahi hā hōhonu
Ia hāwhe haora me hā hohonu e 3 ki te 4 ngā wā - whakaroto mā te ihu, kia kī rā anō ō pūkahukahu puritia mō te 2-3 hēkona, kātahi ka āta hā whakawaho mā tō waha.

Kia pāroherohe ō pakihiwi me tō uma o runga. Kia pāroherohe ō pakihiwi me to kakī.

Ētahi atu tohutohu:

_____
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_____

Rapu āwhina hauora ina:

- Ka pāngia e te kirikā, te haukōeoeo, te korohāwini
- Ka ngaukinotia e te mamae tārūrū
- Ina ka uaua te hā, ka hē manawa ka renarena rānei te uma.
- Kāore e taea te hā hohonu, te maremare, te neke rānei nā te mamae

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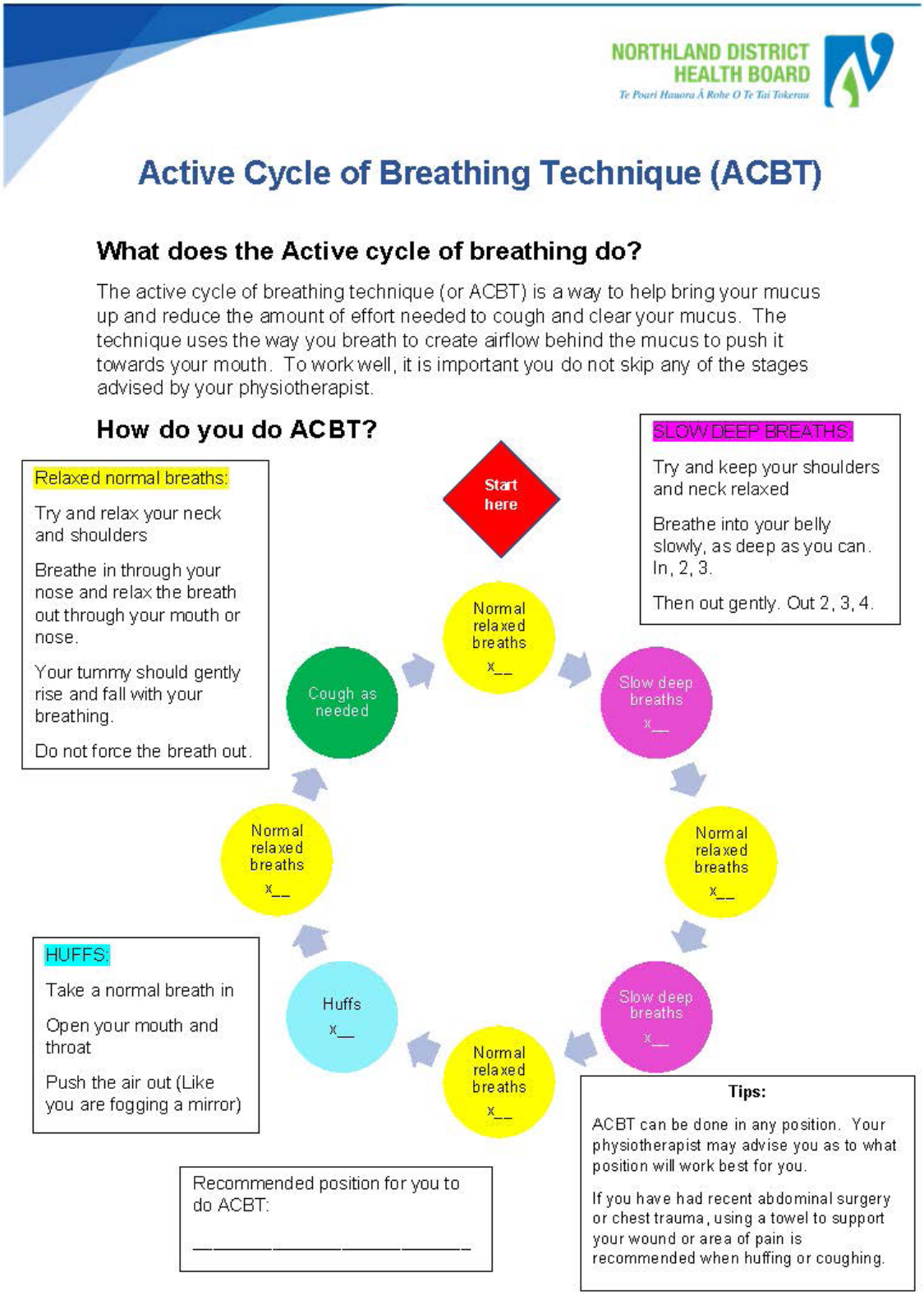
RIB-IMPROVE: Patient Discharge Handout

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.



Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Te Poari Hauora Ā Rohe O Te Tai Tokerau

Breathing Exercises Routine

Please complete the following exercises as recommended by your Physiotherapist.

Slow Deep Breaths x___

Repeat _____

Try to sit upright or in a chair if possible

Deep breaths should be breathed slowly in through your nose, pause, then out through your mouth.

If you have phlegm, follow your deep breaths with:

Supported huffs x____

then supported coughs as needed

Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Appendix 2 (continued): RIB-IMRPOVE guideline: a management guideline for patients with acute rib fractures.

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Aotearoa New Zealand cochlear implant programmes equity audit: addressing disparities and equity for Māori with severe and profound hearing loss

Pat Tuohy, Neil Heslop, Jill Mustard, Phil Bird, Holly Teagle, Robert Gunn

ABSTRACT

AIM: We examined equity in the provision of cochlear implant services for New Zealand Māori compared with other New Zealanders.
METHODS: The client databases of both Aotearoa New Zealand cochlear implant programmes were searched and an anonymised dataset was provided to the audit team. Ethics committee approval was not required. Ethnicity was categorised as Māori or non-Māori.
RESULTS: There is no significant difference between Māori and non-Māori with respect to acceptance for surgery rates and time from acceptance to surgery. Māori children and adults have a higher rate of proceeding to surgery than non-Māori ethnic groups. Average days to surgery for adult clients reduced over the period studied. Time to surgery was low for both child ethnic groups. When a measure of prioritisation (clinical priority access criteria [CPAC]) was incorporated into the evaluation, we found that Māori clients waited slightly, but not significantly less time per unit of CPAC scored.
CONCLUSION: We were able to demonstrate that once Māori clients accessed the cochlear implant programmes, they were implanted at a similar rate as non-Māori, and adult clients experienced equivalent waiting times even when adjusted for CPAC score. These favourable results suggest that our internal systems and pathways are promoting equity.

Section one/tahi: context and background to the audit

The Aotearoa New Zealand cochlear implant programme

A cochlear implant is a surgically implanted electronic device that provides a sense of sound to a person who is severely or profoundly deaf, who is not helped by standard (acoustic) hearing aids.

The Aotearoa New Zealand cochlear implant service is fully government funded for those eligible, and includes audiological and medical/surgical assessment, provision of the implant (an implanted electrode and a sound processor, which is worn externally), surgery and ongoing support and (re)habilitation services.

The Aotearoa New Zealand government contracts two providers to provide cochlear implant services through the Ministry of Social Development. These providers are the Northern Cochlear Implant Programme (NCIP), which covers Northland, Auckland, Waikato, Bay of Plenty, Rotorua and Taupo, and the Southern Cochlear Implant Programme (SCIP), which covers the rest of Aotearoa New Zealand. The NCIP contracts with The Hearing House (THH) to provide audiology services and with private specialists and Southern Cross Healthcare (Gillies Hospital) to provide the otolaryngology (ORL) component. The SCIP provides audiology services in-house and contracts with several hospitals and specialists for the ORL components of the implant. The programmes also provide device upgrades and replacements when required.

This review project was initiated by the boards of the Northern and Southern Cochlear Implant Trusts in response to their obligations to Māori under Te Tiriti o Waitangi and recommendations of the Waitangi Tribunal as part of the 2019 Waitangi Tribunal Wai2575 claim[1] in which the Tribunal states:

> *We recommend that the commitment to achieve equitable health outcomes for Māori is expressly stated in all documents that make up the policy framework of the primary health*

> *system: the strategies, the plans, and the so-called lower-level documentation.*

Inequities exist for Māori across a range of health issues. This includes inequities for Māori with lived experience of disability compared with non-Māori. The Aotearoa New Zealand Ministry of Health – Manatū Hauora define equity as follows:

> *In New Zealand, people have differences in health that are not only avoidable but unfair and unjust. Equity recognises different people with different levels of advantage require different approaches and resources to get equitable health outcomes.*[2]

Overall, Māori have greater exposure to the determinants of health and illness, poorer access to health and disability services and often receive lower-quality health and disability services.[3] Williams raised this issue with respect to cochlear implant services in a viewpoint article.[4]

There is also strong evidence of systemic and structural barriers affecting health and disability outcomes for Māori, which are now recognised as secondary to institutional racism and colonisation. Colonisation resulted in resources being taken from Māori, and ongoing marginalisation of tikanga Māori within Aotearoa New Zealand society.[3,5–8]

Curtis et al.[9] argue that colonisation, historical and contemporary power imbalances, the unequal impact of social determinants such as lower income and poor-quality housing and inequities of access to and the quality of healthcare services play seminal roles in persistent health inequities for Māori. The authors emphasise that even when inequity data are adjusted to account for socio-economic deprivation, health inequities remain.

This report utilises a model by Rathore and Krumholz,[10] which defines a health disparity as a difference in appropriate treatment use that is associated with poorer clinical outcomes and is not attributable to patient factors. The healthcare service and resource of specific interest in this report relates to untreated hearing loss and the availability and uptake of hearing technologies and interventions.

Disability and hearing impairment

Hearing loss has considerable impact on individuals, whānau and communities and is a substantial burden on social and economic wellbeing of Aotearoa New Zealand.[11] Recent research by Anovum[12] indicates that around 10% of the population experiences hearing loss. This Aotearoa New Zealand–based report showed that the rate of hearing loss increased from around 5% in young adults to almost 40% in adults over 75 years of age. Although the prevalence of hearing loss increases with age, severe and profound hearing impairment tend to be concentrated in the early years and in older adults. This is of particular relevance to the provision of cochlear implant services and these two groups are the primary focus of this audit.

Hearing impairment is the second most common impairment experienced by Māori at 8%, compared with 9% for non-Māori.[13] More recent research suggests that the overall hearing disability figures may not be representative of the experience of older adults. A number of reviews have confirmed the disparity, but the findings vary considerably due to variability in hearing loss definitions and populations studied.[14–16]

Prevalence and severity of hearing loss in Aotearoa New Zealand children

In 2007/2008, the Ministry of Health – Manatū Hauora implemented two formal newborn and childhood hearing screening initiatives. These were the Universal Newborn Hearing Screening and Early Intervention Programme[17] and the B4 School Check.[18] The 2023 *Deafness Notification Report* (DNR; see footnote 1)[19] shows a marked reduction in the age of detection and intervention for congenital and early-acquired/progressive hearing loss in Aotearoa New Zealand children. In 2022, 165 children and young people 0–18 years of age were reported to the Deafness Notification Database with non-conductive hearing loss. With regards to ethnicity breakdown, the 2023 DNR shows that children and young people of European ethnicity made up two-thirds of the population, but only half of the notifications. Children and young people of Māori ethnicity made up a third (34%) of deafness notifications despite being only a quarter (26%) of the population. The DNR also found that Māori children had higher rates of bilateral hearing loss than European children.

Table 1 shows the distribution of severity of hearing loss in children and young people reported to the Deafness Notification Database between 2010 and 2022. It can be seen that over a 10-year period, 11% of children had severe to profound bilateral loss and were potential

Table 1: Severity distribution of hearing loss for children notified to the Deafness Notification Database 2010–2022.

Degree of hearing loss ASHA severity codes	Unilateral	Bilateral
Mild	46%	52%
Moderate	17%	29%
Moderately severe	12%	8%
Severe	9%	4%
Profound	17%	7%

Source: 2023 Deafness Notification Report. Table 22.

candidates for cochlear implantation. A further 26% of children had severe to profound unilateral loss.

Prevalence and severity of hearing loss in Aotearoa New Zealand adults

The World Health Organization has identified hearing loss in older adults as a significant global health and disability concern.[20,21] There is a well-documented association between untreated hearing loss in older adults and adverse health and social effects, ranging from social isolation to depression and dementia.[22–24]

At present, approximately one-third of the Aotearoa New Zealand population over 65 years is affected by disabling hearing loss,[25] although it should be noted that estimates of hearing loss in adult populations have considerable variability due to differences in study methodology and the diversity of population sampling. The Massey University Health, Work and Retirement (HWR) study and its successor, the New Zealand Longitudinal Study of Ageing,[26] collected information from older adults about the presence of a range of chronic health conditions. The study explicitly asked about hearing loss using three self-reported categories. It found that 33% of respondents reported hearing loss, with 32% experiencing mild-to-moderate difficulties and 1% experiencing more severe difficulties with hearing in normal social situations (personal communication in an email from Dr Fiona Alpass, received 29 January 2024).

Prevalence and severity of hearing loss in older Māori/kaumātua

Several sources were examined to provide a rate of hearing loss in this demographic, broken down by ethnicity. The Disability Survey 2013[13] reported that 32% of kaumātua aged 65 and over had some degree of hearing impairment. Teh et al.[14] and Manuel et al.[15] found that a third of Māori participants reported hearing loss that adversely affected their day-to-day functioning. In comparison, 26% of non-Māori participants reported disability from hearing loss. With respect to severe hearing loss, the Massey University HWR study,[26] which oversampled older Māori/kaumātua, found a rate of self-reported severe hearing loss of 3% in this age group for kaumātua and 1% for European. For the purposes of this review, the HWR data are used as they are the most up-to-date, and are likely to be fairly accurate, given the oversampling of kaumātua and the repeated contact with participants, despite being self-reported and not objectively verified.

Section two/rua: methods

The client databases of both Aotearoa New Zealand cochlear implant programmes (SCIP and NCIP/THH) were searched by administrative staff in the programmes, and an anonymised dataset of programme participants who were referred to the programmes between 2016 and 2022 was provided to the audit team. For the purposes of this report, the dataset contained information on age, ethnicity and clinical pathway such as whether the client progressed to implant, and, if so, time from referral to implant, and clinical priority access criteria (CPAC) score, which is a composite metric of health and socio-demographic status (see footnote 2). No identifiable client information was shared with the audit team. As this review was an audit of clinical

services, no ethics committee consultation was required or sought (see footnote 3). For the purposes of this audit, ethnicity was dichotomised as Māori or non-Māori (Other). Māori ethnicity was determined according to the HISO 10001:2017 prioritisation protocols of Health New Zealand – Te Whatu Ora.[27]

The extracted data were entered into an Excel spreadsheet and an initial descriptive analysis was undertaken. Where required, statistical analysis was performed using the MedCalc and Prism Graphpad software packages.[28,29] The draft review was peer reviewed by external reviewers and presented to the boards of the Northern and Southern Cochlear implant programmes.

Section three/toru: results

Equity of access to surgery

Results from the two programmes between 2016 and 2022 (Table 2) show that there is no significant difference between Māori and non-Māori adults or children with respect to the rate of acceptance for surgery (adult: 95% confidence interval [CI] 0.37–0.61, p=0.37; child: 95% CI 0.64–1.00, p=0.59).

Children have a significantly higher surgical intervention rate (81%) than adults (48%) due to the more robust ascertainment of hearing loss and systematised follow-up of screen-positive children (p<0.0001). Figure 1 shows the rate of proceeding to surgery for both ethnic groupings over this period.

Progress to surgery has remained reasonably stable apart from a drop in 2022, which likely reflects the COVID-19 pandemic effects and incomplete data. Around 70–80% of child clients and 40–50% of adult clients progress to surgery. Although Māori children and adults currently have a slightly higher rate of proceeding to surgery than the non-Māori group, this is not significantly different. When reasons for adults not proceeding were assessed, about a third were related to declining physical and cognitive health; another third chose to withdraw, citing desire to remain part of deaf culture (see footnote 4). The final third felt that they were too old or unwell to participate in follow-up care.

Days to surgery

Average days to surgery (Figure 2) shows that waiting time for adult clients has fallen from about 2–2.5 years to around 9 months over the 6-year period studied. Eligible children of both ethnic groupings generally receive their cochlear implant within 6–9 months of diagnosis, depending on age and clinical factors.

Differences by ethnic grouping for adults were apparent in the first few years of this time period, but as shown in Table 3, there is currently (2019–2022) no significant difference between days to surgery for Māori and non-Māori (two-tailed p-value=0.59).

Equity of access to surgery based on different levels of need

Further analysis looked at stratification by CPAC scores (see footnote 2) to identify whether

Table 2: Numbers of referrals and surgeries and analysis of significance.

	Adult	Child
Māori referrals	133	98
Māori surgeries	64	79
Māori referral:surgery rate	0.48	0.81
95% confidence interval	0.37–0.61	0.64–1.00
Non-Māori (Other) referrals	1,358	302
Non-Māori (Other) surgeries	581	227
Non-Māori referral:surgery rate	0.4	0.75
95% confidence interval	0.39–0.46	0.66–0.86
P-value	0.37	0.59

Figure 1: Percentage of clients proceeding to surgery by age and ethnicity (Southern Cochlear Implant Programme and Northern Cochlear Implant Programme/The Hearing House data).

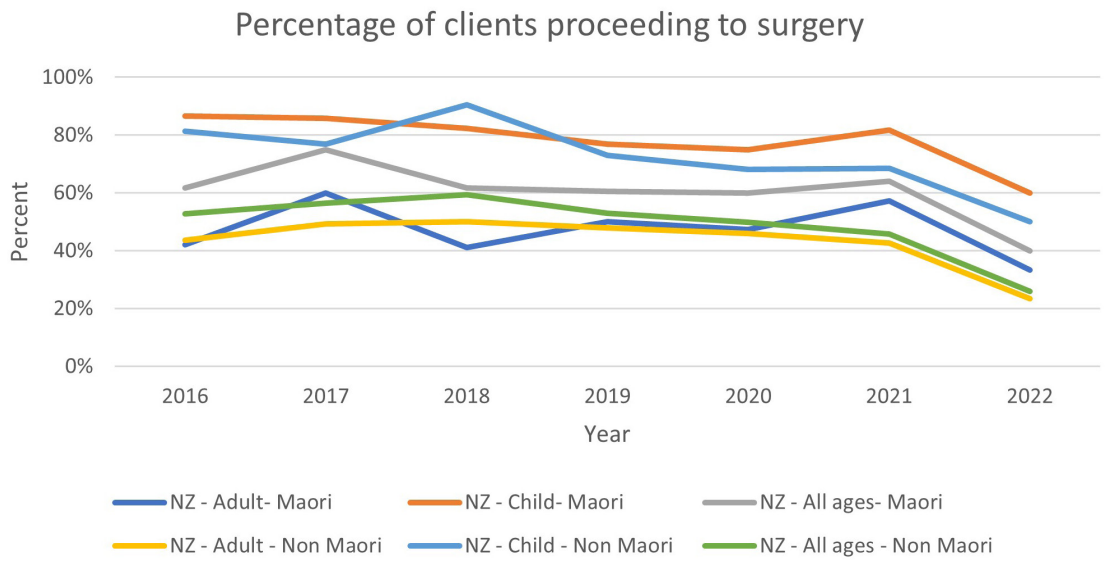

Figure 2: Average days to surgery by ethnicity and age (Southern Cochlear Implant Programme and Northern Cochlear Implant Programme/The Hearing House data, 2016–2022).

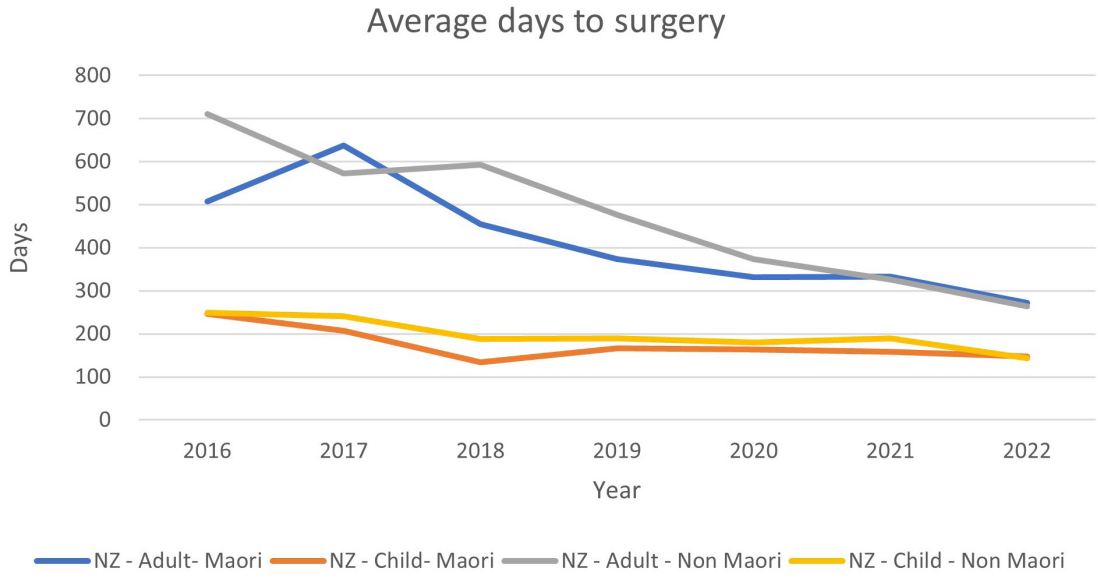

Table 3: Days to surgery between adult Māori and non-Māori (2019–2022).

	Māori	**Non-Māori**
Mean	317.75	301.19
SD	148.3	125.58
SEM	33.16	9.99
N	20	158

SD = standard deviation; SEM = standard error of the mean.

Māori and non-Māori adult waiting time to surgery was related to CPAC scores. This should be the situation as CPAC scoring is intended to prioritise higher "need" as determined by a range of medical and social criteria.

Initial CPAC data show that Māori have significantly higher CPAC scores (mean 58.4) at acceptance into the cochlear implant programme than non-Māori (mean 50.5, two-tailed p-value=0.018) (see Table 4).

In order to determine whether the higher CPAC scores for Māori were associated with shorter waiting times for surgery, we plotted these two variables as shown in Figure 3. This shows that for both groups there is an inverse relationship between CPAC and wait time to surgery, which is appropriate. For non-Māori (blue dots) the correlation coefficient is 0.03, which is small, indicating that CPAC has little effect on waiting time to surgery. For Māori (orange dots), the correlation coefficient is 0.2, which is medium to large, indicating an (appropriate) inverse relationship between CPAC and waiting time to surgery.

When ethnicity at entry to the programme was plotted against distribution of CPAC scores and waiting times (upper and lower quartiles and median) we found that more Māori had higher CPAC scores at entry compared with the CPAC scores for non-Māori (Table 5). The waiting times for surgery were skewed in the other direction, with fewer Māori waiting longer than non-Māori ethnic groups.

Combining these two sets of information provides a measure of waiting time in days per CPAC unit allocated at booking. Table 5 shows that Māori clients waited slightly less than non-Māori per unit of CPAC score.

Tables 6 and 7 present a statistical analysis (two-

Table 4: Clinical priority access criteria (CPAC) scores by ethnicity.

	Māori	Non-Māori
Mean	58.4	50.5
SD	10.68	13.72
SEM	2.45	1.19
N	19	133

SD = standard deviation; SEM = standard error of the mean.

Figure 3: Clinical priority access criteria (CPAC) vs wait time scatterplot by ethnicity (Southern Cochlear Implant Programme and Northern Cochlear Implant Programme/The Hearing House data).

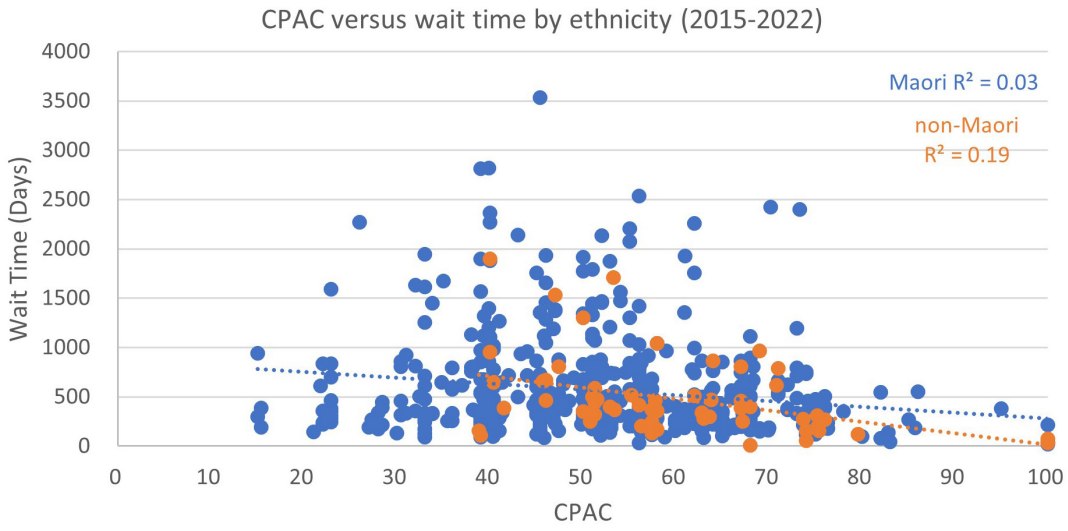

Table 5: Adult clinical priority access criteria (CPAC) scores and wait times by ethnicity (Southern Cochlear Implant Programme and Northern Cochlear Implant Programme/The Hearing House data).

	Lower quartile	Median	Upper quartile
CPAC scores			
CPAC—Māori	51	58	68
CPAC—non-Māori	40	52	63
CPAC—total	43	53	63
Wait times (days)			
Wait time—Māori	205	370	587
Wait time—non-Māori	250	381	679
Wait time—total	248	381	669

Table 6: Adult wait time/clinical priority access criteria (CPAC) unit by ethnicity (Southern Cochlear Implant Programme and Northern Cochlear Implant Programme/The Hearing House data).

