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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, marking the beginning of a rich 136-year history. It was a key asset of the New Zealand Medical Association (NZMA) up until July 2022.

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Risk factors for readmission in patients with acute diverticulitis: a retrospective study at Auckland City Hospital
Stina Höckert, Patricia Maldonado Valdivieso, Rebekah Jaung, Pamela Buchwald, Ian Bissett

After acute diverticulitis, patients who presented with a collection, a previous history of the disease or Māori origin have a higher risk of recurrence. The findings about ethnicity needs further investigation utilising appropriate research methodologies.

Doctors’ views on the impact of the absence of an in-person rheumatology service at a major New Zealand hospital
Sinead Donnelly, Yesim Ersoy, Rebecca Grainger

Rheumatic diseases often present with musculoskeletal symptoms but can affect any body system. Rheumatologists are the medical specialists (Physicians) specifically trained in, and are expert in, assessing and managing rheumatic diseases. Best practice requires rheumatologists to be involved in all stages of care of people with rheumatic diseases. Wellington Hospital does not have any rheumatologists on staff. If a person admitted to Wellington Hospital (inpatients) has or could have a rheumatic disease, the doctors at Wellington hospital have to use telephone advice from rheumatologists at nearby Hutt Hospital. This is unusual in that all other large hospitals in Aotearoa New Zealand have rheumatologists on site (on staff) and patients are seen by the rheumatologist during that admission and all other medical specialities are available for in-person consultation at Wellington Hospital. Doctors on the internal medicine service at Wellington hospital told us this anomaly had three main impacts: 1) a negative impact on quality of patient care, which is inequitable to other nearby DHBs; 2) workarounds are found; and 3) doctors’ knowledge of rheumatology and education opportunities suffer. Best practice was considered to be an in-person rheumatology consultation service, as offered at the six DHBs surveyed. These data have important implications how future rheumatology services are provided in New Zealand public hospitals, highlighting potential problems when in person review by a rheumatologist is not available. This has implications for the re-organisation of the health system by Te Whatu Ora Health New Zealand when aiming to meet the expectations of the Pae Ora (Healthy futures) Bill 2022.

Improving early detection of colorectal cancer in Aotearoa New Zealand: how do the direct access criteria perform?
Rhys A John, Holly Wang, Valentyna Sylevych, James D Falvey

In New Zealand, patients with gastrointestinal symptoms can be referred for colonoscopy or other equivalent tests if they meet certain national criteria (which include an age range, symptoms such as the presence of blood in the stool, and whether the patient has a low red blood cell count caused by iron deficiency). Our study looked at all colonoscopy referrals to Christchurch Hospital through this referral pathway during the year 2018 to examine, amongst other outcomes, how the current criteria perform at detecting colon cancer. Of the 3,200 referrals, 128 patients were found to have colon cancer, which is only 4.0% of the referred patients. This can be thought of as the number of colonoscopies needing to be performed to detect one cancer being 25. Due to the pressure on colonoscopy resources in New Zealand, we argue that the current performance of the pathway is inadequate primarily due to the poor performance of a patient’s symptoms alone in determining colon cancer risk, and this leads to a large number of colonoscopies being performed with a low cancer “yield”. An improved pathway is required, which might combine symptom-based criteria with the addition of a test to detect the presence of blood in the stool (similar to the test used in the national bowel screening programme). This approach has been enacted in the UK in order to better target colonoscopy resources and has been shown to outperform symptom-based criteria.
Audit of Southern DHB B4 School hearing screening referral process: is there unmet need?

Thomas Oliver, Paul Joice, Patrick J D Dawes

The B4 School Check for hearing works well in Otago and Southland, it identifies those at risk of hearing loss and has good guidelines for managing these children. The check also shows that more Māori and Pasifika children may have glue ear compared to others and this warrants attention so that and hearing loss is managed as they commence school.

The effect of COVID-19 on orthopaedics in Aotearoa New Zealand—a survey of orthopaedic surgeons and training registrars

Matthew J Bowman, Scott M Bolam, Mark Wright

This study is surveyed New Zealand orthopaedic surgeons and registrars who are training to be orthopaedic surgeons to assess the impact of COVID-19. Both consultants and training registrars felt more burnt out because of the pandemic. Theatre productivity was believed to have reduced significantly. The disruptions caused by COVID-19 significantly impacted the training for both registrars and consultants.

Microvascular reconstruction outcomes from a New Zealand oral and maxillofacial surgery unit

Hannah Maher, Ellen Simpson, Thasvir Singh

Treatment of large defects in the oral cavity is unique because of the many roles of the oral cavity. Commonly tissue grafts including muscle, fat, skin, blood vessels +/- bone are used in the reconstruction. The operation is often long and requires specialist training. Waikato Hospital is the only tertiary centre in New Zealand where this surgery is done independently by oral and maxillofacial surgeons. The aim of this study was to audit the outcomes of patients treated by this department to ensure they are receiving quality care. The results show that the Oral and Maxillofacial Department at Waikato Hospital have results similar or better than most results from other departments both nationally and internationally.

Radiology and Te Whatu Ora – Health New Zealand in 2022. Why we should all care

Anthony James Doyle

Radiology is a key enabler of clinical medicine and has been shown to be highly cost effective. Demand and activity have increased over time, with demand for computed tomography (CT), magnetic resource imaging (MRI) and ultrasound (US) growing faster than population growth. Resources in the public sector have not kept up with demand, exacerbated by the COVID-19 pandemic. A reliance on an overseas trained workforce has resulted in critical shortages. This paper covers the areas of need and how these can be addressed over the next few years.
Suicide amongst doctors
Roger Mulder, Frank Frizelle

Mental health conditions are a significant part of the national burden of disease.\(^1\) Burnout, depression and anxiety are increasingly common diseases amongst doctors that impair their ability to perform at home and at work, as well as cope with life stressors.\(^2,3\) Burnout has been documented to affect 45% in a consultant survey in one New Zealand hospital prior to the COVID-19 pandemic, and this is likely to have increased with the present frustrating work environment.\(^4\) Overseas counties have found increased mental health issues amongst doctors in the present phase of the COVID-19 pandemic.\(^5,6\)

Documentation of increased suicide risk among doctors dates back to the nineteenth century. Estimates of suicide vary but are generally considered to be higher than the general population. The first published systematic review in 2004 estimated doctors' relative risk at 1.41 (95% CI 1.21–1.65) for men and 2.27 (95% CI 1.90–2.73) for women compared with the general population.\(^7\) However, a second more recent systematic review and meta-analysis reported that male physicians had a lower rate compared with men in general (0.67; 95% CI 0.55–0.79), and while female physicians still had a higher rate (1.46; 95% CI 1.02–1.91), it was considerably less than that reported 15 years prior. The study also compared suicide rates before and after 1980 and showed a significant decrease over this time.\(^8\)

Despite this encouraging news, there remain headlines,\(^9\) expressing concern over the suicide risk of doctors. It is possible that rates have again risen since the data used in the most recent review pre-dated COVID-19. Furthermore, the fact remains that although female rates have dropped, they remain significantly higher than the general population.