Waiting time (days) per CPAC unit			
	Lower quartile	**Median**	**Upper quartile**
Māori	4.0	6.4	8.6
Non-Māori	6.3	7.3	10.8
Total	5.8	7.2	10.6

Table 7: Statistical analysis (two-tailed *t*-Test) of the adult wait times/clinical priority access criteria (CPAC) unit by ethnicity.

	Māori	**Non-Māori**
Mean	8.75	11.99
SD	8.67	12.009
SEM	1.11	0.51
N	61	556
Two-tailed P-value = 0.041		

SD = standard deviation; SEM = standard error of the mean.

tailed *t*-Test) of the adult wait times by ethnicity, confirming that Māori clients experienced a significantly shorter wait time per unit of CPAC (p=0.041).

Section four/whā: discussion and recommendations

This report examined a selected range of available data from the two Aotearoa New Zealand cochlear implant programmes. Analysis of the available data demonstrated that Māori and non-Māori children were implanted at equivalent rates and waiting times following referral, and that children had significantly shorter waiting times than adults. This is due to the childhood hearing screening and early intervention policy and programmes implemented in Aotearoa New Zealand since 2007/2008. With regard to adults, once kaumātua accessed the cochlear implant programmes they were implanted at a similar rate as older non-Māori clients, and experienced shorter waiting times, even when adjusted for CPAC score. These favourable results suggest that our internal systems and pathways are promoting equity.

However, there are several gaps associated with this review that need to be addressed in subsequent reviews. These include:

- The experience of Māori kiritaki of their delivery pathway
- More in-depth data by ethnicity about why Māori kiritaki may not proceed to surgery
- No data by iwi or hapū affiliation
- No routine analysis of clinical outcomes data by ethnicity
- Whānau-based outcomes data (not just the individual)

Recommendations

There are a range of emerging equity issues facing some non-Māori ethnic populations and some demographic groups. This was not the focus of this report. These issues could be addressed in future reviews.

The health sector has an opportunity to enhance cochlear implant services to continuously improve equity of access, experience and outcomes. This means tackling core service and broader system issues linked to appropriateness, accessibility and equity of provision for Māori along the total pathway. Accordingly, there are opportunities and challenges for the Northern and Southern cochlear implant programmes to continue to work at a systems level to advocate for a pro-Tiriti approach. These include:

- To share our best practice with others to support an equity-focussed community of practice
- To develop and implement a Māori responsiveness policy and associated practices based on Te Tiriti o Waitangi and in partnership with Māori
- To identify agreed data gaps and develop a process to address them
- To examine our data on a frequent basis and use it to inform gaps in delivery and to fulfil those gaps, including scaling successful internal implementation systems and processes
- To co-design with Māori an outcome framework and data suite to measure Indigenous-inspired success that sits alongside clinical success
- To encourage the audiology community who provide entry-level care for hearing loss for adults in Aotearoa New Zealand to refer all appropriate candidates to the cochlear implant programmes

Footnotes

Footnote 1: The New Zealand *Deafness Notification Report* analyses the Deafness Notification Database, which contains information on children and young people under the age of 19 years diagnosed with permanent hearing loss in one or both ears. It is available at https://www.nsu.govt.nz/health-professionals/universal-newborn-hearing-screening-programme/new-zealand-deafness-notification

Footnote 2: The clinical priority access criteria (CPAC) is a weighted metric that considers a number of candidate variables, including current quality of life and the importance of hearing to retain or secure meaningful employment, support dependents and succeed in education. CPAC scoring does not take account of ethnicity. A higher CPAC score usually indicates a higher priority ranking on the waiting list.

Footnote 3: According to Section 30 of the Health and Disability Ethics Committee (HDEC) standard operating procedures v.3, audit or related activity requires HDEC review only if it involves the use, collection or storage of human tissue without consent, other than in accordance with a statutory exception (set out at section 20(f)

of the *Human Tissue Act 2008* and Right 7(10)(c) of the *Code of Health and Disability Services Consumers' Rights 1996*). See https://ethics.health.govt.nz/operating-procedures/

Footnote 4: Deaf culture according to Deaf Aotearoa is a unique community with its own language, values, rules for behaviour and traditions. Deaf people see themselves as a distinct group within a country and their first language is sign language—in Aotearoa New Zealand, it's New Zealand Sign Language (NZSL).

COMPETING INTERESTS
Northern and Southern Cochlear Implant Trusts provided financial support to PT for data analysis. PT is Chair of the Joint Clinical Governance Committee of the Cochlear Implant Trusts.
PB is on the NZ CI Advisory committee and a Trustee of the Southern Hearing Charitable Trust for governance of the CI programme.
HT is an employee of The University of Auckland and the role of Clinical Director at The Hearing House fills their service obligations.
RG is a Trustee of Cochlear Implant Foundation of New Zealand, and a beneficiary of a family trust with 400 shares in Cochlear Ltd, a manufacturer of hearing devices including cochlear implants.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/aotearoa-new-zealand-cochlear-implant-programmes-equity-audit-addressing-disparities-and-equity-for-maori-with-severe-and-profou

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Appendix: glossary of te reo terms used

Hapū—kinship group, subtribe
Iwi—extended kinship group, tribe/tribal affiliation
Kaumātua—older Māori person
Kiritaki—client, customer, consumer
Rua—two
Tahi—one
Te reo—Māori language
Te Tiriti o Waitangi—the Treaty of Waitangi
Toru—three
Whā—four
Whānau—family grouping

Pembrolizumab-related toxicity in patients with advanced melanoma

Florence de Roo, Amritpreet Singh, Eric Zheng, Alvin Tan, Annie N M Wong

ABSTRACT

AIM: Pembrolizumab has revolutionised the treatment of melanoma. Immune checkpoint inhibitors (ICI) are well tolerated in trials, but the real-world incidence of toxicities and their management are not well described. We investigated the incidence and management of toxicities in New Zealand.

METHODS: A retrospective review was conducted on patients with metastatic melanoma treated with pembrolizumab at Wellington and Waikato Hospitals between March 2016 and September 2021. The occurrence, severity and management of toxicities was recorded.

RESULTS: Of the 273 patients, 42% experienced treatment-related toxicity. Seventy-five percent of toxicities were grade 1/2 (mild), 25% grade 3/4 (moderate or life-threatening) and <1% grade 5 (fatal). Per organ system, 28% were dermatological, 18% gastrointestinal, 14% endocrine, 9% musculoskeletal, 5% respiratory, 5% renal and <1% haematological, cardiac or neurological. Thirteen percent of patients were hospitalised and 21% had pembrolizumab stopped due to toxicity. There were 45 referrals to subspecialty services.

CONCLUSION: Pembrolizumab-related toxicities are common and mostly mild but can require protracted courses of steroids and specialty referrals. Prospective data on toxicity and the management of toxicities from ICIs are needed.

Australia and New Zealand have the highest incidence of melanoma worldwide at over 50 cases per 100,000 population.[1,2] Historically, treatment options for metastatic melanoma were limited, with a median survival of less than 1 year.[3] Immune checkpoint inhibitors (ICIs) targeting programmed cell death protein 1 (PD-1), programmed cell death-ligand 1 (PD-L1) or cytotoxic T lymphocyte-associated antigen 4 (CTLA-4) have revolutionised the treatment of metastatic melanoma, with a subset of patients experiencing durable long-term responses and median overall survival now approaching 3 years.[4] PD-1 blockade with anti-PD-1 monoclonal antibodies such as pembrolizumab and nivolumab now represent standard of care for the treatment of unresectable stage III and stage IV melanoma.[2]

PD-1 is expressed on T cells and binds to its ligands, PD-L1 and PD-L2, which are expressed on cancer cells. Pembrolizumab blocks the interaction between PD-1 and PD-L1 to prevent T cell inactivation, thereby increasing the anti-tumour response.[3] Due to this blockade, the immune system can overcome self-tolerance, resulting in treatment-related immune toxicities.[3] Toxicities most commonly involve the skin, endocrine glands and gastrointestinal tract, but can potentially involve any organ system.[5]

ICIs such as pembrolizumab are generally well tolerated. In a meta-analysis of 18,000 patients, 66% developed some form of toxicity, with only 14% being severe or life threatening (Common Terminology Criteria for Adverse Events [CTCAE] grade 3 or higher).[6,7] The majority of CTCAE grade 3 or higher toxicities can be managed with oral and/or intravenous steroids; however, other immunosuppressants such as mycophenolate, calcineurin inhibitors or monoclonal antibodies may be required in refractory cases.[3] Although largely manageable, there are no real-world analyses describing the duration of toxicities, their management and the implications for their treatment regimen in the New Zealand setting.

The exact mechanism of immune toxicities is not known, but one postulated mechanism is the cross-reactivity of the immune system to antigens common to both tumour and involved organs.[8] Therefore, some studies suggest that patients with toxicities are more likely to respond to ICIs.[8,9] Across different types of cancer, such as non-small cell lung cancer and renal cell carcinoma, patients who experience toxicities have been documented to experience improved progression-free survival (PFS) and overall survival (OS).[8–10] However, in metastatic melanoma, the association between toxicity and ICIs is not well established.[8] This association between survival and the development of toxicity from ICIs highlights the importance of understanding the incidence and management of these toxicities to enable ongoing therapy where toxicity is mild.

Therefore, the purpose of this retrospective

study is to document the incidence of pembrolizumab-related toxicities in the real-world setting. We also examined how toxicities were managed, their time to onset and resolution, and their clinical consequences to get a real-world understanding of their impact on patients.

Methods

Data source

A retrospective analysis of electronic data was conducted on all adult patients with advanced melanoma treated with pembrolizumab at Wellington Blood and Cancer Centre between March 2016 and August 2020 and at Waikato Hospital between September 2016 and September 2021. Data from relevant nearby district health boards (DHBs), such as Hutt Valley and Wairarapa DHB, were also reviewed when required. The data collected for the Wellington and Waikato sites were collected over slightly different time periods and the data points collected differed, given the two datasets were conceived separately; however, given the purposes of the studies were similar, a decision was made to combine the datasets for some of the descriptive analysis.

Patient population

Inclusion criteria were adult patients with histologically confirmed advanced melanoma (unresectable stage IIIC or stage IV) of cutaneous, mucosal, ocular or unknown origin who received at least one dose of pembrolizumab as per standard regimen. Patients with cutaneous, mucosal, ocular or unknown origin were included, as to date there is no evidence to suggest that ICI toxicity differs based on location of origin of melanoma. Patients who were on concomitant *BRAF* and MEK inhibitors, which are not available as first-line therapies in New Zealand, were also included in the final analysis. Those who were previously part of a randomised trial comparing pembrolizumab to placebo were excluded, as the treatments were blinded.

Outcomes

Data collected at the time of treatment commencement for each patient included age, gender, presence of baseline autoimmune disease, date of treatment commencement, date of progression and date of death. Data were also collected on the complications of treatment including organ site affected, grade of toxicity and discontinuation of pembrolizumab due to toxicity. In addition, in the Wellington cohort data were collected on lactate dehydrogenase (LDH), *BRAF* status, melanoma stage and performance status as per the baseline performance status, Eastern Cooperative Oncology Group (ECOG) scale. For patients treated in the Wellington Region, further data were collected on the management of toxicities including total hospitalisations, referrals to subspecialty services for toxicity management and toxicity-related deaths.

Clinic letters and discharge summaries were reviewed to determine the development of toxicities. Toxicities were grouped based on organ system. The start date for toxicity was recorded as first description in medical documentation. The end date for toxicity was when there was clear documentation of resolution, otherwise it was simply recorded as not resolved (NR). In cases of biochemical toxicity, such as hypothyroidism, the end date of toxicity was determined by reviewing laboratory records for normalisation of TSH and T4 while on treatment.

Toxicities that represented a flare of a pre-existing autoimmune disease were grouped per organ system with those who did not have a pre-existing autoimmune disease.

Toxicities were graded using the CTCAE v5.0 framework.[7] Grade 1 was defined as toxicity with no or only mild symptoms and grade 2 as a moderate toxicity for which non-invasive intervention was required. Grade 3 refers to a severe but non–life-threatening toxicity and grade 4 to a life-threatening toxicity. Grade 5 was a toxicity-related death. If toxicity of varying grades at different times was described, the highest documented grade was used. In situations where a grade was not documented, deductions were made based on a description of symptoms. Due to this limitation of retrospective grading, toxicities were grouped into those that were mild (intermittent or needing supportive medications), which equated to grade 1/2, moderate or life-threatening (requiring delay in treatment or hospitalisation), equating to grade 3/4, and fatal toxicities (grade 5).

Data on the management of toxicities were also collected for the Wellington cohort. The total duration of oral steroids prescribed for toxicity was determined based on documentation of start and stop dates as well as pharmacy dispensing records. Any steroid prescribed for brain metastases, nausea or *BRAF* and MEK inhibitor-related toxicity was excluded from the analysis. For patients who remained on steroids with no

documented cessation date, the end date for their steroid use is the date of last contact. Use of additional immunosuppressants was also recorded.

Results

Wellington

Patient characteristics

One hundred and thirty-one patients met inclusion criteria for analysis in the Wellington Region. The median age at pembrolizumab commencement was 69 years, and 92 (70.2%) were male. *BRAF* mutations were observed in 36 (27.5%) patients. One hundred and thirteen (86.3%) patients had stage IV disease, while 18 (13.7%) had unresectable stage IIIC disease. The majority were cutaneous primaries (74.0%), followed by unknown primary (19.1%), mucosal (3.8%) and ocular (3.1%). Five (3.8%) patients received concurrent *BRAF* therapy. Fifteen (11.4%) patients had an underlying autoimmune disease. The median duration for follow-up was 735 days. Further baseline characteristics are described in Table 1.

Toxicity development

Eighty-three (63.3%) patients experienced pembrolizumab-related toxicities. In total, there were 221 individual toxicity episodes, as 61 (46.6%) patients experienced multiple toxicities. Only 22 (16.8%) patients experienced a single toxicity. In total, 79.6% of all toxicities were grade 1/2, 19.5% were grade 3/4 and 0.9% were grade 5. The two grade 5 toxicities were cases of pneumonitis and pancreatitis respectively, who both died in hospital. The median time to first toxicity onset was 42 days and median time to toxicity resolution was 122.5 days; however, for 57.9% of toxicities, no date of resolution was recorded. The time to first toxicity development is represented in Figure 1.

Dermatological toxicities, notably rash and vitiligo, were most frequent, accounting for 32.1% of all toxicities. Generalised toxicities accounted for 22.2% of all toxicities, with 43 cases of fatigue being the most common within this category.

Table 1: Baseline characteristics of patients with advanced melanoma treated with pembrolizumab in the Wellington Region.

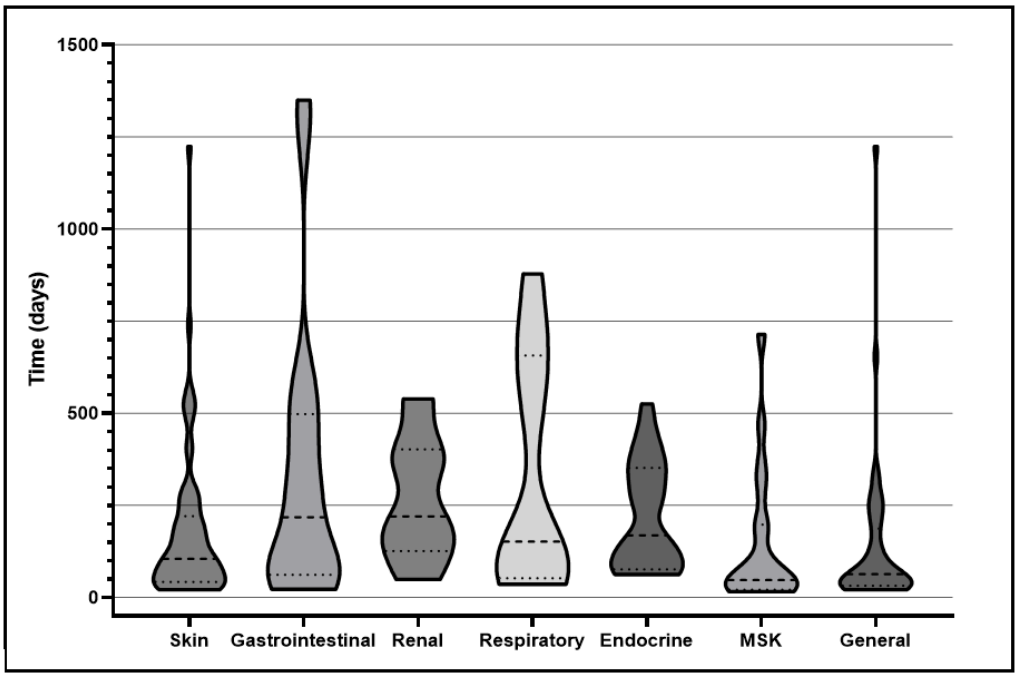
	All patients (n=131)
Sex	**Number (%)**
Male	92 (70.2%)
Female	39 (29.8%)
Age	
Median	69
<60	33 (25%)
>60	98 (75%)
Histology	
Cutaneous	97 (74.0%)
Mucosal	5 (3.8%)
Ocular	4 (3.1%)
Unknown	25 (19.1%)
Baseline autoimmune disease	15 (11.4%)
Polymyalgia rheumatica	2
Rheumatoid arthritis	2

Table 1 (continued): Baseline characteristics of patients with advanced melanoma treated with pembrolizumab in the Wellington region.

Sarcoidosis	3
Eczema	1
Asthma	2
Coeliac disease	1
Ulcerative colitis	1
Psoriasis	1
Hypo/hyperthyroidism	2
ECOG	
0	52 (40%)
1	33 (24%)
2	11 (8%)
3	9 (7%)
4	0 (0%)
Not recorded (NR)	26 (20%)
BRAF	
Positive	36 (27.5%)
Negative	88 (67.2%)
Not recorded (NR)	7 (5.3%)
Concurrent *BRAF* therapy	5 (3.81%)
Stage	
IIIC	18 (13.7%)
IV	113 (86.3%)
Post-pembrolizumab therapy	
BRAF	5 (4%)
Chemotherapy	9 (7%)
Other	1 (0.07%)
LDH	
<ULN (480/220)	68 (52%)
>ULN (480/220)	53 (40%)
Not recorded (NR)	15 (8%)

ECOG = Eastern Cooperative Oncology Group scale; LDH = lactate dehydrogenase; ULN = upper limit normal.

Figure 1: Violin plot representing time to toxicity in days for each organ system for patients treated in the Wellington Region.



Overall, 16.3% of toxicities were gastrointestinal, 11.3% endocrine, 9.5% musculoskeletal, 4.5% respiratory, 3.6% renal and 0.5% haematological. More information on the specific toxicity for each organ system is tabulated in Table 2.

Three (20%) of the 15 patients with a baseline autoimmune disease experienced a flare, with one flare of eczema managed with topical steroids, and one flare of polymyalgia and rheumatoid arthritis respectively, both treated with oral steroids.

Toxicity outcomes

Twenty-one (16.0%) patients were hospitalised for toxicity management. Colitis, pneumonitis and adrenal insufficiency were the most common grounds for hospitalisation. One patient had three separate admissions to hospital: two presentations for pneumonitis and one for arthritis. There was one hospitalisation for diabetic ketoacidosis due to pembrolizumab-related pancreatic insufficiency. Thirty-one (23.6%) patients had pembrolizumab stopped permanently due to the development of toxicity, 25 of which went on to have ongoing treatment response. There were 30 total referrals to other services for inpatient or outpatient review of toxicity management, of which 11 were to endocrine, five to renal and four to gastroenterology. More information on the grade of each toxicity, resolution and clinical consequence is tabulated in Table 2.

Toxicity management

Thirty-two (24.4%) patients required steroids to manage pembrolizumab-related toxicities. The mean days of steroid use per patient was 197 days (6.47 months) and the median was 120 days (4 months). Four patients with endocrine toxicities required an average of 683.2 days of steroid, mostly accounted for by the use of hydrocortisone for adrenal insufficiency. Only two patients required secondary immunosuppressants in addition to steroids. One case of pembrolizumab-related thrombocytopenia required intravenous immunoglobulin (IVIG) and rituximab. One case of new-onset arthritis required methotrexate and leflunomide for a combined total of 596 days. More information on the number of patients requiring steroids, mean days of steroid for organ-specific toxicity and use of additional immunosuppressants is listed in Table 3.

Waikato

Patient characteristics

One hundred and forty-two patients met inclusion criteria for analysis in the Waikato

Table 2: Grade of toxicity as per organ involvement, clinical consequence and documentation of resolution for patients treated in the Wellington Region.

	Grade 1/2	Grade 3/4	Grade 5	Hospitalisations	Treatment stopped	Referrals	Resolved	Not recorded if resolved
(n=221, % in brackets)								
Skin								
Rash	50 (22.6%)	2 (0.9%)	0	0	2	3	20	34
Vitiligo	13 (5.9%)	0	0	0	0	0	0	13
Pruritus	3 (1.4%)	0	0	0	0	0	0	3
Dry nails	1 (0.5%)	0	0	0	0	0	0	1
Xerostomia	2 (0.9%)	0	0	0	0	0	0	2
Gastrointestinal								
Hepatitis	6 (2.7%)	8 (3.6%)	0	3	3	4	11	3
Colitis/diarrhoea	15 (6.8%)	4 (1.8%)	0	4	3	0	14	5
Pancreatitis	0	0	1 (0.5%)	1	1	0	0	1
Nausea	1 (0.5%)	0	0	0	0	0	1	0
Mouth ulcers	1 (0.5%)	0	0	0	0	0	0	1
Renal								
Nephritis	2 (0.9%)	6 (2.7%)	0	1	6	5	7	1
Respiratory								
Pneumonitis	3 (1.4%)	5 (2.3%)	1 (0.5%)	4	5	3	6	3
Dry cough	1 (0.5%)	0	0	0	0	0	0	1

Table 2 (continued): Grade of toxicity as per organ involvement, clinical consequence and documentation of resolution for patients treated in the Wellington Region.

Endocrine								
Hypo/hyperthyroidism	14 (6.3%)	1 (0.5%)	0	0	0	4	13	2
Adrenal insufficiency	0	5 (2.3%)	0	4	1	4	2	3
Pancreatic insufficiency	1 (0.5%)	2 (0.9%)	0	1	1	1	1	2
Hypopituitarism	0	2 (0.9%)	0	0	0	2	0	2
Haematological								
Thrombocytopenia	0	1 (0.5%)	0	1	1	1	1	0
Musculoskeletal								
Arthritis	14 (6.3%)	3 (1.4%)	0	2	2	3	6	11
Polymyalgia rheumatica	0	2 (0.9%)	0	1	1	0	1	1
Rheumatoid arthritis	1 (0.5%)	0	0	0	0	0	1	0
Myalgias	1 (0.5%)	0	0	0	0	0	1	0
General								
Fatigue	42 (19.0%)	1 (0.5%)	0	1	5	0	7	36
Uveitis	3 (1.4%)	0	0	0	0	0	2	1
Sjögren's syndrome	0	1 (0.5%)	0	0	1	0	1	0
Dysgeusia	1 (0.5%)	0	0	0	0	0	0	1
Increased lacrimation	1 (0.5%)	0	0	0	0	0	0	1
Total	**176**	**43**	**2**	**23**	**31**	**30**	**95**	**128**

Table 3: Number of patients requiring steroids, mean days of steroid for organ-specific toxicity and use of additional immunosuppressants for patients treated in the Wellington region.

	Patients requiring steroid	Mean days of steroid per patient	Additional immunosuppressants
Skin	1	12	Nil
Gastrointestinal	9	97.7	Nil
Renal	4	121.5	Nil
Respiratory	6	139.3	Nil
Endocrine	4	683.2	Nil
Haematological	1	159	Rituximab, IVIG
Musculoskeletal	6	180	Methotrexate, leflunomide
General	1	120	Nil
Total	**32**	**197**	

IVIG = intravenous immunoglobulin.

Table 4: Baseline characteristics of patients with advanced melanoma treated with pembrolizumab in the Waikato Region.

	All patients (n=142)
Sex	**Number (%)**
Male	99 (69.7%)
Female	43 (30.3%)
Age	
Median	70
≤60	34 (23.9%)
>60	108 (76.1%)
Baseline autoimmune disease	6 (4.2%)
Psoriasis	2
Rheumatoid arthritis	1
Scleroderma	1
Vasculitic skin rash	1
Pernicious anaemia	1

Region. The median age at pembrolizumab commencement was 70 years, and 99 (69.7%) were male. Six (4.2%) patients had pre-existing autoimmune conditions prior to treatment. The median duration of follow-up was 582 days. Information on *BRAF* status and location of primary melanoma was not collected for the Waikato cohort. Further baseline characteristics are shown in Table 4.

Toxicity development

Thirty-three (23.2%) patients treated in the Waikato Region developed some form of toxicity related to pembrolizumab, with 35 individual toxicity episodes. A total of 48.5% of all toxicities were grade 1/2, while 51.5% of toxicities were grade 3/4. No patients in the Waikato Region developed grade 5 toxicity over this period. Of the 33 patients who developed pembrolizumab-related toxicity in the Waikato Region, 27 (81.2%) had treatment stopped as a result of the toxicity. The median time to treatment failure for those who developed toxicity was 156 days.

The most common toxicities seen in the Waikato cohort were gastrointestinal and endocrine toxicities, accounting for 28.6% each. Renal toxicity was the next most common, accounting for 14.3%, followed by dermatological at 11.4%. Respiratory toxicity accounted for 5.7%, cardiovascular 5.7%, musculoskeletal 2.9% and neurological 2.9%. Fatigue was not recorded as an immunotherapy-related toxicity in the Waikato cohort. One of the five patients with pre-existing autoimmune conditions experienced a flare of rheumatoid arthritis during treatment with pembrolizumab.

Toxicity outcomes

Twenty-nine (20.4%) patients in the Waikato Region had pembrolizumab stopped due to toxicity. Ten of these patients were subsequently rechallenged with pembrolizumab. Of the 142 patients, 14 (9.9%) were hospitalised for toxicity management. The most common reasons for hospital admission in the Waikato cohort were nephritis, colitis, hepatitis and pneumonitis. Fifteen outpatient referrals to subspecialties were generated as a result of the development of pembrolizumab-associated toxicity. Of these referrals, four were to dermatology and two were to endocrine, renal and respiratory clinics. Data on inpatient referrals and consults were not collected. Further detail on grade of toxicities and clinical consequences is shown in Table 5.

Overall

Across the two centres, 273 patients were included in the analysis. Overall, 116 (42.4%) patients experienced pembrolizumab-related toxicity. In total, there were 259 individual toxicity episodes, with 64 (23.4%) patients experiencing multiple toxicities. Seventy-five percent of all toxicities were grade 1/2, 24.8% were grade 3/4 and 0.8% were grade 5.

Dermatological toxicities, notably rash and vitiligo, were most frequent, accounting for 28.2% of all toxicities. Generalised toxicities accounted for 19.7% of all toxicities, with 43 cases of fatigue being the most common within this category, all recorded in the Wellington Region. Overall, 18.1% of toxicities were gastrointestinal, 13.5% endocrine, 8.5% musculoskeletal, 5.4% respiratory, 5.0% renal, 0.8% cardiac and 0.4% neurological and haematological. The rates and grades of toxicity per organ system are summarised in Table 6.

Fifty-eight (21.2%) patients had pembrolizumab stopped permanently due to the development of toxicity, 49 (84.5%) of who went on to have ongoing treatment response. Of the 273 patients, 35 (12.8%) patients were hospitalised for toxicity management. Colitis, nephritis, pneumonitis and adrenal insufficiency were the most common grounds for hospitalisation. There were 45 total referrals to other services for review of toxicity management, of which 13 were to endocrine, seven to renal and five to gastroenterology.

Discussion

Our retrospective analysis describes the incidence of toxicities among a cohort of 273 patients with advanced melanoma who received single agent pembrolizumab across two centres (Wellington and Waikato). To our knowledge, this is the first study to characterise the management and outcomes of ICI toxicities in a New Zealand setting.

The frequency of toxicities, their distribution across different organ systems and grades for the two centres combined were similar to those of other real-world analyses.[3–5,11] The majority (75%) of all toxicities were grade 1/2, 24.8% were grade 3/4 and only 0.8% resulted in death. Our toxicity rates were also similar to that of the KEYNOTE-006 clinical trial; however, we observed lower rates of diarrhoea/colitis (9.0% vs 18.4%), lower rates of grade 3 toxicities (16.1% vs 20.0%) and higher rates of rash (21.9% vs 16.6%) as notable differences.[12]

Table 5: Grade of toxicity as per organ involvement and clinical consequence for patients treated in the Waikato Region.

	Grade 1/2	Grade 3/4	Grade 5	Hospitalisation	Treatment stopped
(n=35, % in brackets)					
Dermatological					
Rash/dermatitis	3 (8.6%)	1 (2.9%)	0	1	4
Gastrointestinal					
Hepatitis	6 (17.1%)	0	0	2	6
Colitis/diarrhoea	0	4 (11.4%)	0	2	3
Renal					
Nephritis	0	5 (14.3%)	0	5	5
Respiratory					
Pneumonitis	0	2 (5.7%)	0	2	2
Endocrine					
Hypo/hyperthyroidism	4 (11.4%)	3 (8.6%)	0	0	5
Adrenal insufficiency	2 (5.7%)	0	0	0	1
Hypopituitarism	1 (2.9%)	0	0	0	0
Musculoskeletal					
Arthritis	1 (2.9%)	0	0	0	1
Cardiac					
Cardiomyopathy	0	2 (5.7%)	0	1	1
Neurological					
Encephalitis	0	1 (2.9%)	0	1	1
Total	**17**	**18**	**0**	**14**	**29**

Thirteen percent of patients required hospitalisation, a metric not documented in comparable studies, mostly for the management of colitis, nephritis, hepatitis, pneumonitis or the initiation of hydrocortisone for adrenal insufficiency. This, in conjunction with the 45 referrals to other services, reflects the broad manner in which toxicities may develop and is an impetus for clinicians to be aware of their onset across an array of organ systems. Most referrals were for refractory toxicities that required ongoing monitoring of a systemic steroid regime initiated by the oncology service. This is with the exception of toxicities such as adrenal insufficiency or hypopituitarism, in which referrals were promptly made to endocrinology for initiation of hormone replacement.

Table 6: Grade of toxicity as per organ involvement for both centres (Wellington and Waikato) combined.

	Grade 1/2	Grade 3/4	Grade 5
	(n=256, % in brackets)		
Dermatological			
Rash	53 (20.5%)	3 (1.2%)	0
Vitiligo	13 (5.0%)	0	0
Pruritus	3 (1.2%)	0	0
Dry nails	1 (0.4%)	0	0
Gastrointestinal			
Hepatitis	12 (4.6%)	8 (3.1%)	0
Colitis/diarrhoea	15 (5.8%)	8 (3.1%)	0
Pancreatitis	0	0	1 (0.4%)
Nausea	1 (0.4%)	0	0
Mouth ulcers	1 (0.4%)	0	0
Renal			
Nephritis	2 (0.8%)	11 (4.2%)	0
Respiratory			
Pneumonitis	3 (1.5%)	7 (3.1%)	1 (0.4%)
Dry cough	1 (0.4%)		
Endocrine			
Hypo/hyperthyroidism	18 (6.9%)	4 (1.5%)	0
Adrenal insufficiency	2 (0.8%)	5 (1.9%)	0
Pancreatic insufficiency	1 (0.4%)	2 (0.8%)	0
Hypopituitarism	1 (0.4%)	2 (0.8%)	0
Haematological			
Thrombocytopaenia	0	1 (0.4%)	0
Musculoskeletal			
Arthritis	15 (5.8%)	3 (1.2%)	0
Polymyalgia rheumatica	0	2 (0.8%)	0
Rheumatoid arthritis	1 (0.4%)	0	0
Myalgia	1 (0.4%)	0	0

Table 6 (continued): Grade of toxicity as per organ involvement for both centres (Wellington and Waikato) combined.

Cardiac			
Cardiomyopathy	0	2 (0.8%)	0
Neurological			
Encephalitis	0	1 (0.4%)	0
General			
Fatigue	42 (16.2%)	1 (0.4%)	0
Uveitis	3 (1.2%)	0	0
Sjögren's syndrome	0	1 (0.4%)	0
Dysgeusia	1 (0.4%)	0	0
Increased lacrimation	1 (0.4%)	0	0
Xerostomia	2 (0.8%)	0	0
Total	**193**	**61**	**2**

Only two referrals resulted in another service introducing an alternative immunosuppressant. Our rate of pembrolizumab cessation due to toxicity was comparable to other studies.[3,4]

While the overall frequency of toxicities and their distribution per organ system was similar to other studies, there were some notable differences seen between the rates of toxicities in the Wellington and Waikato cohorts, as the studies were conceived separately. The frequency of toxicity was higher for the Wellington cohort at 63.3% compared with 23.2%; however, this is largely driven by the recording of fatigue as a toxicity in Wellington but not in Waikato. Given a high number of patients having documented fatigue in the Wellington cohort, there was also a high proportion of general toxicities recorded for this group. In addition, the Wellington cohort had a higher percentage of patients experiencing rash at 23.5%, compared with only 11.4% in Waikato. Despite these differences, the occurrence of dermatological, gastrointestinal and endocrine toxicities was common across both groups and echoes commonly observed toxicities in the literature.[3–5,11]

Of the 131 patients treated in the Wellington Region, 24.4% of patients required steroids for toxicity management. This figure is comparable to other real-world analyses, in which 20.7–33.3% of patients were prescribed steroids.[3,4] However, the only other study that documented steroid duration found a mean number of days of 49.2.[4] Our mean days of steroid per patient was 197, likely due to the inclusion of hydrocortisone for adrenal insufficiency, in our attempt to reflect the long-term clinical sequelae of certain toxicities. Given the long duration of steroid use in patients with immune toxicities, it would be prudent for clinicians to consider the prevention of steroid-related side effects, such as *Pneumocystis jirovecii* pneumonia (PJP) prophylaxis, dual-energy X-ray absorptiometry (DEXA) scan for bone protection and adrenal insufficiency. There was also a limited exploration of steroid side effects in clinical notes, as only two of the 32 patients reported adverse effects: a fungal rash and peripheral oedema, respectively. Limited data on the management of toxicity were available for the Waikato cohort, and these patients were therefore excluded from this part of the analysis.

The involvement of toxicity in multiple organ sites highlights the need for the development of subspecialty expertise in the management of immune toxicities, e.g., gastroenterology, respiratory, endocrinology and neurology, as ICI use becomes more widespread in oncology with the broadening of treatment indications in different cancer types. Prospective data collection is also

needed to assess the management that is required for these cases in the New Zealand setting.

The management of toxicity is important to enable ongoing treatment with lower-grade toxicities. While grade 3 or higher toxicities may be reasonable grounds for cessation, an accumulation of lower-grade toxicities may not be a deterrent for ongoing therapy given the possible benefit, though it should be an impetus for aggressive management by the clinician. A starting point may be a higher use of systemic steroids or higher potency of topical steroids while staying attentive to the side effects of steroids themselves.

Limitations

The inherent limitations of a retrospective study relate to the dependence on historical documentation. This is particularly relevant to the documentation regarding the cessation of toxicity symptoms and the use of steroids, which was not captured by the Wellington Hospital pharmacy records. In addition, patients' baseline steroid use was not recorded.

The Wellington and Waikato datasets were initially conceived as different studies, and therefore the information collected differs somewhat. The results for each centre have been presented separately to address these differences; however, where overlap in the datasets was present, the datasets were combined. The most notable differences were in the recording of fatigue as an ICI-related toxicity in the Wellington cohort and in the rates of rash documented for the two centres as mentioned previously. In addition, the Waikato dataset did not contain information on the management of toxicity with steroids, so these patients were not included in any of the analyses looking at toxicity management.

Given the frequency with which patients receiving ICIs develop toxicity and the potential for this to require protracted treatment with steroids and ongoing follow-up of toxicities, further data collection is required. Data on the increased clinical demand within the oncology service were not collected for either the Wellington or Waikato datasets. Given the impact on both the oncology services and across the broader subspecialty teams, it is important to understand the increased clinical workload associated with ICI toxicity. Further data collection on a national scale will aid in the development of expertise in the management of immunotherapy-related toxicity in New Zealand.

Conclusion

Our retrospective study of 273 advanced melanoma patients demonstrated that pembrolizumab is generally well tolerated. However, a minority of toxicities can be long lasting and complex, requiring support from additional specialties. This highlights the importance of accurate toxicity quantification and effective management so as to minimise discontinuation of therapy and long-term sequelae.

COMPETING INTERESTS
FdR has received a Clinical Research Training Fellowship from the Health Research Council of New Zealand.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/pembrolizumab-related-toxicity-in-patients-with-advanced-melanoma

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Evaluating the safety and effectiveness of bariatric surgery performed by a trainee or fellow in a low-volume New Zealand centre

Preekesh S Patel, James Jin, Rowan French

ABSTRACT

BACKGROUND: Metabolic bariatric surgery (MBS) is an effective treatment for obesity and its related comorbidities.[1] Publicly funded MBS in New Zealand is regionally limited with variable case volumes, potentially limiting surgical training.[2] This retrospective study aims to evaluate if MBS safety and effectiveness are impacted by teaching within a low-volume unit.

METHODS: A retrospective outcomes analysis was carried out for all MBS cases of a single surgeon (public and private). Cases were compared based on primary operator status: consultant (COP) and trainee/fellow (TOF). Primary outcomes included multiple safety and effectiveness parameters including leaks, haemorrhage, 30-day morbidity and total weight loss (TWL).

RESULTS: Two-hundred and fifty patients satisfied inclusion criteria. Results are reported as COP and TOF. Primary operator: 87 (34.8%) and 163 (65.2%). There were no leaks, strictures or 30-day mortalities. Perioperative haemorrhage: 1 and 4. Thirty-day morbidity: 1 and 5. One-year TWL: 36.0% and 35.0%. Sleeve stenosis: 0 and 1. Thirty-day readmissions: 1 and 4. One-year readmissions: 4 and 9. Length of stay: 3 and 4 (p=<0.001).

CONCLUSION: MBS safety and effectiveness outcomes in low-volume practice performed by TOF were no different to COP within our study setting.

Obesity is a global health issue with an increasing prevalence demonstrated across New Zealand, and it poses a significant burden on publicly funded health resources.[1] In comparison with lifestyle measures and pharmacotherapy, metabolic bariatric surgery (MBS) is the most effective method for achieving and sustaining weight loss, with a variable degree of obesity-related comorbidity resolution.[2] MBS effectiveness and safety profiles vary based on the specific operative options. In Australasia, the most commonly performed primary MBS is sleeve gastrectomy (SG) followed by Roux-en-Y gastric bypass (RYGB) and one anastomosis gastric bypass (OAGB), with New Zealand having a lower SG rate compared with Australia (52% vs 65%).[3]

SG is often considered to be (perhaps controversially) the safest, simplest and easiest to teach MBS option. The General Surgery Surgical Education and Training (SET) programme in New Zealand over the last 10 years has been a 4–5-year training experience, with trainees allocated to various hospitals nationally. MBS exposure and teaching throughout training can thus be variable and limited for some trainees, as public funding and resource allocation to MBS varies by region.[4] On the surface, MBS practice in New Zealand is considered high volume based on 1,976 cases being performed in 2023 across the 18 units contributing to the bariatric surgery registry (BSR).[3] However, 97% of these were in the private sector (where New Zealand trainees achieve minimal exposure) and the BSR does not capture all bariatric practice within New Zealand.[3] Many of the seven New Zealand public units contributing to the BSR are low volume/provincial units. New Zealand bariatric surgical practice in comparison with Australia is considered low volume. Training surgeons to perform bariatric surgery in New Zealand requires educational experiences within predominantly low-volume units, defined as <50 cases per year.[5,6]

The aim of this study was to identify the local MBS primary operator rate of trainees and fellows within a low-volume bariatric centre and determine whether surgical safety and effectiveness are impacted based on operating surgeon seniority. We hypothesise that it is possible to teach safe and effective MBS within a low-volume unit.

Methods

Ethics

The Health and Disability Ethics Committee (Ministry of Health, New Zealand) provided an overall exemption for this study to undergo formal ethics committee review (OOS 20956).

Design

A comprehensive retrospective outcomes analysis using electronic records was carried out on prospectively collected data, based on the International Classification of Diseases 10th revision (ICD-10) coding and surgical logbooks. The setting was public and private hospitals in Hamilton, New Zealand. All MBS cases performed or supervised by a single surgeon between May 2011 and November 2018 were included. There were no exclusions. The cases were divided into two groups based on primary operator status: consultant (COP) or trainee/fellow (TOF).

Outcomes

The primary outcomes are divided into safety and effectiveness. Safety outcomes included the following events occurring within 30 days of surgery: staple line leak, anastomotic leak, mortality, morbidity and perioperative haemorrhage. The effectiveness outcome was measured as mean percentage total weight loss (TWL) calculated from baseline to 1 year postoperative and defined as effective if >25%. Secondary outcomes included: median total length of stay (LOS), sleeve stenosis within 6 months, gastrojejunal anastomotic (GJ) stricture within 6 months and 30-day and 1-year readmission. This information was collected from physical and electronic records at both the contributing public hospital and private surgeon rooms.

Definitions

Primary operator was defined as having performed ≥50% of the operation including all gastric stapling (based on the operative notes). COP was defined as the single surgeon that performed or oversaw all the cases. TOF is defined as either a senior registrar (SET trainee, in years 1–5 of training) or an unaccredited surgical fellow (not part of a formalised post-fellowship training programme). Primary operator status for public cases was TOF by default, with the final decision based on case complexity (e.g., comorbidity profile, body shape), list scheduling and COP discretion. Private cases were performed by COP alone (no TOF observing or assisting). All public COP cases had a TOF present. For TOF cases, the consultant was scrubbed for the entire case, actively assisted and provided guidance. Staple line leak, anastomotic leak and perioperative haemorrhage diagnosis was based on clinical, radiological and surgical diagnosis made by COP. Leak diagnosis criteria were signs of sepsis, contrast leak on computed tomography (CT) and operative confirmation. Postoperative haemorrhage diagnosis criteria were signs of haemorrhagic shock, haemoglobin drop of >20mmol/L and CT or surgically proven haemorrhage. Sleeve stenosis and GJ stricture diagnoses were based on gastroscopic confirmation and expert opinion from the endoscopist. Body mass index (BMI) was calculated by dividing the weight in kilograms by the square of the height in metres. TWL at 1 year was calculated by dividing the difference between baseline weight and weight at 1 year by the baseline weight. The total follow-up period for each patient was 1 year, including postoperative face-to-face appointments at 6 weeks, 3 months, 6 months, 9 months and 1 year. Weight was measured on calibrated clinic scales and height measured manually by nursing staff.

Statistical analysis

Data analysis was undertaken utilising R Statistical Software (v4.1.2; R Core Team 2021). Descriptive criteria of frequency and percentage values were employed. Normality tests for continuous variables were conducted using the Shapiro–Wilk test. Normally distributed data were displayed as mean and standard deviation, while skewed distributions were presented as median and interquartile range (IQR). Student's *t*-Test was employed to test normally distributed variables, while the non-normally distributed variables were tested using Wilcoxon Rank-Sum. Chi-squared test was utilised to analyse categorical data. A significance level of $P<0.05$ was observed as statistically significant. Absence of statistically significant differences between the two groups denotes that primary operator status is unlikely to impact on MBS safety and effectiveness and supports the ability of teaching MBS in a low-volume unit.

Results

Baseline characteristics, surgeon seniority and primary operator rates

These findings are summarised in Table 1–3. Two hundred and fifty patients satisfied inclusion

Table 1: Baseline characteristics.

	COP (n=87)	TOF (n=163)	p-value
Mean age (years) ± SD [range]	45.2±10.7 [15–67]	44.0±9.14 [21–65]	0.382
Gender—female (%)	66.0 (75.9)	123 (75.5)	1.00
Gender—male (%)	21.0 (24.1)	40.0 (24.5)	1.00
Median weight (kg) [IQR]	131 [34.7]	137 [41.7]	0.032*
Median BMI [IQR]	45.8 [12.0]	49.9 [11.1]	<0.002*

COP = consultant primary operator; TOF = trainee/fellow primary operator; SD = standard deviation; kg = kilograms; IQR = inter-quartile range, BMI = body mass index.
* Statistically significant difference.

Table 2: Surgeon seniority.

	Total (n=250)
COP	
Consultant (%)	88 (35.2)
TOF	
1st Year fellow (%)	88 (35.2)
SET 5 trainee (%)	45 (18.0)
SET 4 trainee (%)	22 (8.8)
SET 3 or below trainee (%)	7 (2.8)

COP = consultant primary operator; TOF = trainee/fellow primary operator; SET = surgical education and training.

Table 3: Operative details.

	Total (n=250)	COP (n=87)	TOF (n=163)
Sector performed			
Public (%)	196 (78.4)	33 (37.9)	163 (100)
Private (%)	54 (21.6)	54 (62.1)	0 (0)
Operative type			
SG (%)	226 (90.4)	84 (96.6)	142 (87.1)
OAGB (%)	24 (9.60)	3 (3.45)	21 (12.9)

COP = consultant primary operator; TOF = trainee/fellow primary operator; SG = sleeve gastrectomy; OAGB = one anastomosis gastric bypass.

Table 4: Primary and secondary outcomes.

	COP (n=87)	TOF (n=163)	p-value
Primary safety outcomes			
Staple line leak	0	0	1.00
Anastomotic leak	0	0	1.00
30-day mortality	0	0	1.00
30-day morbidity (%)	1 (1.15)	5 (3.07)	0.610
Perioperative haemorrhage (%)	1 (1.15)	4 (2.45)	0.820
Primary effectiveness outcomes			
1-year mean % TWL [SD] overall	36.0 [7.99]	35.0 [8.50]	0.435
Secondary outcomes			
Median LOS (days) [IQR]	3 [0]	4 [1.00]	<0.001*
Sleeve stenosis (%, n=226) †	0 (0)	1 (0.704)	1.00
GJ stricture (n=24) ‡	0	0	1.00
Readmission within 30 days (%)	1 (1.15)	4 (2.45)	0.820
Readmission within 1 year (%)	4 (4.60)	9 (5.52)	0.989

COP = consultant primary operator; TOF = trainee/fellow primary operator; TWL = total weight loss; SD = standard deviation; LOS = length of stay; IQR = interquartile range; GJ = gastrojejunal anastomotic.
† Sleeve stenosis can only occur in sleeve gastrectomy patients, n=226.
‡ GJ stricture can only occur in one anastomosis gastric bypass patients, n=24.
* Statistically significant difference.

criteria over the 7½-year recruitment period. There were no exclusions. The overall cohort was predominantly female. The majority of TOF were fellows (54.3%). The majority of cases were performed by TOF and in the public sector. TOF was five times more likely to be the primary operator for public sector cases. All private sector cases were performed by COP. Approximately 10% of cases were OAGB as the study period occurred during a time when OAGB was being adopted within the unit. Baseline weight and BMI were higher for TOF (p=0.032 and <0.002 respectively). All other baseline characteristics were similar between the two groups.

Primary outcomes

Follow-up completion for safety-related primary outcomes was 100%. Follow-up completion for effectiveness-related primary outcomes was 66.7% for COP and 78.5% for TOF. All primary outcomes are summarised in Table 4**.** There were no staple line leaks, anastomotic leaks or 30-day mortalities. There were no statistically significant differences in any primary outcomes for safety or effectiveness.

There were five perioperative haemorrhages. The one COP case was a sleeve staple line and splenic bleed requiring a relook laparotomy with packing, formation of laparostomy and a post-operative day 1 return to theatre for pack removal and placement of haemostatic adjuncts, drains and a nasojejunal feeding tube. Of the four TOF cases, two were small bowel mesenteric injuries from optical port entry requiring conversion to open, one was a staple line bleed requiring same-day return to theatre and one was a small

subcapsular splenic haematoma presenting 10 days postoperatively with pain and managed nonoperatively.

There were six 30-day morbidities, including all five perioperative haemorrhages. The sixth morbidity occurred in the TOF group. There was an umbilical hernia noted during OAGB. It was not repaired at the index surgery and became complicated with strangulation during the index admission. This was definitively managed with a laparotomy and small bowel resection.

Secondary outcomes

Follow-up completion for secondary outcomes was 100%. All secondary outcomes are summarised in Table 3. There were no GJ strictures. Median LOS was significantly higher for the TOF group (p=<0.001) with an absolute difference of 1 day. There were no other statistically significant differences in secondary outcomes. There were five 30-day readmissions. The one COP case was related to dehydration and syncope. The four TOF cases related to pain, dehydration, conservatively managed adhesional small bowel obstruction and the aforementioned delayed presentation of subcapsular splenic haematoma.

There were 13 1-year readmissions. The COP cases related to dehydration and poor intake. The TOF cases related to dehydration, poor intake, reflux, constipation and a single case of elective resection of small bowel lesion (identified during SG, histology confirmed pancreatic ectopia).

Discussion

The results demonstrate no statistically significant differences in all safety and effectiveness primary outcomes based on primary operator status for MBS within the study period. The overall complication rate for both COP and TOF was 2.00%. This is comparable to published complication rates for MBS.[7,8] TOF performed 21 MBS cases per year on average during the study period. The findings from this study are important given they demonstrate that it may be possible for MBS to be taught within low-volume practices without compromising safety and effectiveness.

Baseline weight and BMI were significantly higher in the TOF group (6kg and 4.1 respectively). This was unlikely to have clinical consequence and is reflective of private case selection favouring a relatively healthier patient cohort.[3] The study patients were similar to the BSR cohort in terms of age and gender (female predominance), reflective of the patients that seek referrals and undergo MBS both within Australasia and internationally.[3,9]

LOS was significantly shorter for COP (by 1 day) but was confounded by standardised private hospital practices facilitating earlier discharge with rapid senior decision making (daily specialist ward rounds) and higher-risk patients in public. There was a 12% diabetes rate and 70% class III obesity rate in private New Zealand BSR patients in 2023 (compared with 71% and 80% respectively in the equivalent public cohort).[3] Inclusion of the private patients provided a comparative group and a better reflection of real-world practice (part public/part private MBS). Private assisting is a valuable learning tool but access to this is variable throughout New Zealand, and TOF did not attend any private cases within our study due to public commitments. TOF employment is full-time public, limiting their ability to capitalise on the private assisting learning opportunities. Private practice in New Zealand differs to Australia given it is completely independent of public practice (different hospitals and theatre teams).

In our study there were no staple line leaks, anastomotic leaks or 30-day mortality. Complications are generally rare events—based on a large-scale registry study of 77,596 patients, the overall leak rate was reported as 0.6%.[10] In order to conduct an equivalence study, assuming a leak rate of 1% and setting the equivalence limit of 1%, 3,394 patients would be needed for the study, powered at 80%, p=0.05. This study would not be practical based in our region. Multi-centred registry studies over several years could further assess these safety outcomes.

We defined effectiveness as 1-year TWL of >25% and concluded there was no significant difference based on primary operator status. The decision to choose TWL >25% was based on consensus within the literature.[11] TWL was measured over 1 year, given that by this stage weight loss is often stable and substantial.[11,12] We acknowledge 1-year TWL is a crude measure of MBS effectiveness but note that our results of 35% for TOF and 36% for COP were in keeping with BSR outcomes of 36% for OAGB and 31.8% for SG.[3] Effectiveness may have been impacted by COP involvement but the authors believe this is representative of real-world surgical educational practices. Long-term effectiveness is also impacted by many non-surgical/non-anatomical factors such as dysregulated eating behaviours, socio-economics, mental health disorders and inadequate physical activity.[13]

The volume/outcome relationship in surgery is

well established across a range of surgical specialties, with higher institutional operative volumes associated with better outcomes.[7] MBS low-volume practice is fewer than 50 procedures per year, per institution.[5,6] This definition is important to allow comparison between units, but is limited given the number of bariatric surgeons per unit (which is not clearly described in the literature) and MBS type is not considered. Therefore, volume classification could over-estimate unit and surgeon practice. Our public unit practice was low volume at 26 MBS per year within the study period (with 21 per year performed by TOF). The public unit complication rate was 3.06%, which is comparable to the published literature.[7] As our results do not conform to the volume/outcome relationship, there are likely other contributing factors, such as high degree of COP oversight, active assistance and guidance, as well as a higher level of TOF experience (with >50% of the TOF group being a fellow).