The most common contributors to suicide risk are burnout, depression, alcohol and drug disorders, and compassion fatigue.\(^10\) Most surveys report that rates of burnout and depression in doctors are higher than rates found in the general population. A series of meta-analyses estimate the prevalence of depression to be 27% in medical students, 29% in resident doctors, and up to 60% in practising doctors.\(^10\)

Rates of depression and thoughts of suicide in doctors are reported to be significantly higher than other professionals leading to speculation that personality traits associated with good doctoring—perfectionism, obsessiveness and competitiveness—may act against them when stressed.\(^11\) In a system where doctors feel unable to deliver the care required by their patients, they may suffer guilt for events beyond their control. Defences that are useful in surviving medical practices such as intellectualisation, dissociation and sublimation may make it harder to create attachments to others, or to recognise when the emotional burden of work becomes too much, therefore contributing to the spiralling of discontent and increased risk of suicide.\(^11\)

In addition, doctors tend to neglect their own need for psychiatric, emotional, or medical help, and are more critical of themselves and others.\(^7\) They are more likely to blame themselves for their illnesses and feel they have failed by becoming mentally unwell. Henderson et al. (2012) studied doctors out of work with mental illness and reported that most felt guilty, ashamed and fearful. They were also stigmatised within and outside the profession, leaving them isolated and sad. Most described a lack of support from colleagues, which may help explain why 41% of doctors said they would not disclose their mental illness.\(^12\)

Complaints and disciplinary processes are increasingly recognised burdens that weigh heavily on doctors, adding to their risk. A survey of doctors, comparing those with recent or current complaints, found that they were more than twice as likely to report thoughts of self-harm or suicidal ideation and, of those referred to the General Medical Council in the UK, around one in four had moderate to severe depression and/or anxiety.\(^13\)

In summary, suicide in doctors appears to be associated with multiple factors including: organisational and occupational stressors, such as long working hours, increasing administration, lack of support, and dealing with death; individual differences, such as personality, coping style, and skill set; and life stressors, such as relationship break-ups and complaints and litigation.
What can be done?

Interventions are more likely to be effective if there are good data. New Zealand does not have this. As far as we can ascertain, there are no data on New Zealand doctor suicide or attempted suicide rates. We have some data on doctors’ burnout which, at 45%, appears similar to most Organisation for Economic Co-operation and Development (OECD) countries. These rates in New Zealand medical students are higher, with around two-thirds reporting burnout.

There are no specific, evidence-based interventions to reduce suicide. The most useful interventions are those that focus on improving doctors’ mental health, since this is the most potent risk factor associated with suicide. The most comprehensive available review is one done recently by the Society of Occupational Medicine, on UK doctors. They noted that primary interventions, such as reducing workload and improving teamwork and communication, are the most effective. However, changing organisations is complex, time-consuming and costly, and almost impossible in the present time given the difficulty in bringing in staff from overseas at present. So, health care organisations prefer introducing initiatives that help individuals enhance their stress management skills. These secondary interventions include mindfulness, psycho-education modules, and general stress management training. Meta analyses suggest that these produce only minor benefits, and then only in those motivated and interested in them. The responsibility for protecting one’s health is firmly placed upon that person, with the organisation erroneously believing that these methods are sufficient to tackle what could be a pathogenic work environment.

Tertiary interventions are used when a doctor experiences ill health, to rehabilitate them and adapt their working conditions to their needs and circumstances. These are often implemented via occupational health and return-to-work programmes. Doctors may avoid treatment, as they fear sanctions from their employer and professional regulator, such as the Medical Council of New Zealand (NZMC). Their fears are not irrational, with examples of doctors who have spoken publicly about their mental health problems being disciplined. In New Zealand, doctors can discreetly inform the Te Kaunihera Rata o Aotearoa Medical Council of New Zealand, and the health team there plays an important role in supporting doctors. Medical Protection Society (MPS) and Medical Assurance Society (MAS) also fund access to confidential counselling services for their members, and doctors who need support should reach out to these organisations. The utilisation of these services has increased markedly in the last few years.

In summary, a systemic approach that incorporates primary, secondary and tertiary types of interventions is recommended. Primary interventions typically have the strongest impact on doctors’ mental health. The creation of Te Whatu Ora seems an ideal time to review workloads, administrative teamwork, and the complaints procedures that doctors are exposed to. There is evidence that integrating secondary interventions, such as resilience training, as part of primary changes can increase the success of both. It has been argued that burnout among doctors arises from maladaptive behaviours developed during medical education, and subsequently reinforced in healthcare organisations. Interventions to improve doctors’ mental health will only be effective if the “pathogenic” culture from which they work is addressed.

Resources

1737, Need to talk? – Free call or text 1737 any time for support from a trained counsellor.
Lifeline – 0800 543 354 or (09) 5222 999 within Auckland.
Youthline – 0800 376 633, free text 234 or email talk@youthline.co.nz or online chat.
Samaritans – 0800 726 666.
Suicide Crisis Helpline – 0508 828 865 (0508 TAUTOKO).

For MAS and MPC members – you can access EAP Services directly on 0800 327 669 24hrs a day or make contact via their website: (https://www.eapservices.co.nz/).
COMPETING INTERESTS
Nil.

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REFERENCES
Risk factors for readmission in patients with acute diverticulitis: a retrospective study at Auckland City Hospital

Stina Höckert, Patricia Maldonado Valdivieso, Rebekah Jaung, Pamela Buchwald, Ian Bissett

ABSTRACT

AIM: Approximately one in five patients with acute diverticulitis (AD) will experience a recurrence. This study aimed to investigate the factors at AD admission that correlate with recurrence and test the proposed risk of recurrence-score according to Sallinen et al.

METHOD: This retrospective study followed patients for five years who were admitted with operatively or computed tomography (CT)-verified AD at Auckland City Hospital from January 2012–June 2013. Demographic, laboratory, radiological and patient-related factors at initial admission were analysed in relation to readmission with recurrent AD and to test a risk score presented by Sallinen et al.

RESULTS: In the adjusted analyses, previous diagnosis of AD (OR, 7.3; 95% CI, 3.1–16.9), Māori ethnicity (OR, 5.7; 95% CI, 1.4–22.7) and complicated AD at index admission (OR, 2.5; 95% CI, 1.0–6.2), were all independent factors associated with readmission with recurrence. High-risk versus low-risk groups, according to the risk score, showed 71.4% and 18.6% recurrence rates, respectively.

CONCLUSION: History of diverticulitis and complicated AD are risk factors for recurrence. The finding of higher recurrence rate in Māori requires further investigation utilising appropriate research methodologies. The risk score presented by Sallinen et al. may be a useful predictor of recurrent AD.

The risk of developing acute diverticulitis (AD) in patients affected by diverticulosis is relatively low, approximately 4–7%. However, the prevalence of AD is rising, along with AD-related hospital admissions, which impacts on wider wellbeing as well as imposing socioeconomic costs.

Despite complete remission, including regression of clinical symptoms, approximately 20% of all patients will experience recurrence requiring admission. The risk of recurrence appears increased during the first year after the initial AD episode and in complicated disease.

During recent years, the management of AD has undergone paradigm shifts, with a trend towards a more conservative approach. Elective resection for patients with recurrent AD has been questioned and guidelines no longer recommend elective surgery based on certain number of previous episodes of AD. Furthermore, there is no evidence that a high fibre diet or medical agents prevent recurrences. Research on the factors at AD admission that correlate with recurrent AD requiring admission could help detect patients with higher likelihood of recurrence with complicated disease, possibly selecting those who would benefit from elective surgery.

Several attempts have been made to create a risk of recurrence tool in the decision making regarding aggressive treatment approach and elective resection. Sallinen et al. have presented a simple bedside risk score to predict complicated recurrence that consists of three parameters, including previous diagnosis of AD, abscess at index admission and corticosteroid use.

The aims of this retrospective study were to identify factors correlating with recurrent AD requiring readmission and test the risk score presented by Sallinen’s group.

Method

Patient population and data sources

All potential admissions for AD were identified by the discharge International Classification of Diseases (ICD)-10 code K57 under General Surgery at Auckland City Hospital between January 2012–June 2013. The National Health Index numbers were used to gather clinical data at index admission and AD readmissions for a follow-up period of five years.
Inclusion/exclusion criteria and definitions

Inclusion criteria for the index admission were all patients aged >18 years with computed tomography (CT) or intraoperative evidence of sigmoid AD. Cases with diverticulosis only, elective hospital admissions, diverticular bleeding, patients living outside Auckland District Health Board (ADHB) jurisdiction and those lost to follow-up were excluded. Patients who underwent acute surgical resection on index admission were excluded, as those with a previous resection would not pose the same risk of recurrent disease.