The primary operator rate for TOF (all in public) was 83.2%, representing a good opportunity for TOF to gain supervised MBS exposure, which could improve TOF operative confidence and promote MBS practice long term. It is acknowledged that operative time can be used to assess training comparatively.[14] It was not evaluated in this study as it was deemed a measure of efficiency rather that effectiveness, expected to be quicker in private cases (introducing bias) and longer in TOF/teaching cases. Practically, this could lead to reduced total MBS case volume, cost effectiveness and financial burden, which is compounded by the TOF prolonged LOS.[5] A balanced approach is required between teaching and case provision, which could include dedicated training lists, defining which components of the operation will be performed by which member of the team based on time, skill and competency-based teaching.

Reasons for limited MBS exposure by hospitals include no local bariatric service, limited public funding and busier alternative caseloads (e.g., oncological resection). Low case volume may lead to bariatric surgeons retaining primary operator status, fewer teaching opportunities for TOF and potential reduced interest in future bariatric subspecialisation. Despite this, an unexpected observation was the OAGB primary operator rate of 87.5% for TOF. They were all fellows with advanced laparoscopic skills, prior bariatric trainee experience and a strong desire to perform MBS long term. There were no anastomotic/staple line leaks, perioperative haemorrhages or stomal stenoses. This is likely attributed to the unit being strongly teaching focussed, and thus the single surgeon being comfortable teaching despite limited case volume. The low OAGB operative numbers with high TOF primary operator status included are a testament to being able to teach MBS within a low-volume context.

Within New Zealand general surgery training, SET registrar rotations are 6 months long. It is reasonable to expect to learn about perioperative management for MBS patients and gain exposure to MBS. Upper gastrointestinal (UGI)/bariatric fellow rotations are generally 1-year placements and may be the only subspecialty training for bariatric surgeons. The Australian and Aotearoa New Zealand Gastric and Oesophageal Surgery Association supports UGI oncological resectional work to be carried out by an appropriately trained surgeon if the following criteria are satisfied: achieved Fellowship of the Royal Australasian College of Surgeons, completed at least 1 year of dedicated UGI fellowship training and has satisfactory supervisor reports and a logbook demonstrating adequate case load and mix.[15] Similar credentialling may be suitable for MBS practice too.

For SG, the specific operative steps that require teaching include greater curve gastric mobilisation and gastric stapling ensuring avoidance of narrowing the pylorus, incisura and gastroesophageal junction. The learning curve for SG is 50–100 cases but the operation can be performed safely even in the early stages of the learning curve.[16,17] For OAGB, the specific operative steps that require specialised teaching include formation of the gastric pouch, gastrojejunostomy and jejunojejunostomy. The learning curve for this procedure is 100 cases.[18] Progression along the bariatric learning curve is likely dependent on pre-existing operative skills, case exposure during training/early years of practice and proctorship.[16–18] Teaching in our study was beneficial to improving TOF skillsets and providing MBS experience under the direct supervision of a specialist bariatric surgeon. This enhances the experience gained from future fellowships/practice. MBS teaching can be augmented with other educational modalities such as coaching, internet modules and training courses.[19]

An intermediate-volume MBS unit (70 cases per year) demonstrated that MBS teaching does not significantly impact surgical safety or effectiveness.[20] Our unit's 26 cases per year demonstrate the same outcome may be possible

in low-volume practice. There are a number of reasons why our safety outcomes in a low-volume practice were favourable. Ninety percent of the MBS performed were SG, which has a favourable complication profile compared with OAGB.[21] The single surgeon either performed or oversaw every operation, ensuring all MBS were performed with a standardised technique. This optimised intraoperative decision making and operative flow, allowing particular attention to be paid to certain key points (e.g., stapling near the incisura and gastroesophageal junction carefully to prevent stenosis). Stapling was deliberately performed slowly to allow maximal tissue compression and with manual devices. Tisseel fibrin sealant was applied to all staple lines to reduce the risk of haemorrhage and staple line leak, as has been demonstrated in the literature.[22,23] TOF experienced two optical port–related mesenteric injuries in comparison with none for COP. Safe optical port entry into the peritoneal cavity is a key skill to be acquired to improve safety outcomes. This technique should be highlighted during case teaching. The between-group difference in 30-day morbidity data largely reflects these mesenteric port injuries as well.

There were some limitations associated with our study. The 1-year TWL follow-up was approximately 70.0%. Longer and more complete follow-up would provide more meaningful results regarding safety and effectiveness (e.g., weight regain and nutritional sequelae). It is possible that follow-up data were impacted by patients' relocation out of district and/or presenting to other hospitals/private rooms that were not included within the study. Selection bias exists as private MBS patients were likely to be lower risk and public COP patients were likely more technically challenging.[3] The definition of primary operator carries a degree of subjectivity given anywhere from 51 to 100% of the operation was carried out by TOF in a TOF-led case. The findings reflect real-world practice regarding surgical training as SET trainees' and fellows' experience level and MBS exposure are both variable.

The findings of this study promote MBS teaching in a supervised, low-volume environment, which could foster interest in the MBS field. This is important given obesity is a growing problem. The results are less applicable to MBS surgeons in high-volume units and those that practice only in the private sector, as in these settings there are other contributors to optimal outcomes for MBS safety and effectiveness, such as having a regular surgical team, bariatric-specialised anaesthetists and skilled/experienced assistants.

Conclusions

This study retrospectively compared MBS safety and effectiveness rates in our region based on primary operator status. Although we cannot make a clearly generalisable conclusion of safety and effectiveness based on the limited numbers in our study, in our setting based on 7 years of observational data we found no differences in safety and effectiveness outcomes. Future studies should take a prospective, multi-centre and multi-surgeon approach. They should include RYGB, operative duration and cost effectiveness to provide a more comprehensive evaluation of factors affecting surgical teaching.

COMPETING INTERESTS
RF is the former President of NZAGS.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/evaluating-the-safety-and-effectiveness-of-bariatric-surgery-performed-by-a-trainee-or-fellow-in-a-low-volume-new-zealand-centre

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Clustering of community-acquired pneumonia in hospitalised adults in the Christchurch Region: association with socio-economic deprivation

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ABSTRACT

AIM: Community-acquired pneumonia (CAP) is inequitably experienced in populations globally, with multiple social and environmental factors contributing to the risk of CAP; thus, predicting communities at increased risk is difficult. The aims of this study were to determine the geographical distribution of adults with CAP requiring hospitalisation in Christchurch, and to examine the associations between CAP and socio-economic and area deprivation.

METHODS: A retrospective clinical records review was conducted of all adult patients hospitalised with CAP at Christchurch Hospital over a 12-month period. Geocoding residential addresses allowed for geospatial hotspot analysis using the Getis-Ord Gi* method. Comparison of the relative rates of CAP in different socio-economic deprivation deciles was assessed using New Zealand census data and the Index of Multiple Deprivation (IMD).

RESULTS: The dataset comprised 924 hospitalisations. CAP hotspots were located in the northeast and southwest of the city. CAP was not equally distributed across the deprivation quantiles ($p < 0.001$); compared with the least deprived quintile, quintiles four and five had rate ratios (95% confidence interval [CI]) of 1.5 (1.3 to 1.8) and 1.6 (1.3 to 2.0), respectively. Patients with CAP who identified as Māori or Pacific peoples were significantly younger, and a higher proportion were resident in areas of highest socio-economic deprivation relative to patients who identified as NZ European.

CONCLUSION: This study identified hotspots within Christchurch with higher rates of CAP requiring hospitalisation and has contributed further New Zealand-based evidence on the influence of socio-economic disparities on health inequity.

Community-acquired pneumonia (CAP) is a serious complication of lower respiratory tract infection that is widespread across populations.[1] Demographic and socio-economic factors and comorbidities are associated with high rates of CAP, and with subsequent morbidity and mortality. Socio-economic factors identified include advanced age, infancy, smoking and poor housing conditions.[2,3] In New Zealand pneumonia and influenza, combined, were responsible for 869 deaths in 2017, and 73% of deaths coded as pneumonia were people over 85 years of age, with only 3% under 60 years.[4] Importantly, Māori were three times more likely than non-Māori to be hospitalised for CAP, and Māori men aged 50–64 were six times as likely to die.[5,6]

The relationship between health and geospatial location is recognised through the epidemiological approach of spatial mapping. Although complex relationships exist, spatial techniques, particularly disease clustering, have been used to study CAP in countries such as the United States of America (USA) and Brazil.[7,8] Clusters generally coincide with areas of high socio-economic deprivation, ethnic diversity and poor air quality. The relationship between socio-economic factors and CAP incidence has also been examined internationally using various composite indices of area deprivation. The rates of both incidence and hospitalisation of people with CAP have been shown to increase with area deprivation for both adults and children in the United Kingdom (UK), USA and Australia.[9–11] In New Zealand, there was a 2.8-fold rate ratio for CAP hospitalisation for the most deprived quintile compared with the least,[12] and hospitalisations of children with pneumonia were twice as high in the most deprived quintile when compared with the least deprived.[13]

Inequitable health outcomes driven by disparities in social determinants of health are a persisting issue in New Zealand and improving the health system to address these is a priority. In

the current study we investigated the geographic distribution of Christchurch residents who required hospitalisation for CAP over a 12-month period and whether people living in areas of high socio-economic deprivation had a higher rate of CAP hospitalisation relative to those living in less deprived areas. Adult patients were investigated due to differences in the epidemiology of CAP in the paediatric age group. We used geospatial data from records of patients hospitalised with CAP to perform cluster analysis to identify geographic hotspots of CAP within the city, and to test for a relationship between socio-economic deprivation and hospitalisation using the Index of Multiple Deprivation (IMD).

Methods

Study population

A retrospective review of clinical records of all patients hospitalised with CAP at Christchurch Hospital was conducted. A case was defined as a person with a primary diagnosis of CAP recorded in the discharge notes by the clinical team responsible for their inpatient care. The inclusion criteria were patients aged 18 years and over on date of admission, resident within Christchurch City boundaries[14] and admitted between 1 July 2017 and 30 June 2018. Patients were excluded if they had a previous hospital admission in the 2 weeks prior to exclude possible hospital-acquired pneumonia. Christchurch City has approximately 369,000 residents in a geographical area of 1,415 km^2 (in 2021). It is the only hospital offering acute secondary and tertiary services in the city. The study was approved by the University of Otago Human Research Ethics Committee (HD17/056).

Data collection

Demographic data including age in years, gender, ethnicity and address of kin (as a proxy for social support), comorbidities and smoking status were entered onto a case report form. Ethnicity was self-identified and used the same definitions as the New Zealand Census. Sub-group analyses were carried out on those who identified as Māori and Pacific peoples. Relevant radiographic and laboratory data were taken from electronic report forms. In-hospital mortality data and discharge destination were collected as proxies for severity. Patients' residential address and dwelling were converted at source into 2013 meshblock numbers, the smallest geographical unit used by Stats NZ.[14] Stats NZ data files were used to add area unit codes and names to the collected data, and datazones and IMD deciles were also added.[15] All datasets containing national health indexes (NHIs) were held on password-protected computers. The data were anonymised at source with the assignment of a unique research identifier and the codes were held separately to ensure confidentiality.

Data analysis

The number of people hospitalised with CAP in each area unit was calculated, area units being amalgamations of meshblocks that are a similar size to suburbs. The null hypothesis was that these values would be distributed randomly across the city. The alternative hypothesis was that there would be clustering (areas with many people with CAP that are next to each other, and areas with few people with CAP that are next to each other). The area unit age-group population estimates were downloaded from Stats NZ[14] for rate calculations. These results were all merged with area unit shapefiles from Stats NZ to allow for spatial analysis with open source software GeoDa.[16,17]

CAP rates by deprivation level

Each patient diagnosed with CAP was associated with a datazone (amalgamations of approximately eight meshblocks and comprising an average population of 712 residents) and the corresponding IMD deciles comprising overall IMD, and single domains: employment, income, crime, housing, health, education and access to services (see Appendix for definitions of each IMD domain).[15] The number of patients in each decile could then be counted (for total IMD, and also for each subfactor). The three patients aged under 20 years were excluded, as numbers needed to be presented in the context of available population age groupings. Each datazone had an associated usual resident population count (i.e., Census 2013 data). To calculate those 20 years and above, Microsoft Excel was used to find the meshblocks contained in each datazone and subtract their usual resident populations of under 15 years and 15–19 years from the datazone total population. Chi-squared goodness of fit was calculated for each of the total IMD and the seven individual components using the open source statistics program JASP.[18] Expected frequencies were calculated by summing the population of each decile of the component being investigated, dividing by the total population and multiplying by the number of people with CAP. A p-value of <0.05 was considered significant. After Chi-squared test

revealed that the distribution of people with CAP was not proportional to the population, rates and rate ratios were calculated. Population data are as above. For this analysis, deciles were compressed into quintiles, and each quintile was compared individually with the least deprived quintile.

Spatial analysis

Hotspot analysis was performed using the Getis-Ord Gi* statistic with GeoDa software.[16,17] The Gi* technique locates hotspots and coldspots, and indicates whether these are statistically significant. A Gi* statistic was generated for each area unit by comparing the values for each area unit and its neighbours to the mean value of the dataset.[16] Areas were considered neighbours if their borders shared even a single point.[17] The number of neighbours ranged from 1 to 10, with the median being 6, and the majority (77%) having between 4 and 8 neighbours. A contiguity method was selected for defining weights as opposed to a distance method, as the areas varied greatly in size. GeoDa's default setting of 999 permutations was used to generate the reference distribution for each area unit. Significance was set at $p<0.05$. The Gi* analysis was performed for the total number of people with CAP, number of people with CAP aged 20–64, number of people with CAP aged 65+ and people with CAP excluding residents of aged residential care facilities, as well as rates for each of these. Since aged residential care facilities group large numbers of people who are more vulnerable to CAP together in the same area, aged residential care residents were excluded in several of the analyses to assess their effect on the dataset.

Results

Study population

A flow chart of the inclusion process is shown in Figure 1. Of 2,066 CAP patients admitted, 1,194 were excluded due to *a priori* criteria, and one was excluded due to missing demographic data. Of the 871 patients included, 43 had two admissions each, six had three and one had four. Study numbers were allocated to each admission (n=929); however, two patients were not included for unrecorded reasons, resulting in a study population of 927. The three patients <20 years were excluded

Figure 1: Inclusion and exclusion of study population.

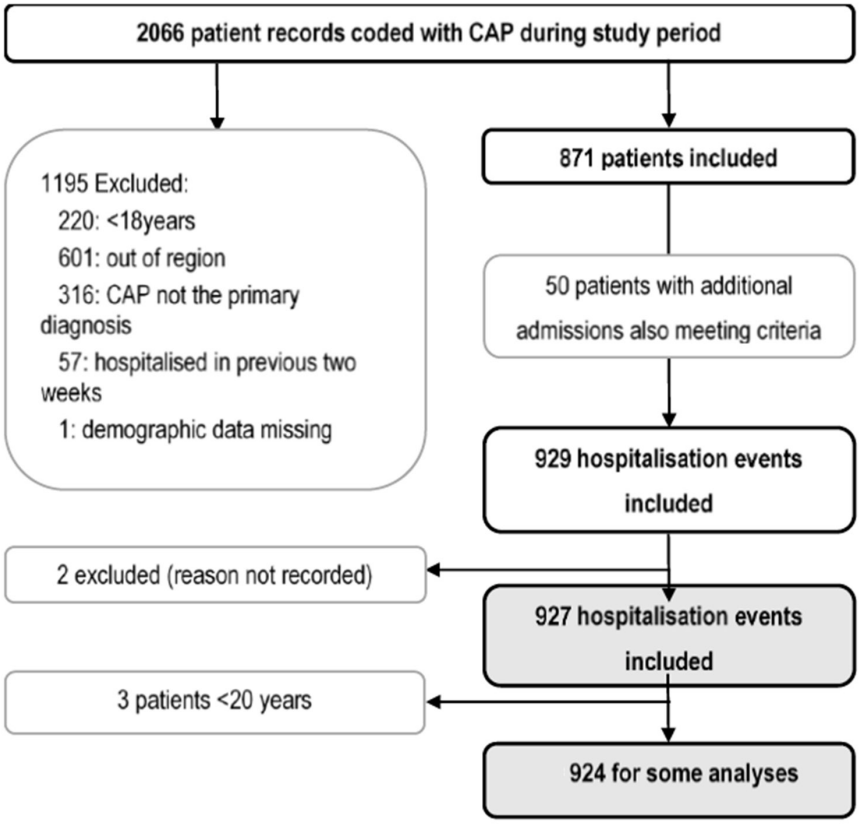


Table 1: Demographics of patients admitted for community-acquired pneumonia. Six percent of the study population had multiple admissions.

Characteristic	N/927 (%)
Age (years)	
<35	60 (7)
35–49	67 (7)
50–64	158 (17)
65–79	318 (34)
80+	324 (35)
Sex	
Male	482 (52)
Female	445 (48)
Ethnicity[a]	
NZ European	750 (81)
NZ Māori	87 (9)
Pacific peoples	47 (5)
Asian	28 (3)
Other	227 (25)
Dwelling type (at admission)	
House	529 (57)
Flat/unit	221 (24)
Aged residential care	173 (19)
Other	4 (0.4)
Social support (house and flat/unit only)	
Next of kin at same address	499 (54)
Negative/unknown	251 (27)
IMD quintiles	
1–2 (least deprived)	202 (22)
3–4	175 (19)
5–6	166 (18)
7–8	252 (27)
9–10 (most deprived)	132 (14)

Table 1 (continued): Demographics of patients admitted for community-acquired pneumonia. Six percent of the study population had multiple admissions.

Smoking status	
Current smoker	129/801 (15)
Ex-smoker	137/891 (15)
Never smoked	621/891 (70)

[a]Where more than one ethnicity was indicated, all were included.
IMD = Index of Multiple Deprivation.

Figure 2: CAP rates per 1,000 residents aged 20 and above in each area of Christchurch City. All areas in cropped Banks Peninsula Region have rates <5. Map produced using GeoDa software.[17]

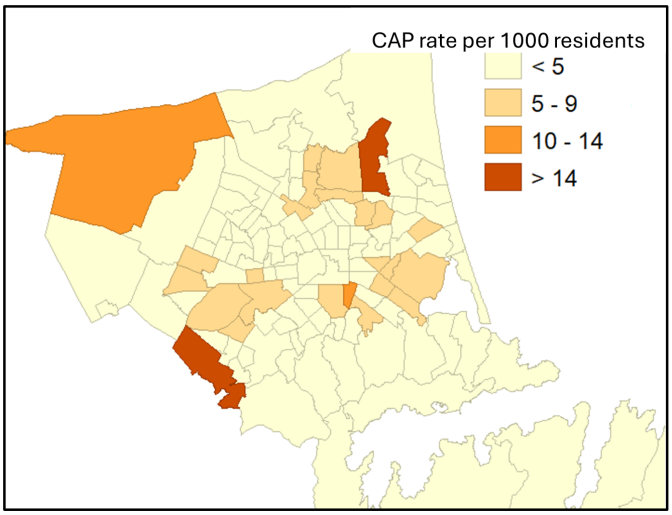


Figure 3: Spatial analysis of CAP rates in Christchurch City showing hotspots (red) and coldspots (blue). The bright red areas are the statistically significant hotspot cores. The rates of CAP in these areas and their neighbours (light red) are greater than the mean rates for the dataset. The bright blue areas are the coldspot cores; light blue areas are their neighbours with below-average rates of CAP. GeoDa was used for this Gi* analysis.[17]

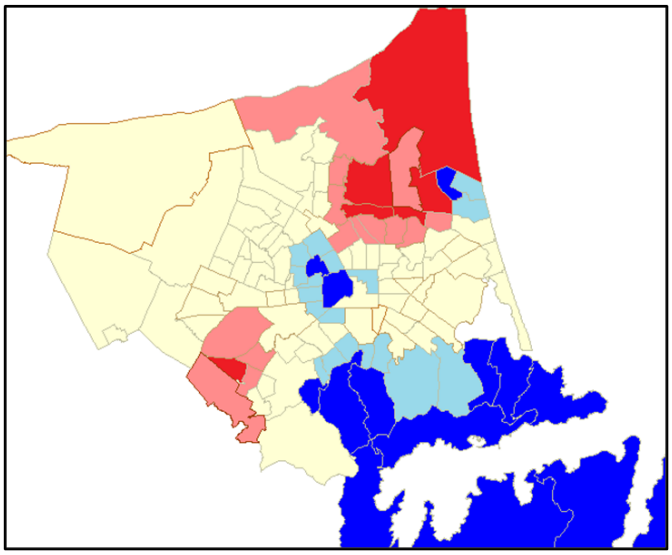


Figure 4: Spatial analysis of CAP rates for the 20–64 (left panel) and 65+ age groups (right panel). Statistically significant hotspot cores (bright red) were identified with Gi* analysis. Their neighbours with above average rates of CAP are light red. GeoDa was used for this analysis.[17]

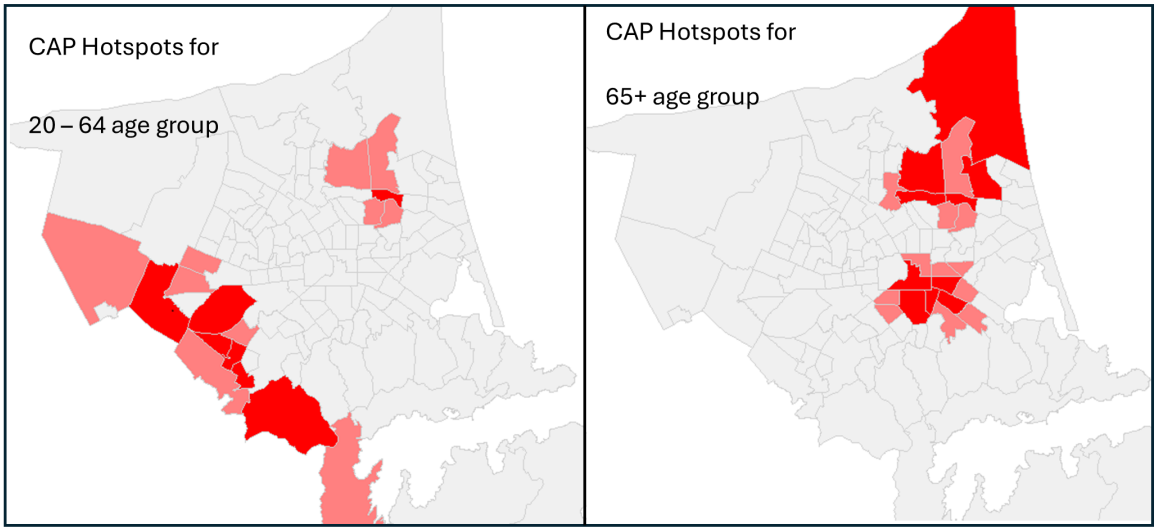
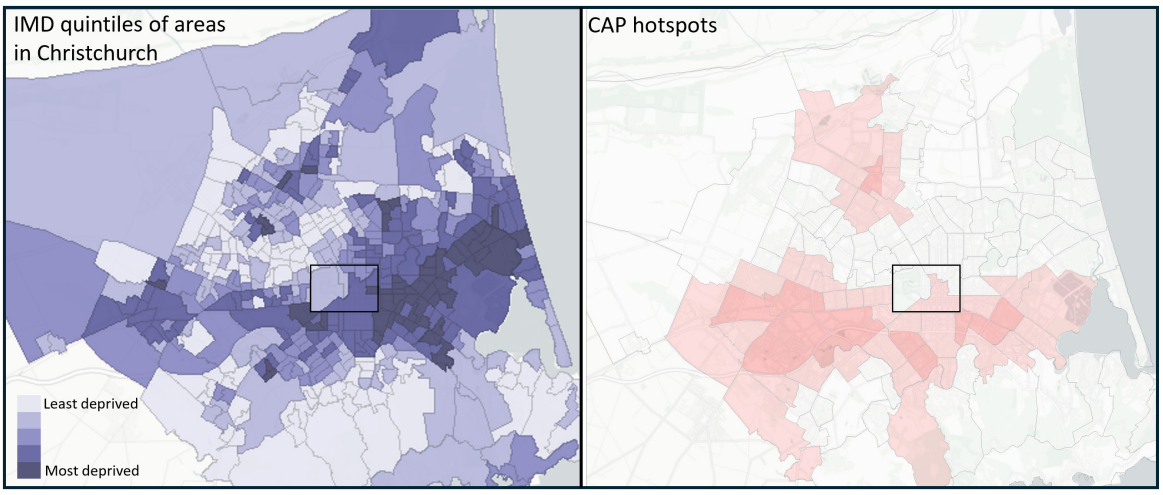


Figure 5: Deprivation quintiles and CAP prevalence clusters in Christchurch City. Left panel is Index of Multiple Deprivation (IMD) quintiles,[15] with darkest purple representing the most deprived quintile, and lightest purple the least deprived quintile. Banks Peninsula area (not pictured) is all in the two least deprived quintiles. Quintiles were based on all-of-New Zealand data. Right panel shows statistically significant Gi* CAP hotspots (darker red) and adjacent suburbs (lighter red). The CBD is indicated with a blank rectangle as a reference point.



from analyses involving calculation of CAP rates as the population data from Stats NZ was available in 5-year age groups.

Demographic data are presented in Table 1. The patients had a mean (standard deviation [SD]) age of 70 (18) years, with the youngest being 18 and the eldest 99. The population was strongly skewed to older age; 50% of the cohort were at least 74 years old. There were slightly more men than women (52% vs 48%). NZ European, NZ Māori and Pacific peoples ethnicity proportions (81%, 9% and 5%) were similar to the Christchurch City population in 2018.[14] The full range of the deprivation index was represented (Table 1). Twenty-two percent came from the least deprived areas (Index 1 or 2), and 14% came from the most deprived areas (Index 9 or 10). The majority (81%) of patients lived in private dwellings and 19% lived in aged residential care facilities. Of those living in private dwellings, 67% had next of kin at the same address (54% of study population).

Most patients (76%) had at least one major

comorbidity, with 17% having at least three. The most common comorbidities were chronic cardiovascular disease (47%) and chronic respiratory disease (34%). Thirty percent were current or ex-smokers (Table 1). Chest radiographs were performed in nearly all cases (95%). Laboratory tests were carried out in 78% of cases (40% had sputum cultures, 56% had blood cultures and 30% had influenza PCR screening). A named organism was detected in half of all sputum specimens, with *Haemophilus influenzae* and *Streptococcus pneumoniae* being the most common (22% and 11% of all tests respectively). Viruses were detected in 13% of the cohort, with no one virus responsible for more than 2% of cases. In-hospital mortality was 5.6% (n=52), length of stay was a median (IQR) of 4 (2, 6) days, with a range of 1–33 days, and C-reactive protein concentrations were a median (IQR) of 101 (37, 192).

Geographic distribution of CAP

There was strong evidence that the CAP rates were not randomly distributed across the city (Figure 2). The majority of areas (80%) had CAP hospitalisation rates of fewer than 5 per 1,000 adults. Two areas had notably higher rates of CAP; these were Prestons and Halswell West, with rates of 51 and 22 per 1,000 adults respectively. Removing the aged residential care residents did not alter these upper outliers significantly, or the distribution of CAP more generally, indicating that aged residential care facilities were not distorting the result.

The initial analysis showed that areas with high rates of CAP were clustered together (Figure 3). Spatial analysis showed two significant separate hotspots; one in the northeast, and the other in the southwest (Figure 3). The northeast hotspot consisted of Belfast, Burwood, Highfield Park, Mairehau, Mairehau North, Prestons, Redwood, Rutland, Shirley, Styx, Travis, Travis Wetland and Westhaven. The southwest hotspot was Aidanfield, Halswell, Oaklands and Wigram. Coldspots were the central business district (CBD), the Port Hills and Banks Peninsula.

CAP distribution stratified by age

Spatial analysis for the rate of CAP for 20–64-year-olds showed the northeast cluster all but vanished, while the southwest cluster expanded and spread (Figure 4). The opposite was seen in the 65+ age group: the southwest cluster vanished and the northeast cluster remained, and a new cluster (inner southeast) became significant ($p<0.05$). Interestingly, the new cluster is the only one that does not border one of the two areas with the highest rates of CAP identified in Figure 3.

CAP distribution relative to socio-economic deprivation

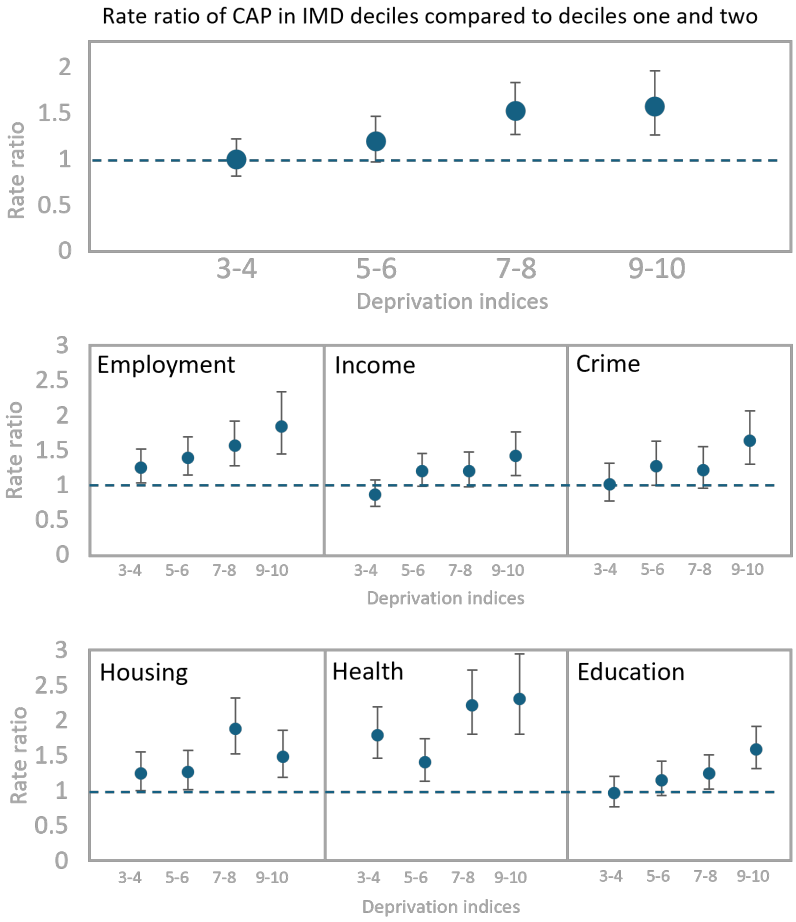
When CAP prevalence clusters were compared with a map showing IMD deprivation quintiles, significant overlap could be seen (Figure 5). Similarly, the maps for individual indicators of the IMD, e.g., housing, income and education, showed a similar distribution (Appendix Figure 1), while the map of smoking prevalence in Christchurch City exhibited less alignment (Appendix Figure 2). Distribution of rates of CAP by IMD index deviated significantly from what would be expected based on population sizes ($p<0.001$). This was also true for all seven individual components of the IMD, i.e., employment, income, crime, housing, health, education and access to services (all $p<0.01$). The rates of CAP per 1,000 adult (age 20+) residents increased significantly in higher (more deprived) IMD deprivation quintiles (Figure 6). People living in the highest quintile had a higher rate ratio (95% CI) of 1.58 (1.27 to 1.96) for CAP hospitalisation than people living in the lowest quintile. Those in the second highest quintile had a similar rate ratio (Figure 6).

The highest quintile of deprivation in six of the seven individual components of the IMD also had a significant increase in CAP rates (Figure 6); the strongest effect was seen when stratified by health deprivation (rate ratio [95% CI] of 2.31 [1.81 to 2.95]), and the smallest by income (rate ratio [95% CI] of 1.42 [1.14 to 1.76]). The component that did not follow this trend was access to services; it was significant in the opposite direction, with rates of CAP hospitalisation decreasing with increasing access deprivation, with the most deprived quintile having a rate ratio (95% CI) of 0.43 (0.26 to 0.71). The context for this is that most of Christchurch City has low access deprivation; Port Hills and Banks Peninsula have high access deprivation. Only 5% of the CAP patients in this study lived in access deprivation deciles 7–10.

Māori and Pacific peoples

Eighty-seven people in the study (9.4%) identified as Māori. The age distribution of Māori patients differed from that of the total study population ($p<0.001$), with a higher proportion of Māori patients being younger (Figure 7). Comparable trends were observed for Pacific peoples ($p<0.001$; Figure 7). Māori and Pacific ethnicity

Figure 6: Rate ratios for CAP by deprivation index components. This figure shows the rate ratio of CAP deprivation quintiles as compared with the lowest (deprivation index 1 and 2). It includes the six components of the IMD with positive association with CAP. The remaining component (access deprivation) had a negative correlation and is not shown here. See Appendix for definitions of each IMD domain.[15]



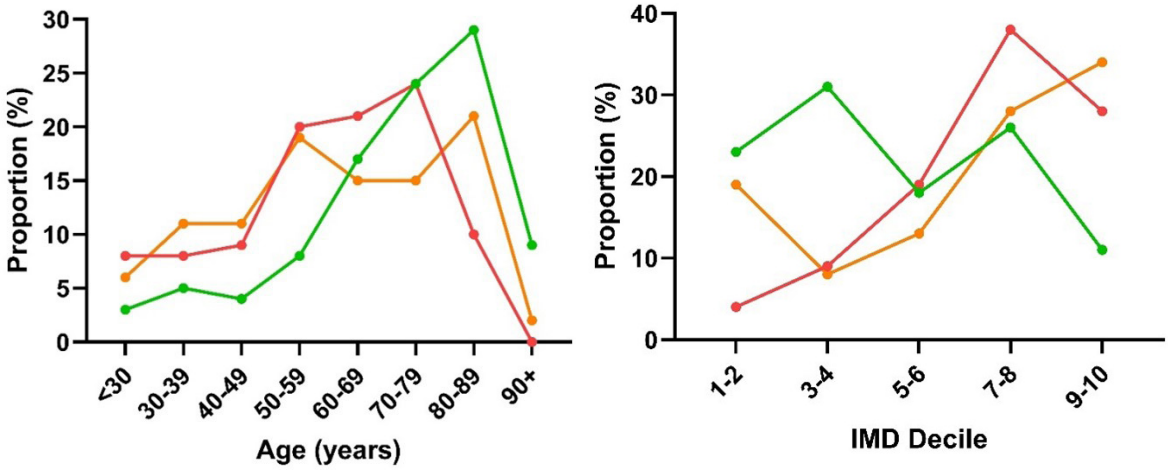
correlated with deprivation (Figure 7); thus, it is possible that deprivation, rather than ethnicity per se, is the predominant risk factor.

Discussion

Our study, comprising spatial analysis of the residential distribution of patients hospitalised with CAP, revealed statistically significant geographical hotspots and coldspots within Christchurch City. Calculation of rate ratios revealed that areas with high socio-economic deprivation experienced a 52–58% greater incidence rate of CAP relative to the least socio-economically deprived areas. Hotspots of rate of CAP in people over 65 were found in the northeast of the city, and the inner southeast. The population aged under 65 years had a large CAP hotspot in the west, and a smaller area in the northeast that overlapped with those 65 years and older. Since age increases the risk of CAP significantly,[3] it was surprising that the CAP hotspots did not more closely mirror the age distribution in the city, as there was a lower proportion of adults aged 65 and over living in the eastern areas of the city. Overall, these results suggest specific distributions of CAP in Christchurch; the reasons are likely to be multifactorial and complex.

The comparison of the spatial data with the known IMD distribution showed that CAP prevalence clusters were co-located with areas of high deprivation scores, as well as the deprivation scores of single indicators: housing, income and education. This is in keeping with the international evidence that CAP rates are higher in more socio-economically deprived areas and areas with lower incomes.[7,9,10] Housing deprivation has been associated with CAP in New Zealand children;[19]

Figure 7: Distribution of age and Index of Multiple Deprivation (IMD) of CAP cohort stratified by ethnicity.



Green = CAP population excluding Māori and Pacific peoples; red = Māori; orange = Pacific peoples.

our data indicates that this may also be true for adults. There were, however, two exceptions: first, a region east of the city, towards New Brighton, which had high deprivation scores but was not a CAP hotspot. Second, a region in the south of the city that was part of a hotspot when rates of CAP in under 65-year-olds were analysed, but which did not have high deprivation. This suggests that CAP incidence cannot be fully explained by deprivation alone. The similarity between the map of CAP prevalence hotspots and the distribution of education deprivation was surprising given the weak evidence for an association in published studies. The theoretical explanation for how higher education could mediate lower levels of CAP is differing approaches to nutrition and preventative hygiene.[8] However, it is also likely that the variables of housing, income and education deprivation all correlate with each other; our spatial analysis was unable to reveal which, if any, of these variables were responsible for the distribution of CAP in Christchurch.

The association between socio-economic deprivation and CAP rates was also analysed separately from the spatial analysis. Our analyses of deprivation quintiles indicated that rates varied significantly from what would be expected based on population sizes. As compared with the rate of CAP in IMD deciles 1–2, the rate of CAP was significantly higher in deciles 7–8 and 9–10, with rate ratios (95% CI) of 1.5 (1.3 to 1.8) and 1.6 (1.3 to 2.0), respectively. As these rate ratios were similar, this suggests that it is not only the highest quintile that has an association with increased CAP. The approximately 50% higher rate of CAP in the most deprived areas is similar to what was reported in the USA.[10]

Severe pneumonia can be associated with delayed health-seeking due to not only socio-economic barriers but also factors such as limited education and poor symptom recognition contributing to the delay. When the seven indicators of the IMD were analysed separately, six had a positive correlation (higher CAP rates seen in areas with high deprivation), and one (access to services) had an inverse correlation. Of the six subscales with positive correlation with CAP rates, the strongest effect was seen for health deprivation. This is unsurprising, given that the IMD health indicator incorporates hospitalisations for selected infectious diseases and respiratory diseases, and comorbid conditions are established risk factors for CAP.[2] Housing deprivation had the second strongest relationship with CAP, with the areas of highest housing deprivation also being comparable to the hotspot locations. There is a clear association between housing deprivation and CAP incidence in the international literature.[20] The IMD measure of housing deprivation incorporates only overcrowding and degree of renting, while New Zealand evidence suggests that mould and dampness also play a role.[19,21] International data suggest that the quality of the house and its facilities also impact on CAP incidence.[20]

The prevalence of current smoking in the CAP cohort was comparable to the New Zealand adult population at the time of data collection, i.e., 15%.[22] There is a well-known link between

smoking and CAP, with a significant dose response.[23] In New Zealand, children exposed to second-hand smoke at home had an increased rate of CAP hospitalisation.[21] As smoking rates are much higher in lower-income households,[24] and smoking has a dose response with CAP,[23] it may be conjectured that it is smoking that mediates the higher rate of CAP in lower-income households. However, when Flory et al.[25] controlled for smoking in their study on CAP, the difference in CAP incidence between low- and high-income households, although smaller, remained significant. While the rate of smoking has fallen significantly in New Zealand, it is still apparent (7%), is more common among Māori (20%) and is four times higher in people living in the most deprived compared with the least deprived decile.[26]

Importantly, this study found that the average age of CAP patients who identified as Māori was 12 years younger than patients who identified as NZ European, as has been reported previously.[5] This is a similar pattern to that seen with chronic disease,[27] and is reflective of the ongoing health inequity experienced by Māori.[28] Across all-cause mortality in New Zealand, Māori carry a disproportionate burden of disease, and have a life expectancy 7 years lower than the rest of the population.[29] Chronic conditions are more prevalent in Māori and Pacific peoples than in other ethnicities, and emerge at a younger age.[27] This study contributes data to the discourse on age-based assessments of disease risk meriting an ethnicity-stratified approach. CAP patients who identified as Māori were also resident in higher proportions in the areas of highest socio-economic deprivation. Although we found deprivation was a predominant risk factor, studies on racial inequities in CAP distribution from the USA have shown that the increased CAP incidence experienced by Black residents is partially, but not completely, explained by variances in measured socio-economic factors.[30] In New Zealand, healthcare-preventable deaths are two and a half times higher in Māori than non-Māori,[29] and this is only partly explained by neighbourhood deprivation levels.[31] Although it is possible that genetic factors could contribute to infection and therefore risk of pneumonia, these appear to be of less importance than socio-economic variables.[32]

This study had several limitations. An important aspect is the study was undertaken in hospitalised patients, representing the more severe end of the spectrum of the disease and, therefore, is not representative of cases treated in the community. There is also the risk of ecological bias, which is when attributes of a person's environment are allocated to them, potentially incorrectly. In this study people were grouped according to residential addresses, the implication being that the characteristics of these areas applied to all residents, which may not have been the case. Using area deprivation as a proxy for individual socio-economic deprivation may underestimate the effect of socio-economic deprivation on CAP incidence, so the effect size may be greater than indicated by these results. Related to this is the use of residential addresses as a proxy for exposure over time. This study did not capture how long someone had been in a specific area. The Christchurch Region is still undergoing area use changes in the aftermath of the 2010–2011 Christchurch earthquakes, which resulted in significant shifts of people and industry. The relatively short accrual period of 1 year could make the study susceptible to the effects of chance variation in the distribution of cases. The attrition to the final dataset could lead to biased estimation; type I error inflation by multiple statistical testing means that some statistically significant findings could be spurious, and type II error could be present for associations that were not statistically significant. The dataset also included 50 patients with two or more admissions, resulting in over-representation in the demographic data and formal analyses. However, the sub-group with multiple admissions was comparable to the wider cohort in many respects (e.g., they were widely distributed across the city and came from all deprivation levels) and, thus, were unlikely to skew the results. The notable exception for this sub-group was that most of them did not have next of kin listed at the same address (a proxy for lack of social support). This could lead into further research on why and how social isolation contributes to increased CAP hospitalisations in Christchurch, and whether there is a component of malnourishment. Finally, there are smaller proportions of Māori and Pacific peoples residing in Christchurch relative to other large populations centres in New Zealand, potentially limiting the generalisability of this data.

In conclusion, this study has revealed how people requiring hospitalisation for CAP over a 12-month study period were geographically distributed in Christchurch. The results demonstrated CAP clusters, and suggested socio-economic deprivation was important, but not the only factor. The study found a strong

relationship between area deprivation scores and CAP hospitalisation rate, with the more deprived areas having rates approximately 50% higher than the least deprived. Specific suburbs, such as the inner south suburbs, may be appropriate for targeted intervention, particularly in those of advanced age and Māori ethnicity. This study supports the impact of socio-economic inequities on health and, similar to other studies globally, shows that universal healthcare is not sufficient to reduce the impact of socio-economic inequities on health. Understanding geographical distribution data for patients hospitalised with CAP in the context of local area socio-economic deprivation indices supports the design and implementation of targeted preventative interventions.

COMPETING INTERESTS
Nil.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/clustering-of-community-acquired-pneumonia-in-hospitalised-adults-in-the-christchurch-region-association-with-socio-economic-dep

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Appendices

Appendix 1: The New Zealand Index of Multiple Deprivation domains[15]

Employment (28% weighting)

- Number of working age people receiving the unemployment benefit
- Number of people receiving the sickness benefit.

Income (28% weighting)

- Weekly Working for Families payments (NZ$ per 1,000 population)
- Weekly payments (NZ$ per 1,000 population) in the form of income benefits.

Health (14% weighting)

- Standardised mortality ratio
- Hospitalisations related to selected infectious diseases
- Hospitalisations related to selected respiratory diseases
- Emergency admissions to hospital
- People registered as having selected cancers.

Education (14% weighting)

- School leavers <17 years old
- School leavers without NCEA Level 2
- School leavers not enrolling into tertiary studies
- Working age people without qualifications
- Youth not in education, employment or training.

Housing (9% weighting)

- Number of persons in households that are rented
- Number of persons in households that are overcrowded.

Crime (5% weighting)
Victimisation rates for:

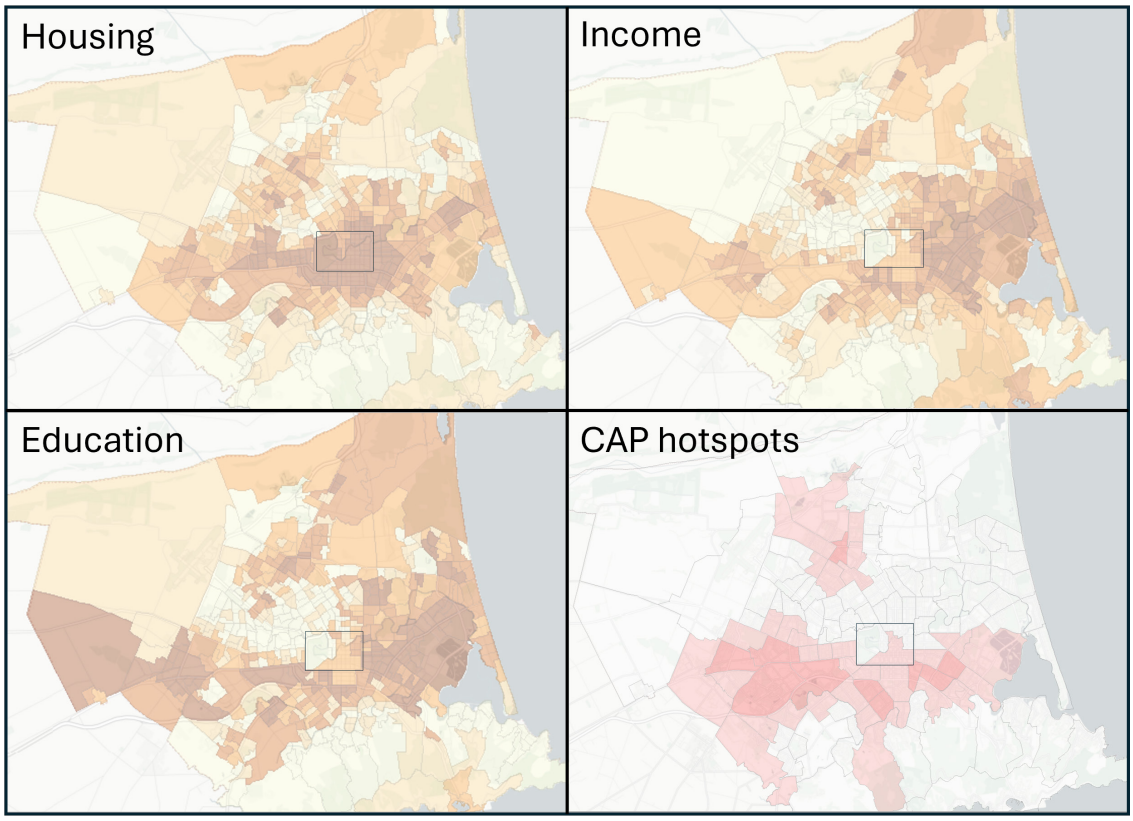
- Homicide and related offences
- Assault
- Sexual assault
- Abduction and kidnapping
- Robbery, extortion and related offences
- Unlawful entry with intent/burglary, break and enter
- Theft and related offences.

Access (2% weighting)
Distance to nearest:

- GPs or urgent care centres
- Supermarkets
- Service stations
- Primary or intermediate schools
- Early childhood education centres.

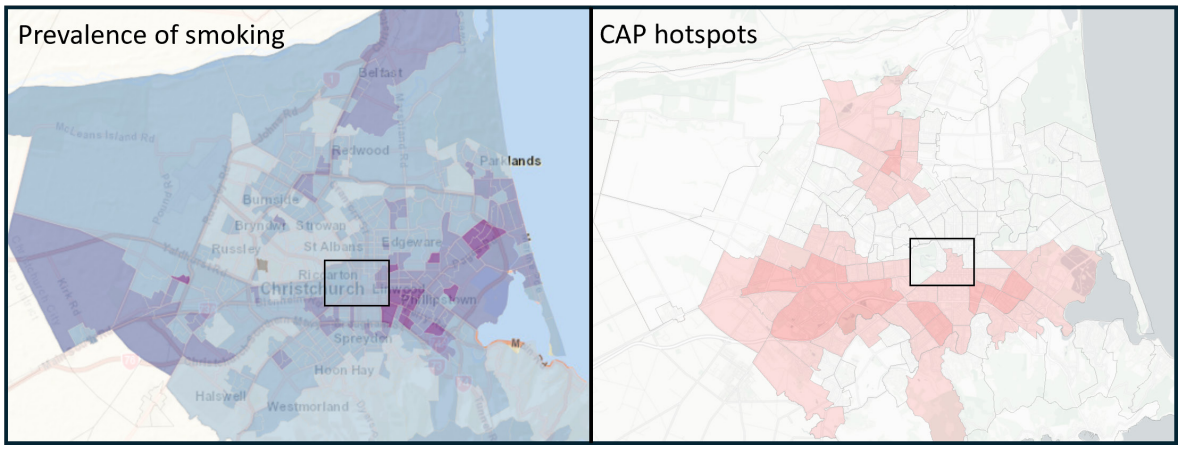
Appendix 2: Community-acquired pneumonia (CAP) distribution relative to individual indicators of deprivation

Appendix Figure 1: Spatial analysis of individual components of the IMD (housing, income and education) in Christchurch City.[15] The darker shades represent the more deprived quintiles. The CAP prevalence hotspot map (lower right panel) shows significant Gi* CAP hotspot cores (darker red) and adjacent suburbs (lighter red). The CBD is indicated with a blank rectangle as a reference point.



Appendix 3: Community-acquired pneumonia (CAP) distribution relative to smoking

Appendix Figure 2: Prevalence of smoking in Christchurch city.[15] The brightest purple areas are those having 31–40% of residents current smokers; the lightest shade indicates 10% or fewer of residents are current smokers. The CAP prevalence hotspot map (right panel) shows significant Gi* CAP hotspot cores (darker red) and adjacent suburbs (lighter red). The CBD is indicated with a blank rectangle as a reference point.



Urgency vs triage prioritisation: appropriateness of referrer-rated urgency of referrals to a public dermatology service

Jessica Yi Han Aw, Israa Al-Manji, Amanda Oakley

ABSTRACT

AIM: To characterise the appropriateness of community referrer-rated urgency among dermatology referrals.

METHOD: Using e-referral data from a month representative of volume and service provision in a tertiary dermatology service, referrer-rated urgency and triage priority assigned by two specialist dermatologists were compared to determine appropriateness. Descriptive analysis was conducted to quantify the proportion of appropriately and inappropriately assigned urgency in priority populations of women, Māori and Pacific peoples and paediatric patients.

RESULTS: One-third of general dermatology referrals, and nearly one in six referrals of suspected skin cancers, had an inappropriately assigned urgency. A quarter of general dermatology and most melanoma referrals had urgency lower than triage priority. Māori and Pacific patients were under-represented in the proportion of referrals received by ethnicity when comparing to national and provincial population estimates. However, no significant disparities in appropriateness of urgency across ethnicity were observed, and the same was seen for female and paediatric patients.

CONCLUSION: Our study adds to the limited research on the appropriateness of referrer-rated urgency. We have pointed out that artificial intelligence (AI) has significant potential to improve the prioritisation of referrals by identifying melanoma and severe skin diseases.

Delayed diagnosis impacts the management, prognosis and survival of skin diseases, especially skin cancers.[1] While most rashes and skin lesions are initially evaluated in primary care, some patients may require referral to dermatology.[2] Delays in processing mean accurate suspicion and assignment of referral urgency by the referrer is imperative.

In our unit, a tertiary dermatology service, due to resource constraints, response to e-referrals for diagnosis or treatment may be delayed for up to 1 to 3 months. Referrers complete one of two templates (suspected skin cancer or general dermatology) and attach clinical and dermoscopy images to show the distribution/location and morphology of the skin problem. We can only offer outpatient appointments to fewer than 10% of referrals (unpublished data), and for the others we provide comprehensive advice and guidance to referrers (teledermatology), processing four to six cases per hour.

Emerging research suggests artificial intelligence (AI) has potential as a triage tool to improve access to dermatology.[3–7] There is limited research investigating existing referral pathways relevant to AI, with most studies focussing instead on the diagnostic capability of AI.[8] We aimed to characterise the appropriateness of community referrer-rated urgency for dermatology referrals by comparing referrer-selected urgency and dermatologist-determined triage priority to understand the current need for AI in referral pathways. We reviewed the diagnoses in referrals that had inappropriately assigned urgency, and investigated disparities across sex, paediatric patients and Māori and Pacific patients.