Recurrent AD was defined as a subsequent readmission with AD >30 days after index admission. Readmissions <30 days from the discharge from index AD were classified as treatment failure, and thus incorporated in the index AD cases.

Study variables at initial admission

At the time of the study, management of the patients was guided by the admitting doctor, and not by a formal protocol. Demographic information of each patient was collected, including age, sex and ethnicity. Vital signs were recorded, including temperature, heart rate, blood pressure, respiratory rate and symptoms of peritonitis. Blood tests, including C-reactive protein (CRP), white blood cell count (WCC), neutrophil count, sodium, potassium and creatinine levels, were collected. The following data were extracted from the patient record: hours to CT, modified Hinchey classification based on CT or intraoperative findings, nil by mouth orders, intravenous fluids, intravenous antibiotics, patient-recorded pain score in an emergency department, length of hospital stay, duration of symptoms, smoking status, previous abdominal surgery, medication including corticosteroids, non-steroidal anti-inflammatory drugs (NSAIDs) and immunomodulators, and comorbidities. Patients were classified in either the low- or high-risk group, according to the risk score presented by Sallinen et al., originally designed to identify complicated diverticulitis (see Table 1).14

Follow-up

Information regarding the five-year mortality and readmission rates for AD were collected. Readmissions in the absence of clinically verified AD, admissions for “elective operative interventions” due to AD and “postoperative complications” after AD surgery were not included.

Ethical approval for this study was obtained from the Auckland Health Research Ethics Committee (reference 000046) and the ADHB.

Statistics

Statistical analyses were performed using IBM SPSS Statistics version 25. The study population was outlined with descriptive statistics. Categorical variables were analysed with the Chi-squared test and Fisher’s exact test. Continuous variables were analysed using the student’s t-test and Mann–Whitney U test. Differences were considered statistically significant at a two-tailed p-value of <0.05. Multivariate analysis was performed for variables that were considered clinically appropriate and had a univariate p-value <0.1. Continuous variables were modified to dichotomous variables and used in a binary logistic regression analysis. As this study is retrospective it was not powered to explore details of subgroups, such as different ethnicities.

Results

Study cohort

In total, 217 patients affected by AD were reviewed. A total of 197 patients with non-surgically treated AD were included in the final study (Figure 1). All but one patient underwent CT imaging; the remaining patient was diagnosed with uncomplicated AD intraoperatively after suspicion of appendicitis.

Recurrent disease

During the follow-up period, 44 patients (22.3%) with a mean age of 53.5 (49.2–57.9) years had readmissions for recurrent AD. 30 (68.2%) of these patients had one readmission, eight (18.2%) had two readmissions, five (11.4%) had three readmissions and one (2.3%) had four readmissions (Figure 1). In patients with readmissions for recurrent disease, two patients (4.5%) underwent acute surgical resection on their first readmission. Overall, three patients (1.5%) had elective surgery with resection during the study period, of which all had previous readmissions for recurrent disease. Of those with recurrent disease, 10 patients (23%) had complicated AD classified by CT, 29 patients (66%) had uncomplicated AD and five patients (11%) did not have imaging during their recurrence and, therefore, were not classified. Māori patients had a significantly higher percentage of readmissions with recurrent AD compared to non-Māori (9/14 versus 17/183: p<0.01).
Figure 1: Study flowchart.

Abbreviation: AD = Acute diverticulitis
Table 1: Risk score for recurrence of complicated diverticulitis as suggested by Sallinen et al.\textsuperscript{14}

<table>
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<tr>
<th>Characteristics</th>
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<tr>
<td>CT: abscess</td>
<td>2</td>
</tr>
<tr>
<td>Medication: corticosteroids</td>
<td>3</td>
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Note: patients are divided into low risk (0–2 points) and high risk (>2 points).

Table 2: Descriptive statistics of patient demographics in the total study cohort and among groups of patients readmitted with recurrent acute diverticulitis (AD) and patients without readmission with recurrent AD.

<table>
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<tr>
<th>Characteristics</th>
<th>Total (%)</th>
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<th>Patients without AD readmission (%)</th>
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<td>44 (22.3)</td>
<td>153 (77.7)</td>
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<td></td>
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<tr>
<td>Age at index AD (years)</td>
<td>57.8 [55.7–60.0]</td>
<td>53.5 [49.2–57.9]</td>
<td>59.1 [56.6–61.5]</td>
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<tr>
<td>Age &lt;50 years</td>
<td>68 (34.5)</td>
<td>20 (29.4)</td>
<td>48 (70.6)</td>
<td>0.08</td>
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<td>Female sex</td>
<td>100 (50.8)</td>
<td>23 (23.0)</td>
<td>77 (77.0)</td>
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<td>Male sex</td>
<td>97 (49.2)</td>
<td>21 (21.6)</td>
<td>76 (78.4)</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Note: means and ranges were used for normally distributed data and median for non-parametric; % in brackets, if another not indicated. Other ethnicities include Fijian, Indian, Middle Eastern, Niuean, Asian, Samoan, Cook Islander and Tongan.
Table 3: Baseline characteristics at the time of index admission among the total study cohort, and in groups of patients readmitted with recurrent acute diverticulitis (AD) and patients without readmission with recurrent AD.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (%)</th>
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<th>Patients without AD readmission (%)</th>
<th>P-value</th>
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<td>n=197</td>
<td>44 (22.3)</td>
<td>153 (77.7 )</td>
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<tr>
<td>AD in history</td>
<td>68 (34.5)</td>
<td>28 (41.2)</td>
<td>40 (58.8)</td>
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<td>Previous abdominal surgery</td>
<td>73 (37.1)</td>
<td>16 (21.9)</td>
<td>57 (78.1)</td>
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<td>119 (60.4)</td>
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<td>7 (26.9)</td>
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<td>Ex-smoker</td>
<td>52 (26.4)</td>
<td>17 (32.7)</td>
<td>35 (67.3)</td>
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<td><strong>Comorbidities</strong></td>
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<td>27 (22.0)</td>
<td>96 (78.0)</td>
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<td>Diabetes</td>
<td>19 (9.6)</td>
<td>2 (10.5)</td>
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<td>Cardiac disease</td>
<td>34 (17.3)</td>
<td>6 (17.6)</td>
<td>28 (82.4)</td>
<td>0.47</td>
</tr>
<tr>
<td>Respiratory disease</td>
<td>22 (11.2)</td>
<td>9 (40.9)</td>
<td>13 (59.1)</td>
<td>0.05</td>
</tr>
<tr>
<td>Renal disease</td>
<td>13 (6.6)</td>
<td>2 (15.4)</td>
<td>11 (84.6)</td>
<td>0.74</td>
</tr>
<tr>
<td>Malignancy</td>
<td>6 (3.0)</td>
<td>1 (16.7)</td>
<td>5 (83.3)</td>
<td>1.00</td>
</tr>
<tr>
<td>Inflammatory disease</td>
<td>9 (4.6)</td>
<td>3 (33.3)</td>
<td>6 (66.7)</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Use of medications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steroids</td>
<td>4 (2.0)</td>
<td>2 (50.0)</td>
<td>2 (50.0)</td>
<td>0.22</td>
</tr>
<tr>
<td>Immunomodulators</td>
<td>3 (1.5)</td>
<td>2 (66.7)</td>
<td>1 (33.3)</td>
<td>0.13</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>9 (4.6)</td>
<td>1 (11.1)</td>
<td>8 (88.9)</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Abbreviation: NSAIDs = non-steroidal anti-inflammatory drugs.
Demographics of study population

The study cohort comprised of 100 (50.8%) women and 97 (49.2%) men (Table 2). The mean age for patients with AD readmission was significantly lower, 53.5 (49.2–57.9) years versus 59.1 (56.6–61.5) years (p=0.03). In the study population, 158 patients (80.2%) were New Zealand European or European, 14 patients (7.1%) were Māori and 25 patients (12.7%) were categorised as Other.