Method

In March 2023, the Waikato Dermatology service (New Zealand), received 830 e-referrals from general practitioners and nurses, with 77 of them declined due to insufficient information or a duplicate referral, or the referral no longer being required. We performed a retrospective analysis of referrals and their corresponding responses, categorising each referral based on urgency and priority. Referrers selected the level of urgency

from a drop-down menu at the time of referral. Two dermatologists reached a consensus on which conditions and severities should be prioritised. Urgency was classified as high for High Suspicion of Cancer cases (intended for lesions suspicious of invasive melanoma), Acute or Urgent referrals, or low for all other categories (Subacute, Routine or Advice-only referrals). Triage was classified as high or low priority. Non-melanoma skin cancers were considered low priority if small (diameter <50mm for basal cell carcinoma [BCC], <20mm for squamous cell carcinoma [SCC]) and not in a mid-facial location. Severe eczema, psoriasis and other extensive or symptomatic rashes (including those affecting the face or genitals or accompanied by fever) were high priority. Urgency and triage were compared to determine the appropriateness of referrer-rated urgency—appropriate or inappropriate, with urgency higher than triage priority or urgency lower than triage priority. Descriptive analysis with 95% confidence intervals (CIs) was conducted to quantify the proportion of appropriately and inappropriately assigned urgency of referrals for general dermatology, suspected skin cancer and in priority populations of women, Māori and Pacific peoples and paediatric patients. All analyses were conducted using Stata version 15 (College Station, TX).

This audit was out of scope for Health and Disability Ethics Committee evaluation, receiving locality approval through the Clinical Audit Support Unit.

Results

Demographics

Among 753 referrals, 57.0% (n=429) used the suspected skin cancer pathway for one to five individual skin lesions, and 43.0% (n=324) used the alternate general dermatology pathway (Table 1). Of all referrals, paediatric patients (<16 years) comprised 9.7% and females comprised 61.8%.

Table 1: Patient demographics and appropriateness of referral urgency by referral type.

	General dermatology		Suspected skin cancer		Overall	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Overall	324	43.0% (39.5–46.6%)	429	57.0% (53.4–60.5%)	753	100
Age						
Paediatric <16 years	62	19.1% (15.2–23.8%)	11	2.6% (1.4–24.6%)	73	9.7% (7.8–12.0%)
Adult 16+ years	262	80.9% (76.2–84.8%)	418	97.4% (95.4–98.6%)	680	90.3% (88.0–92.2%)
Sex						
Female	201	62% (56.6–67.2%)	264	61.5% (56.8–66.0%)	465	61.8% (58.2–65.2%)
Male	123	38% (32.8–43.4%)	165	38.5% (34.0–43.2%)	288	38.2% (34.8–41.8%)
Ethnicity*						
Māori/Pacific	72	22.3% (18.1–27.2)	34	8.0% (5.7–11.0%)	106	14.1% (11.8–16.8%)
Other	251	77.7% (72.8–81.9%)	393	92.0% (89.0–94.3%)	644	85.9% (83.2–88.2%)
Urgency appropriateness						
Appropriate	209	64.5% (59.1–69.6%)	359	83.7% (79.9–86.9%)	568	75.4% (72.2–78.4%)
Urgency too high	34	10.5% (7.6–14.4%)	33	7.7% (5.5–10.6%)	67	8.9% (7.1–11.2%)
Urgency too low	81	25.0% (20.6–30.0%)	37	8.6% (6.3–11.7%)	118	15.7% (13.2–18.5%)

n = sample size; % (95% CI) = proportion (95% confidence interval).
*Ethnicity excludes three referrals due to incomplete data.

Table 2: Dermatologists' diagnoses for general dermatology referrals with urgency too low and urgency too high.

Urgency too low (n=81)	n	%	Urgency too high (n=34)	n	%
Dermatitis			**Dermatitis**		
Severe atopic dermatitis	21	25.9	Atopic dermatitis	1	2.9
Dermatitis[a]	11	13.5	Dermatitis[c]	5	14.7
Autoimmune			**Autoimmune**		
Bullous diseases	4	4.9	Acute lipodermatosclerosis	1	2.9
Cutaneous lupus erythematous	3	3.7	Cutaneous lupus erythematous	1	2.9
Cutaneous polyarthritis nodosa	1	1.2	Dermatitis herpetiformis	1	2.9
Hidradenitis suppurativa	2	2.5	Lichenoid dermatoses	1	2.9
Lichenoid dermatoses	4	4.9	Morphoea	1	2.9
			Morbilliform drug eruption	1	2.9
Severe psoriasis	16	19.8	Psoriasis	3	8.8
Urticaria	7	8.6	Urticaria	1	2.9
Infection related	3	3.7	**Infection related**	7	20.5
Other[b]	9	11.1	**Other**[d]	9	26.5
			Unable to determine	2	5.9

n = sample size; % = column proportion.
[a]Not further specified, contact dermatitis, discoid eczema, seborrhoeic dermatitis.
[b]Vascular, vitiligo, alopecia, acne, vulval lesion, mucinosis, field cancerisation (inappropriate referral category).
[c]Grover disease, contact dermatitis, keratosis pilaris.
[d]Acne subtypes, multiple naevi (inappropriate referral category), erythema.

Overall, 12.9% (95% CI: 10.7–15.5%) of referrals were for Māori patients and 1.2% (95% CI: 0.6–2.3%) were for Pacific patients. Māori and Pacific patients together comprised 22.3% and 8.0% of general dermatology and suspected skin cancer referrals, respectively.

General dermatology referrals

Among 324 general dermatology referrals, in 25.0% (95% CI: 20.6–30.0%), referrers selected an urgency lower than the dermatologist-assigned triage priority; most often the patients had severe atopic dermatitis (n=21/81, 25.9%) or psoriasis (n=16/81, 19.8%) (Table 2). More than a tenth of general dermatology referrals (95% CI: 7.6–14.4%) had urgency higher than dermatologist-assigned triage priority, of which there was no predominant type of skin condition (Table 2).

Suspected skin cancer referrals

The triage priority for the most significant lesion was assessed when a referral was for two or more lesions. Among 429 suspected skin cancer referrals, 8.6% (95% CI: 6.3–11.7%) had urgency lower than triage priority; these were mostly suspected melanoma or *in situ* melanoma (n=21/37, 56.8%) and large or mid-facial SCCs (n=12/37, 32.4%) (Table 3a). A similar proportion had urgency higher than triage priority (7.7%, 95% CI: 5.5–10.6%), of which nearly half (n=15/33, 25.4%) were small, non–mid-facial BCCs or SCCs. Seborrhoeic keratosis was the most common benign lesion assigned a higher urgency (n=6/33, 18.2%) (Table 3a). The dermatologists suspected a total of 25 melanomas or *in situ* melanomas; the majority (84.0%, n=21) had lower urgency than triage priority (Table 3b).

Table 3a: Dermatologists' diagnoses for suspected skin cancer referrals with urgency too low and urgency too high.

Urgency too low (n=37)	n	%	Urgency too high (n=33)	n	%
Malignant			**Malignant**		
Melanoma[a]	21	56.8	Basal cell carcinoma[c]	7	21.2
Squamous cell carcinoma[b]	12	32.4	Squamous cell carcinoma[d]	8	24.2
Other			**Pre-malignant**		
Ulcer	2	5.4	Actinic keratosis	2	6.1
Leukoplakia	1	2.7	**Benign**		
Penile lesion not further specified	1	2.7	Seborrhoeic keratosis	6	18.2
			Melanocytic naevus	4	12.1
			Vascular lesion	1	3.0
			Unspecified	1	3.0
			Other[e]	4	12.1

n = sample size; % = column proportion.
[a]Includes *in situ* melanoma.
[b]Large (>20mm) or mid-facial location.
[c]Small diameter <50mm.
[d]Small diameter <20mm and non–mid-facial location.
[e]Inappropriate referral form: chronic paronychia, discoid eczema, wound.

Table 3b: Referral urgency for probable melanoma referrals and appropriateness of urgency.

	n	% (95% CI)
Referrer-assigned urgency		
Advice only	17	68.0% (46.3–84.0%)
High suspicion of cancer	3	12.0% (3.6–33.3%)
Routine	4	16.0% (5.7–37.5%)
Urgent	1	4.0% (0.5–26.3%)
Appropriateness of urgency		
Appropriate	4	16.0% (5.7–37.5%)
Urgency too low	21	84.0% (62.5–94.3%)

n = sample size; % (95% CI) = proportion (95% confidence interval).

Table 4: Dermatologists' diagnoses of general dermatology referrals with urgency too low by ethnicity.

	Māori or Pacific		Other ethnicity	
Dermatitis	**n**	**%**	**n**	**%**
Severe atopic dermatitis	10	41.7	11	19.3
Other[a]	-	-	10	17.5
Autoimmune				
Cutaneous lupus erythematous	3	12.5	-	-
Cutaneous polyarteritis nodosa	1	4.2	-	-
Bullous disease	1	4.2	3	5.3
Hidradenitis suppurativa	-	-	2	3.5
Lichenoid dermatoses	1	4.2	3	5.3
Severe psoriasis	4	16.7	12	21.1
Urticaria	-	-	7	12.3
Infection-related	-	-	3	5.3
Other[b]	4	16.7	6	10.5
Total	24	100.0	57	100.0

n = sample size; % (95% CI) = proportion (95% confidence interval).
[a]Lesion not further specified, vitiligo, field cancerisation (inappropriate referral category), not further specified, contact dermatitis, discoid eczema, seborrhoeic dermatitis.
[b]Other diagnoses for Māori or Pacific patients included: keloid, uraemic pruritus, alopecia, haemangioma. Other diagnoses for other ethnicity patients included: mucinosis, port-wine stain, pudendal neuralgia, vulval conditions.

Priority populations

Among 73 referrals for paediatric patients, 84.9% were for general dermatology. Of these, over a third (n=21/62, 33.9%) had lower urgency compared to triage priority, and these were predominantly for severe atopic dermatitis (n=16/21, 76.1%). Under one-fifth of paediatric general dermatology referrals had an urgency higher than triage priority (n=11/62, 17.7%), with no predominant condition; dermatologist diagnoses included exanthem, dermatitis, naevus, urticaria, eczema herpeticum, lichenoid dermatoses and acne.

Among 106 referrals for Māori and Pacific patients, 67.9% used the general dermatology template, one-third of which had an inappropriately low urgency (n=24/72), predominantly for severe atopic dermatitis (n=10/24, 41.7%), which was more than twice the proportion seen in all other ethnicities (Table 4).

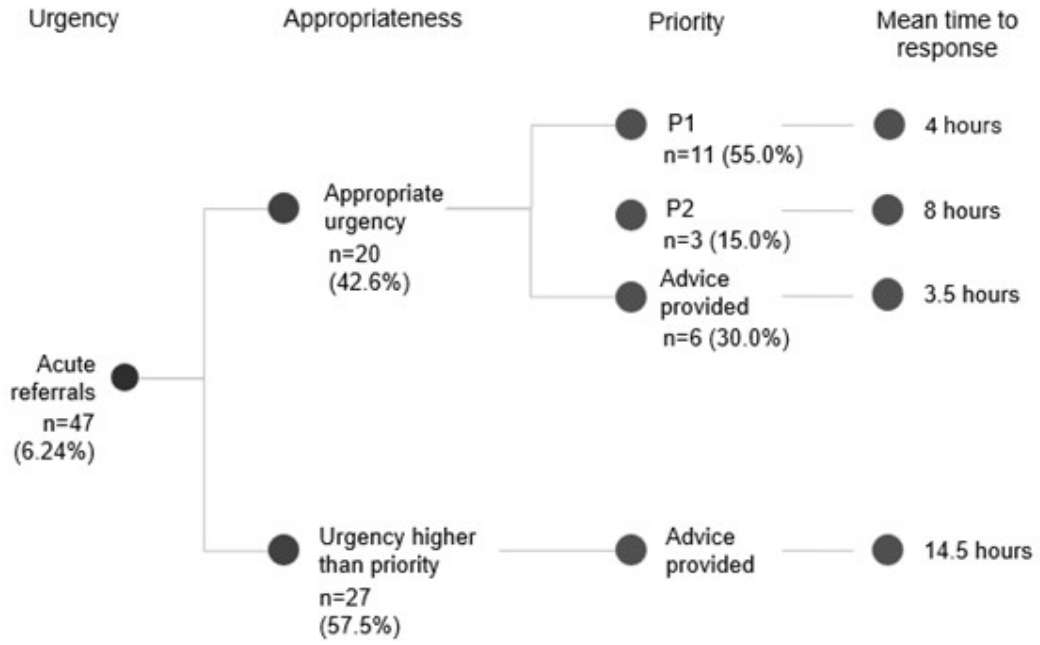
Disparities

To assess disparities in age, we stratified each appropriateness of urgency category for adults and children (Appendix Figure 1). There were higher proportions of paediatric patients among referrals with higher urgency than triage priority compared to all referrals, but this did not reach significance (95% CIs: 18.3–50.5% and 15.2–23.8%). When stratifying appropriateness of urgency by sex and by ethnicity, no significant differences were observed (Appendix Figures 2, 3).

Time to referral response

Mean time from receiving referral to referral response was assessed for referrer-rated urgency categories. Mean response for acute referrals was 10 hours in contrast to 16.5 days for advice-only and routine referrals (Table 5a). Further investigation of acute referrals found more than half (57.5%) had an urgency too high, which

Figure 1: Outcome analysis of n=47 acute referrals. "Urgency" refers to the urgency assigned by the referrer. "Priority" refers to the triage priority of the appointment booked as determined by two specialist dermatologists, where "P1" is the highest priority appointment and "P3" is the lowest priority. "Advice provided" refers to instances where the patient specifically elected not to be treated within the hospital and therefore only advice could be provided, or the referral was of a low enough acuity that providing advice alone for their referrer to continue management was sufficient.



were responded to with a mean time of 14.5 hours (Figure 1). While the majority (88.3%) of advice-only referrals had an appropriate urgency, there were still 50 referrals (11.7%) with an urgency too low that had similar mean response times of 15–17 days compared to those with appropriate urgency (Figure 2a). A similar pattern was observed in the mean response time of the 33.3% of routine referrals that had an urgency too low compared to those with appropriate urgency (Figure 2b). Among general dermatology referrals, those with urgency higher than triage priority had a mean response of 18 hours compared to 14 days for urgency lower than triage priority (Table 5b). Similar differences were observed among suspected skin cancer referrals.

Discussion

In a typical month of referrals to a public dermatology service, many had inappropriate referrer-rated urgency, including one-third of general dermatology referrals and nearly one in six referrals of suspected skin cancers. A quarter of general dermatology and most melanoma referrals were inappropriately low compared to triage priority.

The overall proportions of referrals for Māori and Pacific patients were significantly lower than the 2023 national population point estimates of 17.8% and 8.9% respectively.[9] The most recent 2018 provincial estimates for the region that our dermatology service operates within are higher than the national estimates at 21.0% and 3.2% for Māori and Pacific peoples respectively.[10] There are known barriers to accessing hospital services for Māori patients, including poor communication and racism. Tertiary services require referral from primary care, where additional barriers such as cost and cultural safety also exist.[11,12] One study focussing on older Pacific people found similar barriers to participating in Aotearoa's healthcare system, including access, therapeutic relationships and navigating the healthcare system.[13] While we were unable to investigate these upstream barriers, we were able to investigate whether Māori and Pacific patient referrals were being over-represented among referrals with inappropriate urgency. Reassuringly, we found no

Figure 2a and 2b: Outcome analysis of n=426 advice only and n=123 routine referrals. "Urgency" refers to the urgency assigned by the referrer. "Priority" refers to the triage priority of the appointment booked as determined by two specialist dermatologists, where "P1" is the highest priority appointment and "P3" is the lowest priority. "Advice provided" refers to instances where the patient specifically elected not to be treated within the hospital and therefore only advice could be provided, or the referral was of a low enough acuity that providing advice alone for their referrer to continue management was sufficient.

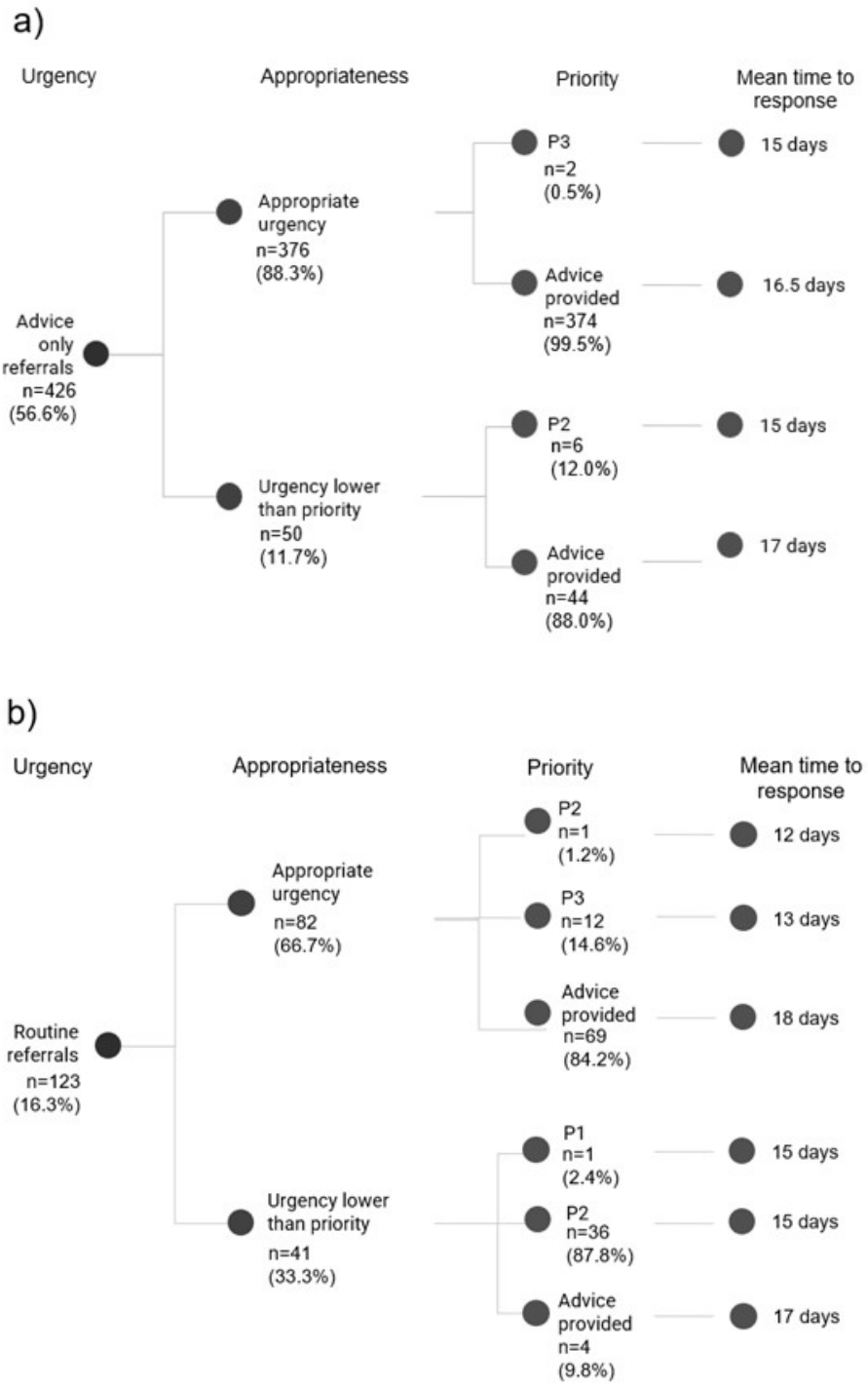


Table 5a: Time to response by referrer-rated urgency.

High urgency	**n**	**Mean (IQR)**
Acute	47	10 hours (1–14 hours)
High Suspicion of Cancer	13	14 hours (2–19 hours)
Urgent	48*	2.5 days (5 hours–5.5 days)
Low urgency		
Routine	123	16.5 days (14–20 days)
Advice only	426	16.5 days (14–20 days)
Semi-urgent	95	8.5 days (5.5–12 days)

n = sample size; IQR = interquartile range.
*One urgent referral was excluded from time to response calculations due to incomplete response time data.

Table 5b: Time to response by appropriateness of referral urgency and referral type.

	Appropriate urgency		**Urgency higher than triage**		**Urgency lower than triage**	
	n	**Mean (IQR)**	**n**	**Mean (IQR)**	**n**	**Mean (IQR)**
General dermatology	208*	13 days (5–18.5 days)	34	18 hours (1–18 hours)	81	14 days (10–17 days)
Suspected skin cancer	359	15 days (13–19.5 days)	33	41 hours (5 hours–4 days)	37	16.5 days (14–20 days)

n = sample size; IQR = interquartile range.
*One general dermatology referral with appropriate urgency was excluded from time to response calculations due to incomplete response time data.

significant disparities for Māori and Pacific patients in ethnicity, across sexes or in paediatric compared to adult patients. Such findings can be utilised to bolster strengths-based policy to improve upstream barriers.[14]

Psoriasis and atopic dermatitis were the most common conditions with low urgency when dermatologists assessed them as severe and high priority, and with high urgency when mild, emphasising the importance of including objective clinical severity indices.[15] Many referrals for small BCCs and SCCs were assigned to a high urgency, whereas their diagnosis and treatment can safely wait.

Inappropriate urgency selection suggests an important role for AI. While AI cannot replace clinical judgement, there is strong evidence for its use as a clinical support tool. Depending on the data AI is trained on, it could be more accurate and less biased than human clinical judgement.[16] In experimental settings, AI can diagnose melanoma more accurately than most dermatologists and primary care providers.[2,17] In one study, AI triage for suspected skin cancers improved service provision, returning benign lesions for follow-up in primary care and enabling >90% of urgent referrals to be seen within 2 weeks.[6] It is also important to recognise the workload primary care referrers face.[18,19] Writing referrals is time consuming, but the use of an AI medical scribe can reduce the burden.

The 6 working day referral response-time elective services patient flow indicator (ESPI) was largely met for high urgency referrals, but not for low urgency referrals. Overall, time to response was allocated according to referral urgency,

indicating misallocation of resources towards the one-quarter of referrals that were assigned an inappropriate urgency.

Limitations

Our assessment assumed no human error in referral triage. Insufficient sample size of inappropriately assigned urgency precluded more robust analyses.

Conclusion

Our study adds to the limited research on the appropriateness of referrer-rated urgency. We have pointed out that AI has significant potential to improve the prioritisation of referrals by identifying melanoma and severe skin diseases.

COMPETING INTERESTS
The authors have no competing interests to declare.

ACKNOWLEDGEMENTS
We would like to acknowledge Dr Julia Zhu for her support and advice in data preparation.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/urgency-vs-triage-prioritisation-appropriateness-of-referrer-rated-urgency-of-referrals-to-a-public-dermatology-service

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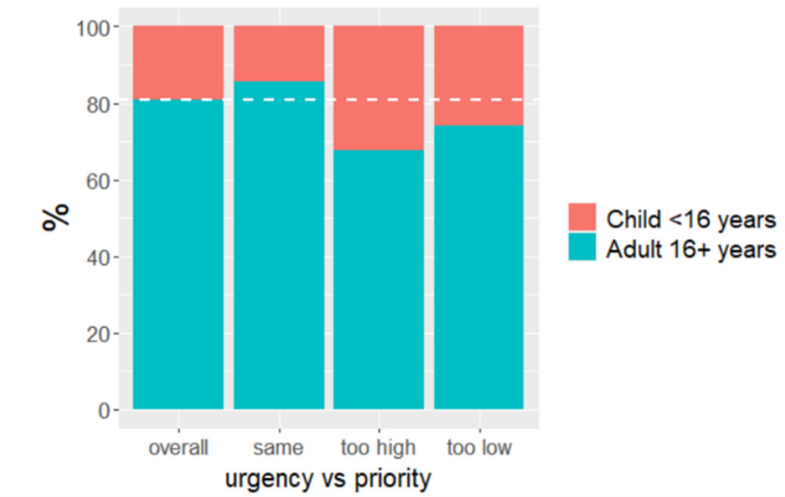
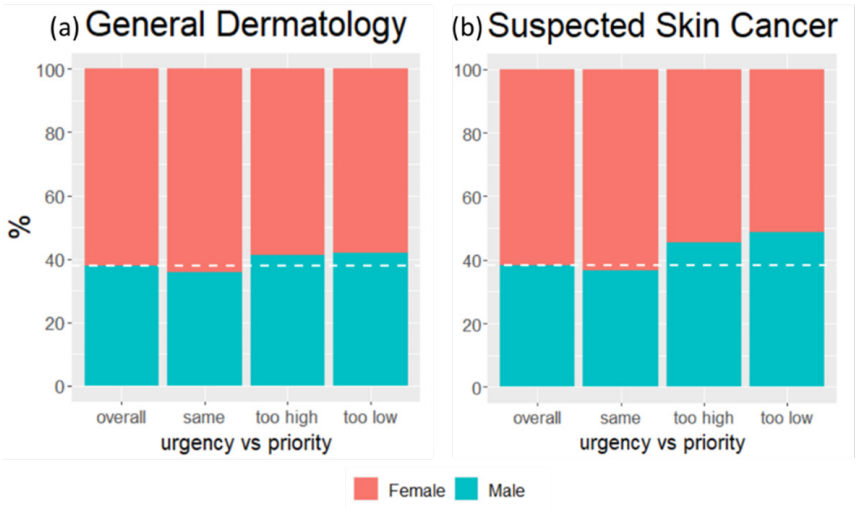
Appendix

Appendix Figure 1: Age-related disparities in appropriateness or referral urgency among general dermatology referrals.