Medical history

Of the 44 patients with a previous diagnosis of AD, 28 (63.3%) had readmissions with AD, compared to 40 of the 155 patients without previous history of AD (26%) (p<0.01) (Table 3). Smoking status failed to be significant for AD recurrence (p=0.06), thus non-smoking status appeared protective for recurrence. Among the current smokers, 14 patients (53.8%) had complicated index AD, compared to 24 (20%) of the non-smoking patients and 16 (31%) previous smokers (p<0.002). No significant differences in specific comorbidity rates were seen in the AD readmission or non-readmission groups, except for respiratory disease (p=0.05). Only a few patients met the criteria for steroid, immunomodulator and NSAID use and there were no significant differences (Table 3).

Clinical data

No significant differences in the vital parameters, duration of symptoms prior to admission, length of stay for index admission or laboratory tests were noted between the AD readmission group and non-readmission group. None of the patients in the study cohort ended up at the ICU on their index admission.

Of the study population, 54 patients (27.4%) were classified as having complicated disease on index admission. Of those with complicated index AD, 18 (33.3%) had readmissions compared to 26 (18.2%) of those with uncomplicated index AD (p=0.02). The five-year mortality in the study population was 13 out of 197 (6.6%) with no significant difference between the two groups.

Multivariate analysis

The binary logistic regression analysis identified three factors associated with recurrence: history of AD (multivariate odds ratio (OR) 7.3; 95% confidence interval (CI) 3.1–16.9), Māori ethnicity (multivariate OR 5.7; 95% CI 1.4–22.7) and complicated index AD (multivariate OR 2.5; 95% CI 1.0–6.2).

Sallinen risk score

Fourteen patients (7%) were classified as having high-risk AD on index admission and 183 patients (93%) as having low-risk index AD. Of those with high-risk AD on index admission, 10 patients (71%) had readmissions with recurrent AD versus 34 patients (19%) in the low-risk group. The OR for AD readmission in the high-risk group compared to the low-risk group was 11.0 (95% CI 3.2–37.0).

Discussion

The management of recurrent diverticular disease remains controversial since there are no clear indications for elective surgery. Despite the fact that elective surgery is associated with lower morbidity and mortality compared to emergency surgery, it still poses some risk for patients who may have a very low risk of recurrent AD. The ultimate goal of this study is to help clinicians identify those patients with a very high risk of readmission for recurrent AD where resection may be indicated. Our retrospective study revealed a readmission rate for AD recurrences of 22%. The risk score presented by Sallinen et al identified a subgroup with a much greater risk (71%) of readmission with AD. Adjusted multivariate analysis showed that previous diagnosis of AD and complicated disease were related to recurrence.

This study tested the risk score presented by Sallinen et al., categorising our patients into high-versus low-risk groups. To our knowledge this is the only risk score described for AD. Our findings indicate that this risk stratification model is a useful clinical tool, with an 11 times higher risk of AD recurrence in the high-risk group compared to the low-risk group. However, there are some differences between the present study and that of Sallinen et al. Their study used a different definition for recurrent AD and included those diagnosed and treated as outpatients in their uncomplicated group. They presented their score as a risk stratification model in the prediction of “complicated” recurrent disease, rather than “overall” AD recurrence. In fact, when Sallinen et al. applied this risk stratification model exclusively for uncomplicated recurrence, it turned out not to be a reliable predictor. Sallinen et al. did not report the utility of this risk score for overall recurrence in their study. Our results, however, indicate that this model is a useful tool and could potentially be used as a predictor of “overall” AD readmission, not only for complicated recurrence. Furthermore, Sallinen et al. did not precisely
describe how they defined corticosteroid use, which could potentially impact the utilisation of the risk score. Finally, only 14 patients were classified as high risk, and although the vast majority of these developed recurrent AD, this only made up a quarter of all those with recurrent AD, as 19% of the low-risk group developed recurrent AD. This lack of sensitivity of the score must be considered in the clinical setting, thus the score itself is insufficient for decision making regarding resection.

Previous diagnosis of AD was the strongest factor correlated with AD recurrence. Several studies have suggested that patients with more than three medically treated episodes of AD had a threefold increase in risk of future recurrence, regardless of previously uncomplicated or complicated AD episodes. This study did not investigate the risk of recurrent AD after one or more recurrences, but it did emphasise that a history of AD is a strong risk factor for recurrent disease.

Participants of Māori ethnicity had a significantly higher risk of readmission for AD recurrence and a lower mean age at index admission compared to NZ European participants. This was an unexpected finding, which the study was not designed to identify or explore. The total number of Māori participants was low and although the increased risk of recurrent admission for AD in Māori was statistically significant, its clinical significance is unknown at present. Previous studies have shown inconclusive results regarding ethnicity and recurrent AD. Bose et al. proposed that American Caucasians were less likely to suffer recurrent AD compared to other ethnicities, whereas Rose et al. suggested the opposite, implying that Asians and Pacific Islanders had lower risks of recurrence.

We note the difference between recurrence of AD (disease-related outcome) and recurrence requiring hospital admission (disease severity, access to health services including community services). Our measure of readmission with recurrent AD may reflect health service factors other than those directly related to AD, including inequities in access to community-based management of AD versus secondary/tertiary hospital care. These factors are important for the optimal management of AD and may reduce the need for hospital admissions with recurrence, but sit outside the scope of this study.

The higher comorbidity among Māori people in contrast to the non-Indigenous population is well known and has been related to socio-economic disadvantage and poorer access to healthcare. Additionally, studies have shown that Māori receive lower quality care, have a lower life expectancy by eight to nine years and the mean age of AD presentation is lower. The finding of higher recurrence rate in Māori requires further investigation utilising appropriate research methodologies.

Complicated AD on index admission was the third factor associated with recurrent disease, which is consistent with earlier studies. Studies on recurrent AD have shown higher likelihoods of complicated AD on the first admission compared to recurrent episodes. Due to our study design, which included clinically verified readmissions and not only CT-verified cases, we were unable to investigate the true rate of readmitted uncomplicated vs complicated disease. Several earlier studies have concluded that abscess formation on first admission is correlated with readmission. Abscess size on the CT images was not routinely measured by a radiologist and as a result, we could not investigate the relationship between abscess size and recurrence rate.

This study was limited by several factors; primarily its retrospective study design, relatively small study population, the low number of Māori in the cohort, no formal treatment protocol, abstractors not blinded and follow-up limited to Auckland City Hospital. However, the present inclusion criteria resulted in a well-defined study cohort that was managed and treated in a similar way and allowed a complete five-year follow-up period. The fact that a low number of patients had a bowel resection (7.5%) in the index admission indicates that the recorded recurrence rate is likely to be an accurate estimate of the risk of readmission with recurrence in those patients presenting with AD.

In conclusion, the risk score presented by Salinen et al. appears to be a useful tool to identify a group with a high likelihood of readmission after an episode of AD. Ethnic differences in readmission with recurrent AD need further attention in larger study cohort.
COMPETING INTERESTS
Nil.

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REFERENCES


Doctors’ views on the impact of the absence of an in-person rheumatology service at a major New Zealand hospital

Sinead Donnelly, Yesim Ersoy, Rebecca Grainger

ABSTRACT

AIM: To describe the views of doctors in one hospital service about the impact of the lack of an in-person rheumatology consultation service and to identify service improvements informed by those views and services at comparable district health boards (DHB).

METHODS: Qualitative study using focus groups of resident and senior medical officers (RMOs and SMOs) from the general medical service at Wellington Regional Hospital. A national survey of DHB heads of rheumatology was also used.

RESULTS: Three major categories emerged from the focus groups with 16 RMOs and 15 SMOs: 1) a negative impact on quality of patient care, which is inequitable to other nearby DHBs; 2) workarounds are found; and 3) doctors’ knowledge of rheumatology and education opportunities suffer. Best practice was considered to be an in-person rheumatology consultation service, as offered at the six DHBs surveyed.