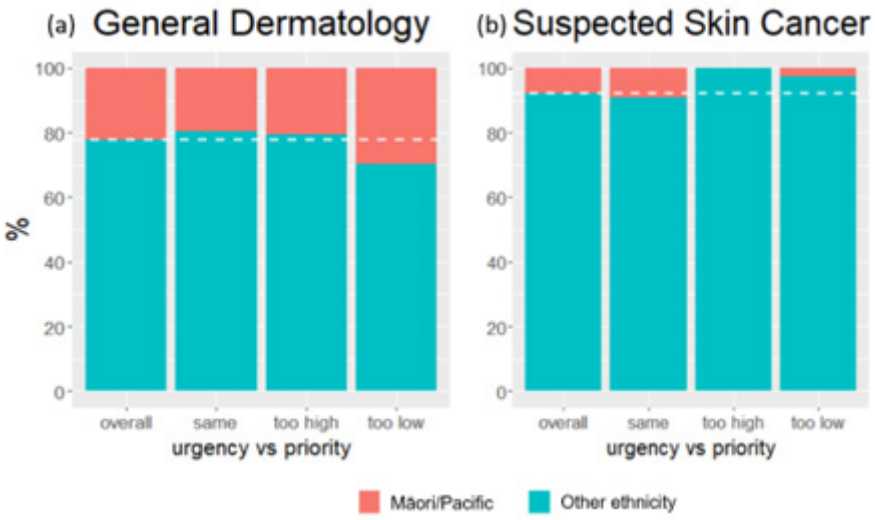
"%" refers to the proportion of referrals for children (<16 years) or adults (16+ years) within each category of appropriateness of referrer-rated urgency, as determined by comparing urgency with the dermatologist-assigned triage priority. The "overall" bar combines all 324 general dermatology referrals. The "same" bar (n=209) refers to referrals with appropriate urgency, the "too high" bar (n=34) refers to referrals with urgency higher than triage priority and the "too low" bar (n=81) refers to referrals with urgency lower than triage priority. The dashed horizontal line compares the proportion of paediatric referrals overall with the proportion of such within each category of appropriateness. There appears to be a relatively higher proportion of paediatric referrals with urgency higher than triage priority (32.4%) compared to overall (19.1%); however, this did not reach significance (95% CIs: 18.3–50.5% and 15.2–23.8%). Similarly, the proportion of paediatric referrals with urgency lower than triage priority (25.9%; 95% CI: 17.4–36.8%) also, to a smaller degree, appeared higher compared to overall, but this was not significant.

Appendix Figure 2a and 2b: Sex-related disparities in appropriateness of referral urgency among a) general dermatology and b) suspected skin cancer referrals.



"%" refers to the proportion of referrals for males or females within each category of appropriateness of referrer-rated urgency, as determined by comparing urgency with the dermatologist-assigned triage priority. The "overall" bar combines all 324 general dermatology **(a)** and 429 suspected skin cancer **(b)** referrals respectively. The "same" bar refers to referrals with appropriate urgency, the "too high" bar refers to referrals with urgency higher than triage priority and the "too low" bar refers to referrals with urgency lower than triage priority. The dashed horizontal line compares the proportion of referrals for females overall with the proportion of such within each category of appropriateness. In **a)**, the proportion of referrals for females with urgency too high (58.8%, 95% CI: 41.0–74.6%) and urgency too low (58.0%, 95% CI: 46.8–68.5%) did not differ significantly from the proportion overall (62.0%, 95% CI: 56.6–67.2%). In **b)**, the proportion of referrals for females with urgency too high (54.5%, 95% CI 36.8–71.2%) and urgency too low (51.4%, 95% CI: 34.9–67.5%) were not significantly lower than overall (61.5%, 95% CI: 56.8–66.0%).

Appendix Figure 3a and 3b: Ethnic-related disparities in appropriateness of referral urgency among a) general dermatology and b) suspected skin cancer referrals.



"%" refers to the proportion of referrals for Māori and/or Pacific patients vs other ethnicities within each category of appropriateness of referrer-rated urgency, as determined by comparing urgency with the dermatologist-assigned triage priority. The "overall" bar combines all 324 general dermatology **(a)** and 429 suspected skin cancer **(b)** referrals respectively. The "same" bar refers to referrals with appropriate urgency, the "too high" bar refers to referrals with urgency higher than triage priority and the "too low" bar refers to referrals with urgency lower than triage priority. The dashed horizontal line compares the proportion of referrals for Māori and/or Pacific patients overall with the proportion of such within each category of appropriateness. In **a)**, the proportion of referrals with urgency too low for Māori and/or Pacific patients (29.6%, 95% CI: 20.6–40.7%) was not significantly higher compared to overall (22.3%, 95% CI: 18.1–27.2%). In **b)**, the proportion of referrals for Māori and/or Pacific patients did not differ significantly between categories.

"Levelling up" the gender pay gap for Asian women academics in medicine and health sciences

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ABSTRACT

The gender pay gap for academic women of Asian ethnicity at Aotearoa New Zealand's largest university is 33.5%. The aim of this viewpoint is to raise consciousness, educate and contribute to dialogue on concerns relating to Asian women advancing in academia, particularly in medicine and health sciences. We invite collective participation in efforts at departmental, faculty and institutional levels to better identify and dismantle discrimination and increase the representation of Asian women in academic medicine. We endorse concepts of accountability, transparency and strengthening institutional frameworks to "level up" intersectional pay gaps by recommending three actions: 1) ensuring accountability by mandatory training, monitoring and reporting on gender pay equity, diversity and conscious inclusion, 2) creating transparency in salary, pay rates, hiring, tenure and promotions, and 3) convening a task force at each faculty with specific mentorship and leadership initiatives for women of colour. We emphasise that "levelling up" requires a collective will to act. We ask our colleagues and the academy to scrutinise attitudes and biases towards ethnic minority women in hiring, tenure and promotion processes. We advocate for enacting policy so those who experience inequity can see change. When rendered, it will be a legacy to the next generation of ethnic minority women entering the academy, and potentially other marginalised groups as well.

What institution was ever so wisely planned that no disadvantage could arise therefrom?" – Spinoza[1]

At Waipapa Taumata Rau | The University of Auckland, academic women of Asian ethnicity bear a grim statistic: a gender pay gap of 33.5%.[2] This figure disproportionately outsizes the already dispiriting 11.9% gender pay gap for all women at the leading university of Aotearoa New Zealand. This large ethnic gender pay gap for Asian women academic staff was attributed to "*50 percent of their students being Asian, many employed as part-time teaching assistants*."[3] If this is the case, it is unclear if the ethnic gender pay gap is actual or perceived. Gender and ethnic pay gaps are measured using pay data (hourly or salary), using pay as a proxy for seniority. Data about ethnic identity are captured by the total response method of self-identity as used by Stats NZ.[2] Several factors affect hourly rate of pay: gender, ethnicity, permanence and service length. On average, the hourly rate is higher for those who are men, are European, have a permanent role and have a longer service length.[2] There is a similar pattern in comparable New Zealand institutions reporting unacceptable pay gaps between genders and ethnicities,[4] but the highest gender pay gap is in medicine.[5] The Medical Council of New Zealand, the body that ensures doctors are competent and fit to practice, calculate that 26.1% of the workforce are of Chinese, Indian or other non-European ethnicity.[6] Medical specialist salaries are specified by a multi-employer collective agreement negotiated by the Association of Salaried Medical Specialists, who find that male specialists earn a large and statistically significant premium over their female colleagues.[7] In medical academia, the gender pay gap has been partly attributed to lower research scores, but there are harder to measure factors such as bias.[8] Asian women are scarce in medical academia, even more so in professorial and senior leadership positions, and may have additional challenges in encountering discrimination[9] and unconscious bias.[10] We are a diverse group of Asian[11] women academics, at various career stages, who work in a faculty of medical and health sciences. The aim of this viewpoint is to raise consciousness, educate and contribute to scholarly dialogue on concerns relating to Asian diaspora women advancing in academia, particularly in medicine and health sciences. We use the term Asian acknowledging its limited utility as a categorisation, not as an ethnic

identity.[12] We examine barriers to advancement and recommend actions to address the discrepant status quo for this particular group. In this article, "level up" is used in its broad vernacular meaning to "*go to a higher level or to reach the same high level as something else*."

The focus of this article is the pay gap experienced by Asian academic women. (Note: Some agencies, for example the New Zealand Ministry of Women,[13] use European men as the denominator group. As recommended by New Zealand's Public Service Commission,[14] the comparison group as used by The University of Auckland is "all men" as the denominator. We do not directly compare with women of other ethnicities, although this is necessarily inferred from data showing that the largest gap is experienced by Asian women academics.) The hierarchal structure of academic medicine affects women more negatively than men. Women are not promoted similarly; men are more than doubly likely to attain professorship compared with women with equivalent research scores and age.[5] Research reveals inequities experienced by women academics in general: they are paid less,[5] are typically over-represented in precarious employment, in teaching-focussed contracts, are less likely to be tenured,[15] are under-represented in continuing positions, start their tenured academic career later than men,[16] are less likely to be mentored,[10] are less likely to be in a leadership position at a similar career stage compared with men,[17] receive lower competency ratings, are evaluated less positively,[18] receive fewer research grants[19] and awards than their male counterparts[9] and shoulder a workload allocation that includes heavier teaching commitments and administrative roles that tend to be considered less favourably in promotion applications.[19] Gender bias in academia has been recognised as a lifetime problem, but not all gender biases are the same.[17] There is evidence that minority ethnic women earn considerably less than their white female and male colleagues[16] and Asian women are less likely to be promoted than their white counterparts.[20] Women of colour have shorter careers, are more likely to leave academia[16] and are the least likely to receive tenure of all demographic groups despite comparable productivity.[21]

The identity of academics working in medical and health specialties is formed during medical and health professional training, when values and beliefs about that profession are transferred and internalised.[9] Asian women entering medicine and health sciences will observe the lack of representation of minority ethnic women in senior faculty and leadership positions.[22] They will discover that the conventional construct of a medical professional is still a male prototype.[23] The prototype of power and privilege may be viewed as quite arbitrary in relation to academic quality and skills.[24] Asian students grapple with another uncomfortable truth when they realise their Asian teachers and supervisors will achieve less success in academia and are conspicuous by their absence as professors.[25] They may doubt the notion of meritocracy[26] when they do not see themselves reflected in their academic leaders.[19,27]

Living our values

As Asian women academics, we value and encourage emphasis on culture in medicine and health science research that focusses on minority groups and intersectional perspectives.[28] Intersectionality is a useful framework to understand how multiple social identities, such as gender and ethnicity, interact and reflect multiple, interlocking structural-level inequalities in society.[29] Women are more likely than men to serve underserved communities as health professionals, collaborate and exercise judicious decision making.[8] Asian professional women share a common lived experience in the assumption that we are not in a position of authority.[30] It is commonly the case that an accompanying white male medical student is spoken to as the attending doctor because we are mistakenly assumed to be a subordinate,[31] or a white male colleague is preferentially referred to in the supervisory context.[27] The under-representation of staff from diverse backgrounds has harmful effects on student perceptions of equity on their options and career pathways[16] in a paradigm that also harms our workforce and patients, as these judgements are internalised within Asian students.[22]

On numerous occasions, we respond to students from minority backgrounds who feel marginalised and actively seek mentorship and role models within the institution. These students ask us for advice, to listen to their experiences of racism, sexism and discrimination and to advocate for them. This "invisible work"[32] of unassigned responsibilities and obligations adds value to the academy but consumes time that thus becomes unavailable for research and teaching.[33] As members of a marginalised group we under-

take such care work, undervalued tasks and academic housework.[34] We support each other in solidarity because we understand that care and gender interface with precarity and insecurity in employment.[35] Asian women report high rates of microaggressions from patients, other students, supervisors and in hospital settings, even compared with Asian male students.[31] Subtle yet impactful bias and discrimination in early training is largely undocumented and unaccounted for and affects professional advancement.[34] Our collective experiences make us more adept at recognising microaggressions, calling them out,[36] highlighting and speaking out on matters of public significance that affect Asian and other minority ethnic communities and adapting to frame our careers in terms of success rather than disadvantage.[37]

Double jeopardy for Asian women at the intersections of medicine and academia

The "double jeopardy"[38] for Asian academic women is in simultaneously encountering gender and racial bias.[39] This is the reality of our lived experiences.[26,32,40] Our stereotype is the "model minority":[41] considered hardworking, competent, technically excellent, but lacking in leadership skills.[38] The insidious effect is the undermining of competence, known as stereotype threat, when the stereotype becomes internalised.[33] The threat is further compounded by workplace discrimination,[40] being presumed incompetent[42] and classified as an outsider.[19] Asian women are more inclined to quiet power in leadership,[43] to subverting in empowering ways.[44] We break a stereotype of being quiet and submissive[31] when we act assertively and decisively, deviating from communal behaviours of being agreeable and focussed on others.[45] As Asian women, we embrace integrated, intersectional identities,[46] of being female in a male-empowered academic workplace, as clinicians and academics, of our central ethnicity and in building community.[33] These intersecting multiple identities attract approaches to lead and collaborate on ethnicity-based research and teach culturally safe practice. However, this intersectionality compounds inequities.[46] Asian-focussed research is rarely prioritised, funded or advocated for, which contributes to devaluing. Negative evaluations by students and managers may have a disproportionately detrimental impact on ethnic minority women.[18] Asian women pay a double price when negatively evaluated on performance-productivity measures;[20] fewer opportunities are then offered to them, resulting in a widening pay gap.

Levelling up the gender pay gap for Asian academic women

"*When they enter, we all enter*." – Crenshaw[46]

We stand in solidarity with Māori and Pacific academic women,[47] who are making some progress and who have less pronounced pay gaps yet are still scratching the surface towards increased representation in senior faculty. So far, we have not observed any specific measures to counter the status quo for Asian women academics. The gender pay gap reflects gender disparity and also systemic barriers[26] that are amplified through career stages[17] and materialise in recruitment, promotion, succession planning[45] and arbitration.[26] Institutions transcend individual endeavours as well as time and generations and so there is momentum for change.[1] Recent revisions of The University of Auckland's framework defining academic leadership and citizenship are welcome but have not been evaluated in terms of supporting the promotion of minority groups and women. We can only infer that institutional barriers exist in advancing Asian women medical academics and suggest there are differences between genders in how success is defined.[48] Discussions on promotions are permeated with an underlying narrative of productivity, or the lack thereof. The clause "achievement relative to opportunity" does not assist women in overcoming additional barriers of gender and racial bias. Asian women academics no doubt contribute to the "leaky pipeline" and there is evidence they leave their jobs feeling devalued,[22] citing lack of opportunities and career progression, discrimination, bias and job insecurity.[10,40]

Current data indicate that Asian women fare worse than all other groups. This is not limited to academic institutions. Women working in government and public services continue to be paid less on average than men in every ethnic group, and pay gaps for Māori, Pacific and ethnic minority women are wider than they are for European women.[49] Minority ethnic groups are over-represented in lower paid work and under-represented in leadership roles. Taking action on gender pay gaps, such as pay equity settlements, has helped to close both gender and

Māori pay gaps in the public service.

Three actions to "level up"

We advocate for Asian women to have more visible opportunities for career progression. In raising awareness, we acknowledge thoughtful colleagues who will speak up when they witness racism or sexism.[33] Addressing gender and ethnic bias requires a multi-level institutional response, with conscious action at all these levels.[50] Decision making on hiring and reviewing performance, career progression and workload distribution take place at departmental, school and faculty levels. We endorse an institutional response to addressing intersectional pay gaps and recommend actions based on three principles: accountability, transparency and strengthening institutional frameworks. We accept the need to gather further data, given that a breakdown of disciplines and faculties that account for the gender pay gap is not yet provided.[2] We suggest an intentional focus on Asian women academics in medicine and health sciences in order to shift culture and norms. Decision making and policy interventions to advance and retain Asian women in the academic medical arena require effective anti-discrimination policy to be operationalised in detail, supporting equitable action and access to opportunities. Acknowledging that Asian academic women are situated in a place of disadvantage, this is a call for more specific and detailed planning on how these policies will be implemented from the ground up to mitigate bias and discrimination.

i. Accountability for building culture and community

Action 1: Mandatory training, monitoring and reporting on gender pay equity, diversity, unconscious bias and conscious inclusion and ensuring accountability for reducing intersectional pay gaps.

Institutions demonstrate they value minority ethnic women by validating their belonging in the academy and providing opportunities to advance as others do.[25] Asian women build community by supporting connection, maintaining a strong centre and staying true to our values. There are definitive measures to build culture and create conditions that address systemic underrepresentation of women in leadership.[48] Having more senior managers that are men widens the gender pay gap.[8] Dismantling structures that disadvantage women can be tangibly advanced by ensuring gender and ethnic diversity on interview panels for hiring, committees for promotion and granting bodies. We encourage a shift in dialogue on leadership: that all leaders have responsibility for actions to support gender pay equity, not just women, and especially not just the few ethnic minority women in senior positions. At an institutional level, we suggest dedicated sponsorship of ethnic minority women in leadership,[51] greater objectivity in evaluating women's achievements,[52] accountability for equitable allocation of research and service opportunities and training in unconscious bias and structural racism to raise consciousness on the impact of decision making on minority ethnic and other marginalised groups.[38]

ii. Transparent processes

Action 2: Creating transparency in salary, pay rates, hiring, tenure and promotions.

Evidence of discrepant pay strongly suggests that Asian women academics do not receive equal resources and opportunities, and that policies designed to provide equity in opportunity are not delivering. Evaluating leadership representation and hierarchy, in addition to compensation, is likely to reveal drivers of inequity[45] but is unlikely to reflect unconscious bias. There are very few financial compensation comparisons that can be made by gender and ethnicity owing to insufficient numbers resulting from a distinct lack of diversity in high-ranking medical academic roles.[45] Thus, we can infer that Asian women are less likely to hold titles that reflect institutional hierarchy or influence. Pay, hiring and progression practices and policies can be inherently biased if there is manager discretion.[8] Being inadequately remunerated for skills and experience is just one way that women are undervalued and underemployed compared with men.[23] Women are less likely to negotiate[53] and have a pattern of being overlooked for leadership opportunities. We surmise there are negative and compounding intersectional effects on the lifetime earnings of Asian academic women.[16] There is evidence that pay transparency interventions significantly lower the gender pay gap.[54] Reporting salaries, making criteria for merit-based pay publicly available and publishing outcomes based on gender are interventions that tackle pay discrimination by revealing what constitutes equal pay and equal work, enabling fair bargaining—notwithstanding the reputational

effects that top institutions seek to maintain.[45]

iii. Strengthening institutional frameworks for providing a valuing climate for Asian academic women

Action 3: Convening a taskforce in each faculty to address gender and ethnic pay gap concerns and specific mentorship and leadership initiatives for minority ethnic women.

We suggest intentional efforts to ensure that work conditions are enhanced so that women from ethnic minority groups can thrive and flourish and the essential contributions of Asian women academics are recognised, valued and rewarded.[45] Any contribution to meaningful change means an uncomfortable examination of implicit bias.[55] It also means resisting the status quo, not only as an aspiration but in concrete actions. It may be more difficult for junior faculty to speak up about the impact of bias on intersectional pay gaps due to fear of negative consequences, including on career progression.[28] Advancing women's interests requires strong leaders from all quarters. We propose that a taskforce examining pay gap concerns is headed by leaders who are invested in advancing women's interests. Taskforce leadership, time and work can be recognised in academic workloads as substantial service and more in career terms. There are tensions in this process: when Asian women are at the forefront, our voices are more likely to be heard.[40] However, this places the onus on us to perform the task of convincing the institution of the need for intersectional pay equity. We suggest the burden of implementation not be left on the shoulders of ethnic minority groups but held collectively at a faculty leadership level. Additionally, such a taskforce may not gain sufficient traction to improve conditions or achieve equity for the groups it seeks to serve.

We draw attention to concerns about intersectional pay gaps because solutions lie in conscious efforts to dismantle discrimination, stereotyping and under-representation of ethnic minority groups in academia. Other institutions are taking measures to address similar concerns. In 2024, the Asian pay gap in the public sector increased from 12.6% in 2018 to 13.8%.[14] This increase was attributed to the growing proportion of younger Asian public servants in the early career trajectory.[14] In response, public service organisations have set targets across a defined timeline to improve gender and ethnic representation in their workforce and leadership.[44] In medical academia, we emphasise that "levelling up" requires a collective will to act. Increased numbers of Asian students and health professionals reflect the rising Asian New Zealand population who look to role models of similar ethnicities. In this regard, the future workforce of minority ethnic health professionals will be closely observing our progress.[33] We anticipate that pay transparency will reveal institutional hierarchy and generate dialogue on the valuation of equal work. It is also likely to reveal the precarious employment of Asian women, who may not actively seek or be shoulder-tapped for opportunities that would make them more visible or advance their careers.[15] Meaningful change in representation and equity for Asian women academics involves understanding lived experiences, supporting and valuing our research, acknowledging our professional attributes and actively promoting opportunities for advancement.[25] Lower pay, lower prospects of promotion and early exits are inter-related.[16] We recommend similar institutional measures that proactively encourage women to apply for leadership positions, recognise emerging and established talent, mentor and sponsor them and monitor for accountability. We also recommend further analysis on the attrition of ethnic minority women from academic roles.

Conclusion

A clear trend of data indicates a marked pay disparity for Asian academic women at New Zealand's leading university. We aspire to a shift in societal values and within our spheres of influence to challenge our colleagues and the academy to expand their ideas about what good leadership is, both collective and distributed. We ask all to scrutinise their attitudes and bias to Asian women in hiring, tenure and promotion processes. We invite collective participation in efforts at departmental, faculty and institutional levels to dismantle discrimination and stereotyping and increase the representation of Asian women in academic medicine and health sciences and to enact policy so those who experience inequity can see change. We advocate for action at all levels to be visible and accountable. When rendered, this will be a legacy to the next generation of Asian women entering the academy. The action points noted can potentially address inequities not just for Asian and ethnic minority academic women or those in medical and health academia, but those experienced by marginalised groups in other New Zealand institutions and internationally.

COMPETING INTERESTS
There are no conflicts of interest to declare.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/levelling-up-the-gender-pay-gap-for-asian-women-academics-in-medicine-and-health-sciences

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Emergency management in a regional setting of a paediatric patient with penetrating injury of the hard palate from a metal drinking straw

Jacob Arahill-Whitham, Hitesh Tailor, Dean Ruske

Case

History and examination

A 21-month-old female presented to a rural Aotearoa New Zealand emergency department with a retractable metal straw impaled through her hard palate following a fall from a push bike. On arrival, the patient was intermittently distressed but consolable. She was clinically stable with a full range of eye movements, no focal neurology and no respiratory distress.

Investigations

The decision was made to proceed with imaging before transfer. An X-ray revealed a radiopaque foreign body that appeared to be penetrating the nasal sinuses, with the tip possibly sitting at the frontal skull base. A computed tomography (CT) of the head was recommended to assess for possible intracranial injury. The CT showed the tip buried in the body of the sphenoid bone. The foreign body was in close contact with the apex of the right orbit, and the report detailed possible right medial rectus muscle impingement.

Management

The case was discussed with the otolaryngology team and accepted for transfer to the nearest tertiary centre. The neurosurgery team were also consulted and available on standby.

The patient was urgently transferred via helicopter to the nearest tertiary centre, 4 hours and 33 minutes following the initial call to emergency services. Intravenous access was obtained before transfer, and the patient was accompanied by a parent and the flight retrieval team. A consultant intensivist with airway expertise and emergency intubation equipment accompanied the patient. She remained stable without the need for airway support.

On arrival, she was taken directly to the operating theatre, 92 minutes following departure from the regional centre. After sedation, the foreign body was removed in one attempt without resistance. The patient was intubated following rapid sequence induction. Tracheostomy equipment was available but not required. The oral cavity was inspected and an anterior hard palate perforation with bony avulsion into the nasal cavity was noted. Nasal endoscopy revealed intact inferior and middle turbinates. The bony fragment that had avulsed from the nasal floor was manipulated back into place with near total closure of the defect before packing the nasal cavity with Nasopore Forte.

The patient remained well on the ward post-operatively and resumed a normal diet. There were no noted concerns with eye movements. She was discharged 1 day post-operatively with a week of oral antibiotics, and no further issues were reported during follow-up.

Discussion

While paediatric traumatic injuries of the palate are a common cause of paediatric presentation to health services, complications with long-term sequelae are relatively rare.[1] Potential complications reported in the literature from oropharyngeal trauma include airway compromise, vascular injury with catastrophic neurological sequelae, bleeding, retropharyngeal abscess, facial cellulitis, velopharyngeal insufficiency and pneumomediastinum.[2–5] Penetrating injuries of the hard palate are comparably rare and present additional risk to the orbit and brain.[6] The discussed case was made more challenging due to care being provided in a regional setting with the need for efficient inter-hospital communication and transfer.

The incidence of oropharyngeal trauma in

Figure 1: Lateral plain film (top left) and CT slices in sagittal (top right), axial (bottom left) and coronal (bottom right) demonstrating metallic foreign body penetrating hard palate and traversing nasal passage with tip in the sphenoid bone.

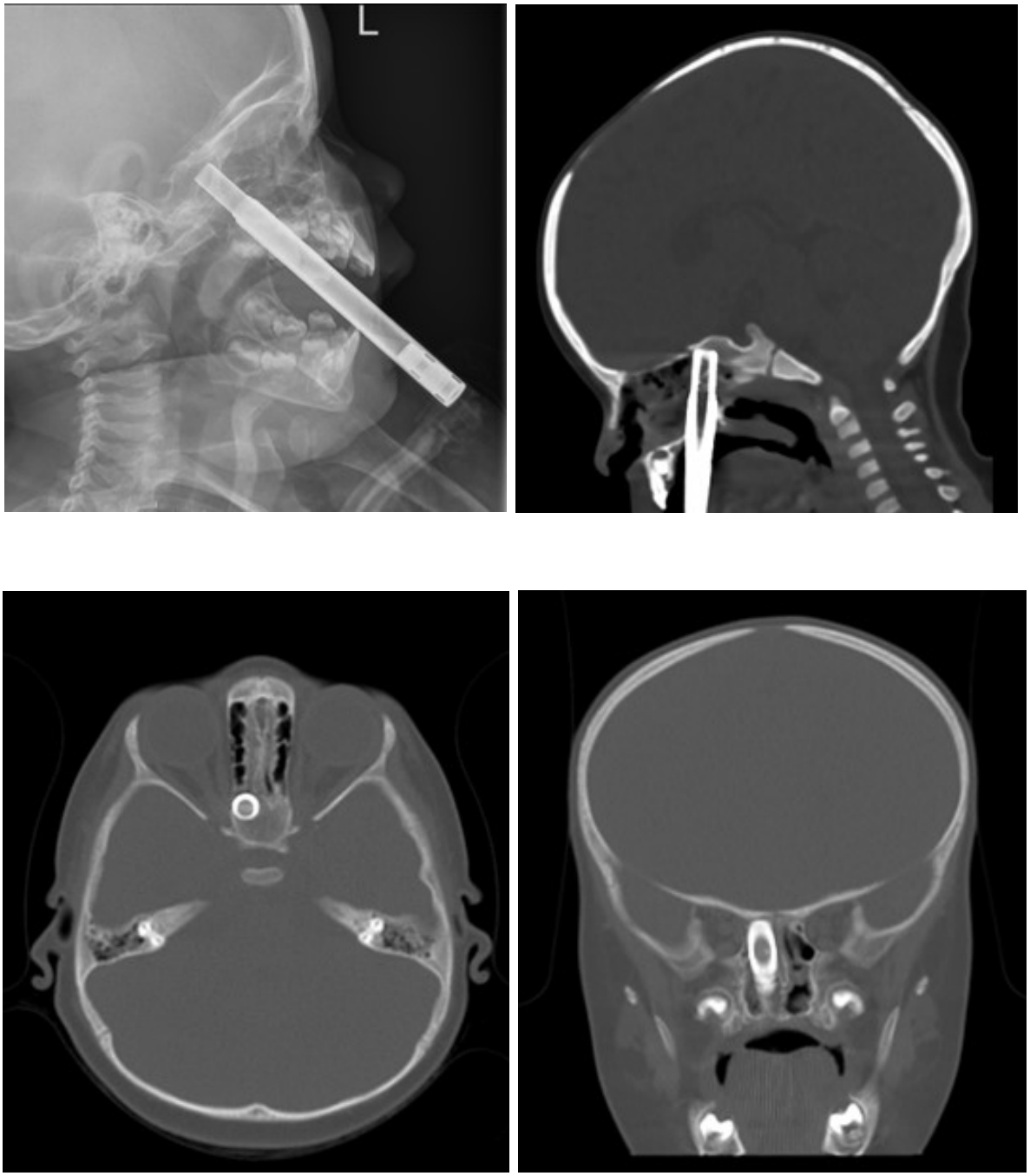
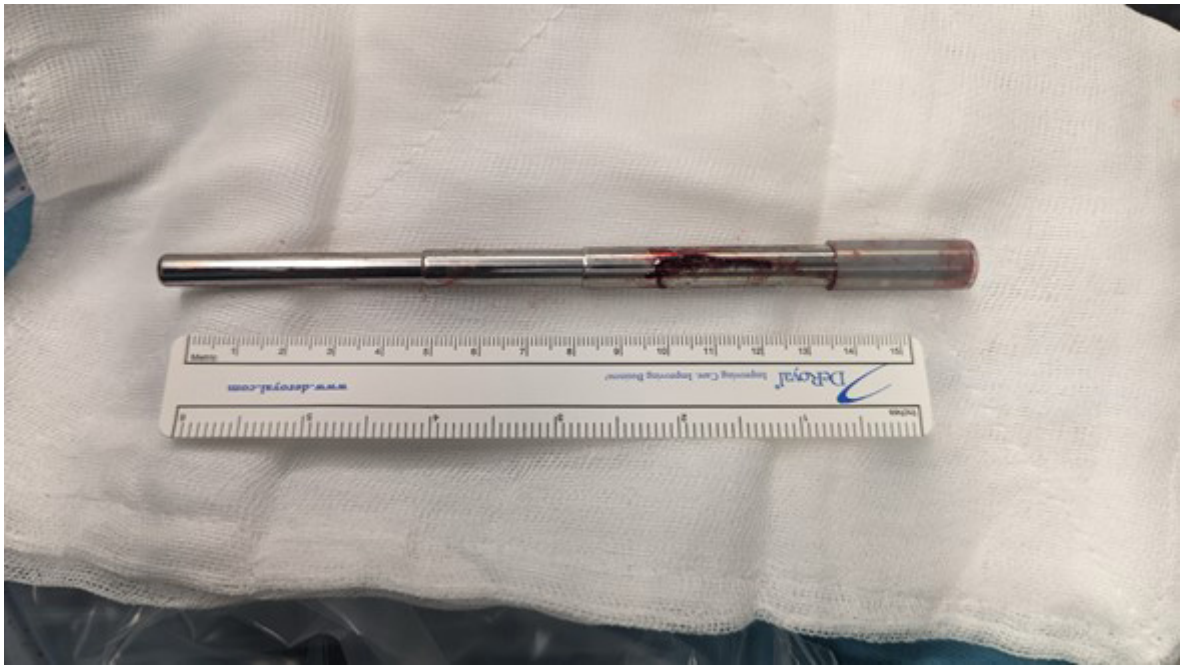


Figure 2: Intraoperative images demonstrating foreign body following removal.



children is likely under-reported and underestimated due to many oropharyngeal injuries being unwitnessed or managed without medical practitioner review.[1] In a single-centre review of 144 patients with penetrating oral cavity injuries, the soft palate was involved in 44.4% of cases followed by the hard palate in 18.1% of cases.[7] The most common mechanism for impalement injuries in paediatric patients is from falling with an object in the mouth.[7] Commonly reported objects include toothbrushes, toys, cooking utensils, stationary and sticks.[7]

Imaging in the evaluation of penetrating palatal injuries is controversial and most commonly considered to assess vascular injury. Reports of sub-acute neurological compromise from internal carotid artery injuries are rare but well described and there is debate in the literature regarding the use of imaging to assess for this.[1] Imaging strategies to evaluate for vascular injury vary from no imaging to ultrasound scan, plain film radiography, contrast CT and computed tomography angiography (CTA).[1,2] Factors that have been shown to increase the likelihood of a CTA being performed following oropharyngeal trauma include lateral injury, soft palate injury, increasing wound severity and otolaryngology consultation.[1] Despite this, the severity of the injury has not been shown to correspond with an increased likelihood of vascular injury or neurological sequelae.[1] In five large, recent studies, there was a 0.6% risk of internal carotid artery injury (2/335) and 0% incidence of neurological sequelae.[1–5] Severe neurologic sequelae have been documented from minor and seemingly innocuous soft tissue injuries and symptom onset is highly variable (3–60 hours post-event).[1,5] Due to the paucity of literature and heterogeneity of presentations, it is difficult to recommend an optimal management strategy for radiological assessment.[1] Soose et al. rationalise using CTA in practice due to its relatively low cost, accessibility, speed and low morbidity. They adopt an approach of obtaining CTA in all lateral soft palate and peri-tonsillar injuries regardless of severity.[1] In the absence of clear evidence in support for or against imaging, it is reasonable for an individual or institution to adopt either approach; however, the authors would advocate for a consistent management approach with local auditing of outcomes.

The clinical concerns in our case differed from soft palate oropharyngeal injuries, and imaging was obtained to determine the risk of intracranial injury and the potential need for neurosurgical input. In this clinical case, the patient was able to tolerate imaging despite her young age. If the patient was

not able to proceed with this, we likely would have abandoned cross-sectional imaging and prioritised transfer. While helpful, cross-sectional imaging before the transfer was not essential, and we would not have advocated for sedation while the patient was still in a rural setting with a potentially compromised airway.

The majority of oropharyngeal penetrating wounds do not necessitate operative intervention. Rates of surgical intervention for oral cavity and oropharyngeal trauma range from 6 to 11%, primarily for closure of gaping wounds with additional indications including haemostasis, airway concerns and foreign body removal.[1–3] Given the relative rarity of foreign bodies penetrating the hard palate, there is no consensus on the preferred method for securing the airway. Previous reports have utilised techniques including removal before intubation, fibreoptic intubation and oral intubation around the foreign body.[8,9] Retrospectively, in an emergency airway situation and with the knowledge of no obvious intracranial penetration of the foreign body, consideration of foreign body removal and intubation may have been considered if this situation had occurred. If the foreign body had been removed before arrival at our centre, a decision likely would have been made to proceed to the theatre for examination under anaesthesia due to the location of injury and difficulty in obtaining a reliable clinical assessment in this age group.

The use of antibiotics in oral cavity and oropharyngeal traumatic injuries is common (70–89%[1–5]); however, evidence to support their use is limited.[1] In a single-centre study of 205 cases, only three patients (1.4%) developed infection. In a case series of nine rural patients, two patients (22.2%) had complications of infection with both instances attributable to retention of fragments of organic material following foreign body removal.[10,11] No trials have investigated the benefit of prophylactic antibiotics following mucosal injury in preventing deep space neck infection. There is limited evidence to provide consensus guidelines regarding the use of antibiotics. Either approach is justifiable; however, the authors would advocate for a consistent management approach with local auditing of outcomes.

Conclusion

This case highlights complexities associated with the management of paediatric patients with potentially compromised airways in rural settings and the potential dangers of rigid drinking straws for young children. Impalement injuries from drinking straws have been documented but, historically, have been relatively uncommon.[7] Rigid drinking straws will likely become increasingly common with the continued phasing out of single-use plastics. Clinicians and parents should be made aware of the associated risks.

COMPETING INTERESTS
The authors declare no conflict of interest in preparing this article.

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Review of the New Zealand Asthma and Respiratory Foundation's New Zealand Adolescent and Adult Asthma guidelines

Robert J Hancox, Richard Beasley, Lutz Beckert, Amy Chan, Nicola Corna, James Fingleton, Matire Harwood, Miriam Hurst, Susan Jones, Stuart L Jones, Zoe Manderson, David McNamara, Betty Poot, Jim Reid, Adrian Trenholme, Joanna Turner

Dear Editor,

The most recent version of the Asthma and Respiratory Foundation's New Zealand Adolescent and Adult Asthma guidelines was published in the *New Zealand Medical Journal* in 2020.[1] The guidelines had been updated to take into account recent evidence on the management of asthma: in particular, the evidence supporting anti-inflammatory reliever (AIR) therapy. An innovative approach was taken to incorporate this evidence into a simple three-step algorithm using a single inhaler as the recommended approach to inhaler treatment. Since the publication of the guidelines, AIR therapy has become widely used in New Zealand, coinciding with a marked reduction in hospital admissions for asthma.[2] The simple 3-step approach to AIR therapy advocated in the New Zealand guidelines has since been emulated internationally.[3] We believe that the adoption of these guidelines by health professionals has contributed to reducing the respiratory health burden across New Zealand. The guidelines have also been used to advocate for better access to asthma treatments, including the recent proposal to enable 3 months' supply of budesonide/formoterol inhalers and also include them on practitioners' supply orders in keeping with best practice AIR therapy.[4]

The expiry date for the 2020 guidelines was set for 2024. For this reason, the Scientific Advisory Board of the Asthma and Respiratory Foundation and the authors of the 2020 guidelines were invited to review the guidelines and compare these with the current Global Initiative for Asthma and other international guidelines. The consensus is that the 2020 New Zealand guidelines are still up to date and fit for purpose.

Inevitably, a few things have changed, and we note some of these here:

- Another budesonide/formoterol inhaler option has been approved and funded by Pharmac for AIR therapy—DuoResp Spiromax, in addition to Symbicort. Both are dry power inhalers. Vannair (a pressurised metered-dose inhaler) contains the same medications but is not formally approved for use as AIR therapy in New Zealand, although it has been approved overseas and appears to be widely used for this purpose.
- Although there has been no change in the biologic (monoclonal antibody) medications registered for asthma treatment in New Zealand, benralizumab is now funded as an alternative to mepolizumab for severe eosinophilic asthma in those meeting special authority criteria.
- Sodium cromoglycate and nedocromil are no longer available in New Zealand.
- Unfortunately, the My Asthma app is no longer available.

We believe that these changes in treatment availability make little material difference to the functionality of the guidelines and advocate for their continued use. We have therefore extended the guideline expiry date with a view to publishing the next update in 2027. If major new evidence emerges in the meantime, they will be reviewed earlier.

Yours sincerely,

The Scientific Advisory Board and 2020 guideline authors

COMPETING INTERESTS

R Hancox has received research funding from GlaxoSmithKline and AstraZeneca, and payment for lectures and advisory boards from GlaxoSmithKline and AstraZeneca, outside the submitted work. RH has participated in the Medical Research Institute of New Zealand; and is the medical director of the New Zealand Asthma and Respiratory Foundation. R Beasley has received institutional research funding from AstraZeneca and Teva, and personal fees from AstraZeneca, Avillion, Teva Cipla, outside the submitted work. RB was chair of the 2020 Asthma Foundation of New Zealand Adolescent and Adult asthma Guidelines group and was a former member of the Board of Directors of the Global Initiative for Chronic Obstructive Lung Disease. L Beckert has received payment for lectures and advisory boards from GlaxoSmithKline and AstraZeneca, outside the submitted work. A Chan reports research grants from AstraZeneca outside the submitted work. AC is current clinical director for Asthma New Zealand and was previously on the Board of Asthma New Zealand and the Scientific Advisory Board for Asthma Respiratory Foundation New Zealand. She is a member of the Respiratory Effectiveness Group (REG), ESPACOMP research, policy and implementation committee, working group lead for the European Respiratory Society Clinical Research Collaboration "CONNECT" and a member of the Global Asthma Network steering group. AC reports participation on the AstraZeneca and GSK advisory boards. AC is a member of the council board of the Pharmacy Council of New Zealand; medical committee member of the Auckland Medical Research Foundation; global lead for workforce transformation of the International Pharmaceutical Federation; research lead of the Commonwealth Pharmacists Association. AC has received a donation of smart spacers from Trudell Medical in support of a research project in asthma. J Fingleton reports grants, personal fees and non-financial support from AstraZeneca, grants from Genentech, grants, personal fees and non-financial support from GlaxoSmithKline, personal fees and non-financial support from Boehringer Ingelheim, outside the submitted work. JF is a past medical director of the Asthma and Respiratory Foundation New Zealand, and the past president of TSANZ NZ branch. Susan Jones has received speaker fees from GlaxoSmithKline and AstraZeneca, outside the submitted work. Stuart Jones has received payments for presenting at GP educational events and for participation in advisory groups by both GlaxoSmithKline and AstraZeneca. B Poot is a member of Pharmac's respiratory advisory committee. M Harwood reports a leadership or fiduciary role in the Hauora Māori Advisory Committee; MRINZ Board; MAS Foundation. N Corna reports advisory board participation for GSK; is a member of Respiratory Foundation New Zealand Expert advisory group and Vaping EAG; and is the New Zealand co-convenor TSANZ nursing SIG. D McNamara reports a leadership or fiduciary role in the Scientific Advisory Group Asthma and Respiratory Foundation of New Zealand; and is co-chair for the Paediatric Respiratory and Sleep Governance Group, Child and Youth Clinical Networks New Zealand.

M Hurst, Z Manderson, J Reid, A Trenholme, J Turner: no competing interests.

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https://nzmj.org.nz/journal/vol-138-no-1617/review-of-the-new-zealand-asthma-and-respiratory-foundation-s-new-zealand-adolescent-and-adult-asthma-guidelines

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The role of chelation for severe lead toxicity

William Boroughf, Adam C Pomerleau

To the editor,

We read with interest the clinical correspondence entitled "Lead pencil: a case of intractable abdominal pain secondary to lead poisoning" by Van der Sluis and Sutherland[1] and wish to offer some points of clarification of the discussion with respect to the efficacy of chelation in severe lead toxicity. The authors state, "*The role of chelation is debated in papers as to its efficacy in long-term reduction in lead levels*."[1] The evidence for chelation efficacy is, indeed, limited in part due to the ethics of randomising treatment in life-threatening conditions such as lead encephalopathy. Regardless, there is, in fact, clear consensus recommending the initiation of chelation in the setting of very high lead levels that are associated with cognitive abnormalities.[2,3] The World Health Organization (WHO), in particular, has issued a "strong recommendation" for the use of parenteral chelation in the setting of blood lead levels >70–100µg/dL (3.3–4.8µmol/L) in the setting of significant neurological abnormalities or overt encephalopathy. Parenteral chelation at these same levels is also "conditionally recommended" by the WHO if other severe complications, such as the intractable abdominal pain presented in this case, are present in the absence of overt encephalopathy.[3]

While the optimal agent for chelation remains controversial, the recommendation for chelation of any kind in severe lead toxicity is nonetheless strong given that the introduction of parenteral chelation has been historically associated with a marked reduction in mortality, as correctly noted by the authors. [1,5–8]

Importantly, cases of severe lead toxicity with encephalopathy or neurological abnormalities are clinically distinct from those of low-to-intermediate lead level elevations, the latter of which are more commonly encountered and often associated with chronic environmental exposure. In these cases, debate does exist regarding the efficacy and outcomes of chelation over environmental mitigation, particularly with respect to neurological development in the pediatric population with blood lead levels <45µg/dL (2.17µmol/L).[9] Again, these cases are clinically distinct from the case presented. Literature related to the neurological development of children chronically exposed to lead should not be conflated with literature related to overt, acute neurotoxicity and encephalopathy.

The management of lead exposure and toxicity is complex and requires careful consideration of the contextual details and clinical course of each case; there is no clear one-size-fits-all approach to management. As such, clinicians are strongly encouraged to consult with subject matter experts, such as their regional poisons centre, if considering and before initiating chelation therapy. The presented case also underscores the importance of consideration of lead exposure in the differential diagnosis of all cases of unexplained, recurrent abdominal pain and highlights the importance of specific, culturally informed questioning regarding Ayurvedic preparation use. We thank the authors for sharing their case.

COMPETING INTERESTS
Nil.

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Provision without vision: the need for a values-informed public health system

Harriet Wild, Lyndon Keene, Virginia Mills, Andrea Black

Professor Frank Frizelle's editorial " Infrastructure is not a cure: Aotearoa New Zealand's health crisis demands vision, not just buildings" [1] articulates two issues that go to the heart of our public health system's future. The first is that capital investment without a thoughtful, values-informed strategic direction risks outcomes unfit for purpose in Aotearoa New Zealand in the twenty-first century. The second, more foundational question, "*What kind of health system do we want, and how will we pay for it?*", has a third component—what values and choices inform these conversations?

The *Darzi Report* highlighted the need for the United Kingdom (UK) to reckon with the health of the National Health Service (NHS) and calls for a renewing of the social contract between the people and its health system.[2] In Aotearoa New Zealand, the *Health and Disability System Review* called for a "*refocussing of the system on people*", but failed to ignite or inspire collaboration that was needed between the system (policymakers), the workforce and the public through the reforms that followed.[3]

Our health system is vulnerable to the nexus of population change, politics and values that Frizelle describes, trapped in a cycle of perpetual transition with little connection to a galvanising vision for the health workforce or the communities our system serves.

This lack of vision to 2040 and beyond is mired in a 3-yearly political cycle that has entrenched popular myths like "there is no money", and "current levels of health funding are unsustainable".

These myths drive political choices and the prevailing narratives used to explain them. Budgets 2024 and 2025 transferred billions: NZ$3.7 billion in tax cuts in 2024, and NZ$12.7 billion in withdrawn pay equity claims to fund, in part, tax breaks for businesses.[4,5] There is plenty of money, and we can afford it—in fact, to ensure a healthy and productive working population contributing to government revenue, we can't afford *not* to invest in health.

The *Darzi Report* details the fallout of austerity on the NHS. These conditions are also present in Aotearoa New Zealand. The 2025 *Budget Economic and Fiscal Update* shows the Government's revenue forecasts are dipping, with a net NZ$14.5 billion drop in revenue for 2027 compared to 2023.[6,7] The economic outlook has shifted as a result of policy choices—and declining revenues risk the Government choosing to tighten its belt further.

In 2020, the Association of Salaried Medical Specialists (ASMS) published *Creating Solutions Te Ara Whai Tika: A Roadmap to Health Equity 2040*.[8] In the wake of a global pandemic, protracted health reforms and growing unmet need, its vision for an accessible, equitable health system grounded in Te Tiriti o Waitangi remains.

Proportionate universalism for health equity

Frizelle points to "*equity and realism*" as guiding principles for a public health system that delivers for Aotearoa New Zealand, while recognising its limitations. Equally, the *Pae Ora (Healthy Futures) Act 2022* notes that the "*Minister, the Ministry and each health entity must be guided by the health sector principles as far as reasonably practicable … including any resource constraints.*"[9]

An equitable approach to health funding and service delivery through proportionate universalism would acknowledge limitations while moving beyond scarcity narratives: improving health for the *whole population* while simultaneously improving outcomes for those most disadvantaged at a greater pace. "*Even if no political party is likely to immediately implement* [a fully-free public healthcare system], this should still be the vision*, a metaphorical marker towards which more incremental reforms can aim.*"[10]

A bipartisan accord for health

There have been recent calls to take the politics out of health. What should be taken out of health is short-termism—temporary fixations that replace and distract from longer-term visions.

The recent *Health Infrastructure Plan* may purport to move beyond the quick fixes short-termism inspires, but there is little that suggests it is bound by anything more than reactivity.[11] There is no reference to the *Pae Ora Act* or Te Tiriti o Waitangi. In short, there is reference to provision, but it is without vision.

To return to the example of the NHS, in 2023 a warning was issued by the chief executives of three health policy institutes: "*Persisting with the current addiction to short-termism and eye-catching initiatives will mean that the NHS will fail to adapt to the huge challenges ahead … It is time to move away from quick fixes and over-promising what it can deliver and give it the tools it needs.*"[12]

With a few edits, this sentence could apply equally to Aotearoa New Zealand and its health system. Facing a future of increased unmet need, worsening workforce shortages and declining revenue, Aotearoa New Zealand must choose to invest rather than entrench austerity as well.

COMPETING INTERESTS
Nil.

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URL
https://nzmj.org.nz/journal/vol-138-no-1617/provision-without-vision-the-need-for-a-values-informed-public-health-system

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Deep X Ray Therapy, with an Account of Twelve Months' Results

By Percival D. Cameron, M.D., Edin.

The object of this paper is to place on record the results of twelve months' work in the treatment of cancer and some non-malignant conditions with intensive or deep therapy X-radiation.

I have purposely let a year elapse before publishing any of my results, and even now have a hesitancy in calling them results when a minimum of five years has, by general consent, been cited as the least time that must elapse before a cure can be claimed.

Until recently, limited by the apparatus at our command, carcinomatous conditions were treated with rays of low penetration, giving doses up to the tolerance of the skin, in the hope that some good might result. Sometimes good results were obtained, particularly in superficial conditions. The physicist came to our aid and showed us that the amount of radiation that could be absorbed and therefore turned to biologic account could be definitely measured at any depth, and, most important of all, that this absorption varied with the voltage applied to the X-ray tube. By means of a water phantom, the practical equivalent of the human tissues, and an ionisation chamber the radiation at any depth could be given as a percentage of the dose falling on the surface, that is to say, the skin.

These results showed, first, how little of our old type of radiation even got beyond the skin layers, and second, that voltages of the order of 200,000 must be used if anything like an even irradiation of the human body was to be obtained.

Many practical difficulties having been overcome, the instrument-makers evolved a machine and an X-ray tube that would stand up to the enormous potential required for long periods of time, giving a certainty of output impossible to obtain with the older types of machine. In fact with the modern transformer our requirements have been met, and one is as certain of the dosage that is being delivered at any depth as is humanly possible.

Again, during the last year the X-ray tube which suffered from an excessively short life on account of the target running white hot, has been replaced by a tube cooled by an elaborate water-cooling system, and which gives an output of X-rays increased about six times. I have been fortunate enough to obtain one of these tubes with the most important result that treatments which formerly extended over four to five hours can now be completed in about one-fifth of that time. The advantage to the patient, who must remain immobile during irradiation, is at once obvious, while the Röentgen sickness that was a feature of deep therapy, does not occur with these shortened exposures.

To turn to the patient. Each case must be treated as an individual, and as accurate a diagnosis as possible made as to the size and location of the tumour, with its possible extensions into the deper tissues and lymphatics. The whole of this field must be covered with a homogeneous dosage of radiation, and to this end it is usual to treat from three or four ports of entry. It is not necessary to enter into the calculations except to state that they can be accurately made to 1 per cent. of the unit erythema dose.

We thus have the conditions to administer to every part of a tumour a definite dose of X-rays, and, if it will react, we shall get that reaction.

Unfortunately, there is a vast difference in the sensibility of tumours in the human body, varying as they do accordingly to type, location, and extent, with possible other factors of which we are totally ignorant, and while some will vanish completely, others prove quite intractable, and a third class will remain more or less inert.

With our present knowledge it is impossible to predict exactly how any tumour will re-act to radiation. My figures show about 20 per cent. apparent cures, therefore one might say the cancer patient has one chance in five for a satisfactory result.

The situation of the growth is evidently one of the important factors as indicated by my statistics. For instance, all the mouth and jaw cases have responded well, as have a reasonable percentage of cancers of the cervix uteri, bladder, breast, thyroid, and prostate, whereas cancers of the œsophagus, larynx, stomach and colon appear to be refractory. One case of œsophageal carcinoma

has proved to be an exception to this rule.

All my cases of gastric carcinoma are dead, although one large tumour diagnosed at operation and for one reason and another not treated until some months later, subsided in a most dramatic manner, and for a short time one had hopes that the patient might recover. Some weeks later, however, the patient developed a large swelling containing B. coli pus in the abdominal region which carried her off. A cancer of the larynx was improved out of all recognition on two occasions, but the improvement finally failed to hold. So that even in the refractory cases sometimes extremely striking but not permanent changes occur.

Erratum

URL: https://nzmj.org.nz/journal/vol-138-no-1616/optimising-the-use-of-certification-findings-to-support-healthcare-quality-measurement-and-improvement

Optimising the use of certification findings to support healthcare quality measurement and improvement

Jerome Ng, Jacky Chan, Jerson Valencia, Kaushik Kaushik, Fran Voykovich, Marama Tauranga, Andrew Connolly, Vanessa Thornton

First published in: *2025 Jun 6; 138(1616)*.

On 27 June 2025, one correction was applied to this manuscript to ensure the correct author affiliation was provided:

1. In the author information section on page 105, the author affiliation for Marama Tauranga originally read: "Marama Tauranga: Deputy Chief Nurse, Office of the Chief Nurse, Health New Zealand, Gisborne."

   We have corrected this to read: "Marama Tauranga: Interim Chief Nurse | GM Innovation and Transformation, Hauora Māori Service Directorate."