CONCLUSIONS: Lack of an in-person rheumatology consultation service in this large hospital had perceived negative impacts on patient care and doctors’ education and competence. Providing an in-person consultation service seems highly desirable but would need more rheumatology capacity regionally. The themes identified may also be relevant to other hospital or specialist services that are not equitably accessible in other parts of the New Zealand health system and thus inform the transformation of the health system required by the Pae Ora (Healthy Futures) Bill 2022.

Rheumatology is a medical sub-speciality with specific expertise in assessing and managing inflammatory and autoimmune conditions. In hospital medicine, rheumatologists contribute to quality patient care by facilitating early diagnosis or initiating early management, including for common conditions like gout. While rheumatic diseases often present with musculoskeletal symptoms, patients can be admitted with undifferentiated illness, systemic symptoms or symptoms of single or multiple organ dysfunction that benefit from the diagnostic expertise of a rheumatologist. Furthermore, people with established rheumatic disease are hospitalised for intercurrent illness or complications of rheumatic disease or its treatment and would benefit from rheumatologist review during their inpatient stay. In large hospitals up to 1% of admissions may have rheumatology service consultation, with most frequent disease concerns referred including vasculitis, systemic lupus erythematosus and gout.

In the Wellington region, the regional rheumatology service has always been based at Hutt Hospital (Hutt Valley District Health Board (HVDHB)). It provides specialist rheumatology care to all patients domiciled in the HVDHB, the Capital and Coast DHB (CCDHB) and the Wairarapa DHB. There is, and to our knowledge has never been, a formal in-person specialist rheumatology consultative service at Wellington Regional Hospital (WRH), part of CCDHB, a tertiary referral centre servicing a population of about 320,000. However, telephone advice is available from the on-call rheumatologist at HVDHB. The impact of the absence of an in-person rheumatology consultation service at Wellington Hospital on patient care is difficult to assess directly. Therefore, we undertook this study with the aims to: 1) explore the perceptions of doctors in the general medicine service on the impact of the absence of inpatient rheumatology consultation service at WRH and elicit their opinions on appropriate rheumatology service provision at WRH, and 2) describe the provision of rheumatology consultation for inpatients at comparable district health boards (DHB) in Aotearoa New Zealand.

Methods

Study setting

CCDHB provides care to people residing in Wellington to north of Waikanae, a population of 320,640. Wellington Regional Hospital is the main...
CCDHB hospital. The internal medicine inpatient service is staffed by 18 senior medical officers (SMO), who are physicians, comprising 12.6 full-time equivalents (FTE), and 19 full-time resident medical officers (RMO), excluding relievers. The service admits approximately 7,800 patients per year, with mean length of stay of 3.2 days.

Data collection
We used focus groups of doctors on the internal medicine service to explore and understand their views of impacts of the absence of an in-person rheumatology consultation service at WRH and to elicit their opinions on appropriate rheumatology service provision at WRH. The internal medicine service was chosen as this service would be responsible for the care of medically unwell patients, with either symptoms that could be new onset rheumatic disease or people with established rheumatic disease diagnoses, admitted for reasons related or unrelated to that disease.

Physician SMOs and RMOs—generally postgraduate Year 1 and 2 doctors and medical registrars (RACP basic trainees)—were invited by email to participate in focus groups held at times convenient around service delivery. Participation was voluntary, and written informed consent was obtained. In addition, we invited potential participants unable to attend a focus group to offer responses to focus group questions via email.

Focus groups were audio-recorded using a secure digital device, transcribed and analysed using thematic analysis. The focus group opening question was “What are the impacts of the absence of an in-person rheumatology consultation service for inpatients under the medical teams at Wellington Hospital”. Follow-up questions were flexible depending on responses. Once no new ideas were elicited, we asked the following three questions to explore confidence in rheumatic disease management and opinions about how an appropriate rheumatology consultation service for this hospital would potentially be organised:

What is your confidence/experience with rheumatic disease assessment and management (e.g., rheumatoid arthritis, psoriatic arthritis, lupus, vasculitis)?

What rheumatology consultation service would you feel is reasonable to expect at Wellington Hospital to provide optimal patient care to people admitted with potential or diagnosed rheumatic disease?

The research method was qualitative descriptive with an inductive approach to analysis using an interpretive research lens. Inductive analysis was most suited to this research as it allowed varied raw data text to be condensed into a brief summary format. Furthermore, general inductive analysis establishes clear links between the research objectives and the summary findings derived from the raw data, and ensures that these links are both transparent and defensible.

Data analysis
Data collection and analysis occurred concurrently. The focus group transcripts were read and analysed to identify emerging codes, themes and categories. Themes were derived, which encompassed similar codes. Analysis of and reflection on the themes led to the development of categories. Themes and categories gained further supporting evidence or reduction in weighting and outlying or possible deviance in the analysis noted. To avoid potential investigator bias and validate findings, the transcripts were reviewed by the three researchers together.

Reporting has followed COREQ guidelines with a checklist provided in Appendix 1.

Rheumatology inpatient consultation services at other DHBs
To describe rheumatology services at other DHBs, we invited the Clinical Directors/Clinical Heads of Department (CD/CHOD) at all DHBs accredited for rheumatology training with the Royal Australasian College of Physicians (RACP) to complete a short survey on Qualtrics about their DHB rheumatology service. Data included the number and total FTE of rheumatology SMO, the number of advanced trainees in rheumatology (registrars) and a free-text description of the inpatient consultation service, including an estimate of consultation requests each week.

Ethics
Ethical approval was granted by the University of Otago Health Research Ethics Committee reference code 20/265.
Results

Doctors’ views on the impact of the lack of in-person rheumatology consultation service

Of the 17 SMO physicians invited, 10 participated in a focus group and five provided email responses. Sixteen RMOs participated in a focus group, with 24 invited. The doctors’ views on the impacts of no in-person rheumatology consultation service for medical inpatients organised into three categories: 1) a negative impact on quality of patient care, which is inequitable to other nearby DHBs; 2) workarounds are found; and 3) doctors’ knowledge of rheumatology and education opportunities suffer. We present each of these and then summarise the suggestions offered for an appropriate rheumatology service at WRH.

Negative impact on quality of patient care

In describing the impact of no in-person rheumatology service, doctors first outlined the shortcomings of the current telephone consultation service. While doctors knew they could seek rheumatology advice by telephone or refer a patient to the rheumatology outpatients clinic, both options were perceived as deficient. Doctors found it difficult to contact rheumatologists over the phone: “They’re difficult to get hold of; it’s always a challenge to pin down the right person” – SMO 2. Being unable to view the rheumatologist on-call roster at Hutt Hospital was frustrating. Telephone advice was considered inferior to in-person patient review, particularly for complex clinical situations: “I don’t think our current system of ad-hoc phone discussions is adequate” – SMO 13. Only two of 15 SMOs considered the phone advice service satisfactory, and one SMO had never needed a rheumatological consultation.

Doctors viewed the wait time for patients to be seen at the rheumatology clinic as too long: “If it was my mother or grandmother, I think I’d rather have them figure it out sooner” – RMO 10; and “A review in outpatients is a bit of a ‘fire and forget’ option” – RMO 4. In addition, the referral process and lack of ready access to patient outcomes information were unsatisfactory: “I just do some online referral that will disappear into a black hole” – SMO 9.

Overall, doctors described the rheumatology service options as so limited, they were functionally non-existent, and the situation was also described as “Completely negligent….We are really not practising the best care for the patient” – SMO 10. SMO 9 summarised, “People are not getting expert care at the front door”. There was also perceived inequity of healthcare across the region: “The people in Wellington have actually missed out badly” – SMO 1. For example, doctors noted that patients of the HVDHB seen at Hutt Hospital have easy access to specialist rheumatology care with a rheumatology registrar, rheumatology clinics and rheumatologists on site.

Doctors found workarounds

Doctors explained that they used other services to compensate for the absence of an in-person rheumatology consultation service. These services included orthopaedics, interventional radiology, immunology, renal medicine and dermatology. For example, orthopaedics were frequently consulted for diagnostic joint aspirations. However, orthopaedic staff were described as sometimes resisting these requests (quoting orthopaedics): “We are not a joint aspiration service” – SMO 11. This led to other referrals: “This pushes it onto interventional radiology, it can be a lot harder to get a slot and can delay making a diagnosis” – RMO 7. On other occasions, SMOs described revising techniques for joint aspiration using YouTube or, as RMO 1 said, “I would just give it a go”.

Doctors explained that immunology was regularly consulted as a surrogate for rheumatology since immunologists were on-site with easily accessed follow-up clinics and documentation. Renal physicians were also consulted for rheumatic conditions: “Currently I would speak to a renal physician, for someone with lupus or vasculitis. Often there’s renal issues, and they’re reasonably well placed to deal with the condition and medication” – SMO 2. Dermatology were also consulted “if its vascular type things and there’s a rash, and we go to dermatology and they’re like you should do this” – RMO 5.

Doctor’s knowledge and education suffer

Most SMOs reported that their confidence in rheumatology was lacking or “about average”, but this was considered insufficient: “We’re amateurs ... skating on thin ice” – SMO 1. There was uncertainty about knowledge of rheumatic diseases: “I’m possibly not as up to date as I should be but of course I don’t know that I’m not as up to date as I should be because I’m not asking for anyone else to help me.” – SMO 7. This was viewed as a patient safety issue: “It’s possible that people are being harmed without us knowing because we just
In-person rheumatologist service would be ideal: "I think having someone come for a short time like once a week or once every second week I think it would enhance the phone consult service know who you're talking to and can build a relationship with them and you think about them cause you see them" – RMO 4.

Other recommendations about processes that could be improved included direct access to the rheumatology SMO on-call roster; having agreed and clearer diagnostic pathways for conditions such as giant cell arteritis; and rheumatology clinic letters from HVHDB available in the electronic record at WRH.

**DHB inpatient consultation services**

Rheumatology services at the six DHBs surveyed all provide in-person advanced trainee inpatient review on the same day, within 48 hours, or another clinically appropriate time frame during the workdays of Monday to Friday (Table 1). All DHBs provide after-hours rheumatology consultation with a rheumatology SMO via telephone.

**Discussion**

Doctors in the internal medical service at a large hospital described the lack of an in-person rheumatology service as having negative impacts on perceived quality of the patient care delivered. While these doctors found workarounds for diagnostic and management needs, these were sometimes problematic. These doctors described a lack of confidence in their knowledge of rheumatic conditions and reported that professional development and learning suffered, particularly for junior doctors. A variety of suggestions for improved access to specialist rheumatology care at the WRH site were offered, which all included some change in deployment of rheumatology staff to provide some in-person service onsite. In-person rheumatology consultation services are provided at the six large DHBs across Aotearoa New Zealand. The views of these doctors are concerning due to the perceived negative impact on
Table 1: Inpatient rheumatology consultation services at six other district health boards in Aotearoa New Zealand.

<table>
<thead>
<tr>
<th>DHB</th>
<th>Rheumatologist</th>
<th>AT</th>
<th>Referral management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counties Manukau</td>
<td>578,650</td>
<td>8</td>
<td>AT review then SMO review within 24 hours.</td>
</tr>
<tr>
<td>Canterbury</td>
<td>578,290</td>
<td>4</td>
<td>AT review then SMO as required, within clinically appropriate time frame (available Monday–Friday).</td>
</tr>
<tr>
<td>Hutt Valley</td>
<td>156,790</td>
<td>7</td>
<td>AT phone advice for HVDHB and CCDHB. SMO review of HVDHB patients ad hoc. SMO review at CCDHB if on site and at discretion.</td>
</tr>
<tr>
<td>Auckland</td>
<td>493,900</td>
<td>7</td>
<td>AT reviews consults daily with SMO review at twice-weekly scheduled ward round.</td>
</tr>
<tr>
<td>Southern</td>
<td>344,900</td>
<td>6*</td>
<td>AT review then SMO review within 24 hours if complex or new, and/or during twice-weekly scheduled ward round.</td>
</tr>
<tr>
<td>Waikato</td>
<td>435,690</td>
<td>5</td>
<td>AT review then SMO as required, within clinically appropriate time frame (available Monday–Friday).</td>
</tr>
<tr>
<td>Waitematā</td>
<td>628,770</td>
<td>7</td>
<td>AT review then SMO review within 24 hours as required.</td>
</tr>
</tbody>
</table>

*When fully staffed – currently 2.5 FTE and five people. Weekly consults are estimates.
Abbreviations: AT = advanced trainee, or rheumatology registrar; DHB = district health board; FTE = full time equivalent; SMO = senior medical officer.
patient care and missed opportunities to maintain doctors’ knowledge and skills in managing rheumatic disease.

There is relatively little literature examining the effects of inpatient rheumatology consultation on patient care and outcomes. Three retrospective studies of hospitalised patients with acute gout have reported that inpatient rheumatology consultation led to more frequent appropriate care. This included more frequent use of diagnostic aspirate and measurement of serum urate,\(^1,2,14\) concordance with best practice therapy and appropriate follow-up.\(^2,14\) Another retrospective study in a New Zealand hospital reported patients with gout in hospital who had rheumatology consultation were more frequently initiated on urate-lowering therapy.\(^15\) These data support the premise that rheumatology consultation is beneficial in achieving high quality patient care, even for gout. This is very relevant to Aotearoa New Zealand with its high prevalence of gout, particularly in Māori and Pacific peoples,\(^16\) and where the quality of gout care is of sufficient priority to be reported on in the Atlas of Health care variation.\(^17\) In a retrospective study of nearly 500 inpatient rheumatology consultations over 10 years in a geriatric hospital in Israel, arthrocentesis occurred in nearly half of consults and rheumatoid arthritis was diagnosed in 9% of consultations.\(^3\) This suggests that rheumatologists undertaking consultations in inpatient hospital settings frequently perform diagnostic procedures or confirm important diagnoses. In a large hospital in the USA, rheumatology consultation occurred in 0.64–0.91% of all hospital admissions, with consultation rate increasing over time.\(^4\) The doctors in our study were inventive in consulting other specialties to obtain diagnostic joint aspirate or management advice, however, they acknowledged that rheumatology consultation would have been preferable.

Early diagnosis and specialist treatment are considered a critical part of high quality care of many rheumatic conditions\(^18,15\) including rheumatoid arthritis\(^20\) and giant cell arteritis.\(^21\) Assessing a person while they are in hospital and at the time a rheumatic disease is considered seems a potentially efficient way to achieve this. Several studies in outpatient settings have shown that early brief assessment is an efficient mechanism for early diagnosis.\(^22,23\) These data support the doctors’ view that the lack of rheumatology consultation during inpatient stay may lead to lower quality patient care. Given improved access to the infrastructure for telemedicine, it is worth considering the role for remote rheumatologist assessment via telemedicine, with a co-located physician and remote rheumatologist. There are now regional evidence-informed guidelines for rheumatology telemedicine that may assist in establishing appropriate rheumatology telemedicine consultation services.\(^24\) This type of service would also address access to specialised rheumatology care in regional or rural settings.

While our study suggested there was a need for inpatient access to rheumatologists to improve patient care and continuing education, there would need to be sufficient rheumatologists employed to provide both inpatient and ambulatory care. In 2018 in Aotearoa New Zealand, the public hospital rheumatology workforce had 0.59 FTE rheumatologist per 100,000 population or one full-time rheumatologist per 169,683 people.\(^23\) This is well below the recommendations in the United Kingdom of one rheumatologist per 60,000–80,000\(^26\) or 86,000 people,\(^27\) which equates 1.16–1.67 full-time rheumatologists per 100,000 population. HVDHB employs approximately 0.55 FTE rheumatologists per 100,000 people in the catchment area of CCDHB, HVDHB and Wairarapa DHB for which rheumatology services are provided.\(^25\) While rheumatology specialist care could be arranged differently to meet perceived (and likely actual) patient care needs, there will need to be an increase in overall DHB rheumatologist FTE to achieve this.

While only focussing on the absence of one medical subspecialty on internal medicine doctors in one hospital, these findings could also be relevant to any medical or surgical specialty that has limited or absent service in any large or smaller hospital in Aotearoa New Zealand. We could not find any similar studies describing the experiences of doctors in an urban hospital in Aotearoa New Zealand of delivering care without relevant specialty support. The experience of barriers to access to specialist services is common for patients and doctors in hospitals in regional or rural settings. People living with inflammatory bowel disease in regional New Zealand have described perceived delays in specialist referrals and unfavourable disparities in access to specialists.\(^28\) In the West Coast of Aotearoa New Zealand’s South Island careful consideration of patient and community health needs, and thoughtful organisation of rural and supporting urban regional hospital services has achieved better access to specialty care that is acceptable to patients and the health service pro-
providers. Novel ways of addressing access to specialists in main centres, like telemedicine, have been successfully used in Aotearoa New Zealand to reduced variability of care in stroke thrombolysis. Telemedicine literature in rheumatology is nascent and emerging, however, guidelines have been developed to guide appropriate deployment of telemedicine for rheumatology care. In our study, simple changes in the organisation, like provision of on-call rosters and closing the loop on outcomes documentation may improve communication with specialist rheumatology services. This could also be addressed by improved digital infrastructure providing comprehensive access to clinical information across Aotearoa New Zealand.

Our study has some limitations. This qualitative study describes the perceptions of doctors in one service in one hospital. Since qualitative research studies investigate a specific issue or phenomenon in a certain group, of a focussed locality in a particular context, generalisability of qualitative research findings is usually not an expected attribute. It cannot be assumed that the findings of this study represent the experiences of all internal medicine services in Aotearoa New Zealand. However, they may credibly reflect the experiences of these doctors at this location, given the high participation rate, with 31 out of a possible 41 doctors responding in person or by email. The reports of lower quality care are the doctors’ perception only and no conclusions about the actual quality of care provided can be made from these data. Future similar studies could consider framing data collection around impact on quality of care for patients, rather than impact on services or care.

Our study is the first to describe the views of doctors in a New Zealand hospital on the impacts of the absence of an in-person specialty consultation service, which is provided in other comparable hospitals in Aotearoa New Zealand. These data are timely as the Pae Ora (Healthy Futures) Bill (1 July 2022) clearly articulates a key principle of the Aotearoa New Zealand health system is that it is equitable. Specifically, Section 7 states that “(a) the health sector should be equitable, which includes ensuring Māori and other population groups— (i) have access to services in proportion to their health needs; and (ii) receive equitable levels of service”. Te Whatu Ora Health New Zealand is now tasked with designing a hospital and specialist service operating model that achieves the aspirations of Pae Ora. While our study is in only one hospital site, given the paucity of reported studies on the impact of variation in organisation of specialist services, it provides valuable insights that can be further explored in other specialist disciplines or sites. Our study suggests both high quality patient care and maintaining and enhancing skills and knowledge of health practitioners are benefits to be directly achieved by appropriate design of health services. Achieving equitable health outcomes for New Zealanders would seem to be dependant on equitable and appropriate access to specialist care.
COMPETING INTERESTS
The authors are employees of the health services discussed in this manuscript. There are no other conflicts to be declared.

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REFERENCES


Appendix 1: COREQ (Consolidated criteria for Reporting Qualitative research) Checklist.

A checklist of items that should be included in reports of qualitative research. You must report on the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Item no.</th>
<th>Guide questions/description</th>
<th>Reported on page no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain 1: Research team and reflexivity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Personal characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviewer/facilitator</td>
<td>1</td>
<td>Which author/s conducted the interview on focus group?</td>
<td>Not possible on anonymous.</td>
</tr>
<tr>
<td>Credentials</td>
<td>2</td>
<td>What were the researcher’s credentials? e.g., PhD, MD.</td>
<td>Title page.</td>
</tr>
<tr>
<td>Occupation</td>
<td>3</td>
<td>What was their occupation at the time of study?</td>
<td>Medical doctors.</td>
</tr>
<tr>
<td>Gender</td>
<td>4</td>
<td>Was the researcher female?</td>
<td>Female.</td>
</tr>
<tr>
<td>Experience and training</td>
<td>5</td>
<td>What experience or training did the researcher have?</td>
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</tr>
<tr>
<td><strong>Relationships with participants</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Relationship established</td>
<td>6</td>
<td>Was a relationship established prior to study commencement?</td>
<td>Yes.</td>
</tr>
<tr>
<td>Participant knowledge of the interviewer</td>
<td>7</td>
<td>What did the participants know about the researcher? e.g., personal goals, reasons for doing research.</td>
<td>Participant information form.</td>
</tr>
<tr>
<td>Interviewer characteristics</td>
<td>8</td>
<td>What characteristics were reported about the interviewer/facilitator? e.g., bias, assumptions, reasons and interests in the topic.</td>
<td>Page 30 indicates researchers background in general medicine and rheumatology.</td>
</tr>
<tr>
<td><strong>Domain 2: Study design</strong></td>
<td></td>
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<tr>
<td><strong>Theoretical framework</strong></td>
<td></td>
<td></td>
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<tr>
<td>Methodological orientation and theory</td>
<td>9</td>
<td>What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis.</td>
<td>Page 24.</td>
</tr>
<tr>
<td><strong>Participant selection</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sampling</td>
<td>10</td>
<td>How were participants selected? e.g., purposive, convenience, consecutive, snowball.</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Method of approach</td>
<td>11</td>
<td>How were participants approached? e.g., face-to-face, telephone, mail, email.</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Sample size</td>
<td>12</td>
<td>How many participants were in the study?</td>
<td>Page 25.</td>
</tr>
<tr>
<td>Topic</td>
<td>Item no.</td>
<td>Guide questions/description</td>
<td>Reported on page no.</td>
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<tr>
<td>Non-participation</td>
<td>13</td>
<td>How many people refused to participate or dropped out? Reasons?</td>
<td>Page 25.</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
<td></td>
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<tr>
<td>Setting of data collection</td>
<td>14</td>
<td>Where was the data collected? e.g., home, clinic, workplace.</td>
<td>Workplace.</td>
</tr>
<tr>
<td>Presence of non-participants</td>
<td>15</td>
<td>Was anyone else present besides the participants and researchers?</td>
<td>No.</td>
</tr>
<tr>
<td>Description of sample</td>
<td>16</td>
<td>What are the important characteristics of the sample? e.g., demographic data, date.</td>
<td>Page 25.</td>
</tr>
<tr>
<td><strong>Data collection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interview guide</td>
<td>17</td>
<td>Were questions, prompts, guides provided by the authors? Was it pilot tested?</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Repeat interviews</td>
<td>18</td>
<td>Were repeat interviews carried out? If yes, how many?</td>
<td>No.</td>
</tr>
<tr>
<td>Audio/visual recording</td>
<td>19</td>
<td>Did the research use audio or visual recording to collect the data?</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Field notes</td>
<td>20</td>
<td>Were field notes made during and/or after the interview or focus group?</td>
<td>No.</td>
</tr>
<tr>
<td>Duration</td>
<td>21</td>
<td>What was the duration of the interviews or focus group?</td>
<td>4 focus group interviews of between 19 mins 43 secs and 35 mins 50 secs</td>
</tr>
<tr>
<td>Data saturation</td>
<td>22</td>
<td>Was data saturation discussed?</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Transcripts returned</td>
<td>23</td>
<td>Were transcripts returned to participants for comment and/or correction?</td>
<td>Presented to general medicine junior and senior doctors in person.</td>
</tr>
<tr>
<td><strong>Domain 3: Analysis and findings</strong></td>
<td></td>
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<tr>
<td>Data analysis</td>
<td></td>
<td></td>
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<tr>
<td>Number of data coders</td>
<td>24</td>
<td>How many data coders coded the data?</td>
<td>Page 24.</td>
</tr>
<tr>
<td>Description of the coding tree</td>
<td>25</td>
<td>Did authors provide a description of the coding tree?</td>
<td>No.</td>
</tr>
<tr>
<td>Derivation of themes</td>
<td>26</td>
<td>Were themes identified in advance or derived from the data?</td>
<td>Derived from data.</td>
</tr>
<tr>
<td>Software</td>
<td>27</td>
<td>What software, if applicable, was used to manage the data?</td>
<td>None.</td>
</tr>
<tr>
<td>Participant checking</td>
<td>28</td>
<td>Did participants provide feedback on the findings?</td>
<td>At oral presentation, feedback from the audience.</td>
</tr>
<tr>
<td>Topic</td>
<td>Item no.</td>
<td>Guide questions/description</td>
<td>Reported on page no.</td>
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<tr>
<td>Quotations presented</td>
<td>29</td>
<td>Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number.</td>
<td>Page 25–26.</td>
</tr>
<tr>
<td>Data and findings consistent</td>
<td>30</td>
<td>Was there consistency between the data presented and the findings?</td>
<td>Page 25–26.</td>
</tr>
<tr>
<td>Clarity of major themes</td>
<td>31</td>
<td>Were major themes clearly presented in the findings?</td>
<td>Page 25–26.</td>
</tr>
<tr>
<td>Clarity of minor themes</td>
<td>32</td>
<td>Is there a description of diverse cases or discussion of minor themes?</td>
<td>Page 25.</td>
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</tbody>
</table>

Improving early detection of colorectal cancer in Aotearoa New Zealand: how do the direct access criteria perform?

Rhys A John, Holly Wang, Valentyna Sylevych, James D Falvey

ABSTRACT

AIM: Colorectal cancer (CRC) is a common malignancy in New Zealand, and there is increasing pressure on investigative resources for diagnosis. The national direct access referral guidelines from the Ministry of Health (MoH) guide who should be referred for investigation, but their performance in detecting CRC and other significant diseases has not been reported previously. This paper describes the yield, by direct access criterion, of all referrals through the direct access pathway to the Canterbury District Health Board (CDHB) during 2018.

METHODS: First referrals received through the direct access colonoscopy/computed tomography colonography (CTC) pathway for 2018 were audited. Patients were assigned to symptom groups corresponding to the MoH direct access criteria, and demographic data were captured. Diagnostic outcomes were collected through analysis of all endoscopy, CT colonography and histology reports in the 18 months following referral for primary analysis, with further follow-up through to May 2021 to detect missed pathology.

RESULTS: Three thousand two hundred referrals were analysed, and 88.5% underwent colorectal investigation. 128 CRC were diagnosed, 176 advanced polyps, 49 cases of inflammatory bowel disease (IBD) and there were 56 other significant findings. The yield by category for the direct access criteria varied between 0–15.0%, and one urgent criterion had a CRC yield lower than two semi-urgent categories. For patients whose symptoms met at least one of the criteria, excluding those referred with suspected IBD, the combined CRC yield was 4.9%, compared with 1.8% in those who did not meet criteria. The sensitivity and specificity of the criteria for CRC (excluding IBD) was 90% and 23% respectively. There were no CRC detected during the extended follow-up period.

CONCLUSION: In this referred population, the MoH direct access colonoscopy/CTC criteria varied significantly in their CRC yield, with an arbitrary distinction between urgent and semi-urgent categories. The low specificity of the criteria means the number needed to investigate to detect one CRC was one in 22. Improved diagnostic algorithms are urgently required to improve both the sensitivity and specificity, thereby more appropriately allocating finite resources to those patients who are most in need of investigation.

Colorectal cancer (CRC) is the third most common cancer in New Zealand, and the second most common cause of cancer-related death. While progress has been made in improving CRC survival, outcomes in New Zealand are poor in comparison to other developed countries. In the pre-screening era, 20% of bowel cancers were diagnosed following emergency presentation, commonly with later stage disease, and with correspondingly poorer outcomes. Improving diagnostic pathways for patients with colorectal symptoms, and population-based screening for asymptomatic disease, are valid strategies for improving early detection and survival from CRC. Symptom-based criteria for accessing colorectal investigation are, however, limited by low specificity of alarm symptoms for CRC, and a significant non-malignant symptom burden in the general population. The New Zealand National Bowel Screening Programme (NBSP), which has been successful in capturing 18% of incident CRC, has also exacerbated waiting list delays for endoscopic procedures. Currently, the New Zealand Ministry of Health (MoH) Direct Access Outpatient Colonoscopy or Computed Tomography Colonography (CTC) guidelines (hereafter the direct access criteria) determine which patients should undergo colorectal investigation based on their age, and the presence of rectal bleeding (RB), altered bowel habit (ABH) or iron deficiency anaemia (IDA). The criteria largely reflect the UK National Institute for Health and Care Excellence (NICE) guidance published in 2005, but also accept younger symptomatic patients with a significant family history of CRC, and those with both IDA and RB irrespective of age. Since 2005, NICE guidance on the appropriate referral and investigation of patients with symptoms suggestive of CRC have undergone several revisions, leading to improved
sensitivity but with a disproportionate increase in investigative burden. While colonoscopy remains the gold standard colorectal investigation, it is invasive, associated with risk for significant harm and costly. Improving the New Zealand direct access criteria to increase sensitivity for CRC must be done with care to limit the number of patients investigated who have no significant finding.

One strategy that may improve the diagnostic pathway would be to combine the existing direct access criteria with an objective measure of colorectal cancer risk, such as the faecal immunochemical test (FIT) for faecal haemoglobin. To develop this concept safely it is necessary to know the rate of CRC according to common clinical presentations (i.e., the prior risk of CRC).

In Canterbury District Health Board (CDHB), general practitioners (GPs) are guided regarding the referral of patients with colorectal symptoms by a pathway based on the direct access criteria. Referral is made via an online referral form (ERMS), which includes a free-text field for clinical history, in addition to tick boxes that summarise the symptoms with respect to the direct access criteria. All direct access referrals are triaged by a gastroenterology consultant and directed by them to the most appropriate investigation, or declined, given the referral history, electronic case note review (where required) and with knowledge of local resource availability. This study sought to use this routinely collected clinical information to determine the diagnostic yield of significant colorectal disease, particularly CRC, for common presentations as per the direct access criteria.

Methods

After institutional and local ethical approval, all referrals from primary care using the ERMS colonoscopy/CTC form in 2018 were identified. Only first referrals for each patient were included. Patients with pre-existing inflammatory bowel disease (IBD) or known active CRC were excluded.

Tick-box information, as completed by the referring general practitioner, was used to categorise referrals according to the direct access criteria. Two additional categories were created for cases referred on clinical grounds but whose symptoms did not meet the criteria. These were “rectal bleeding under age 50 years” (reflecting a local pathway to investigate these cases through the Canterbury Charity Hospital), and “all other referrals not meeting direct access criteria”. If a referral was eligible for inclusion into more than one group, it was assigned to the highest risk category, with two-week categories presumed the highest risk for CRC. Free-text information accompanying 100 referrals was reviewed to check for concordance with the tick boxes to ensure patients were assigned to the correct referral category.

The CDHB data warehouse and endoscopy database were accessed to identify all colonoscopy, flexible sigmoidoscopy, CT colonography and histology reports for the 18 months following the initial referral, with further follow-up for all cases until May 2021 to allow detection of missed pathology. Where no colorectal investigations were identified by this strategy, individual electronic records were searched. Privately performed radiology and histology can be found within the electronic record at CDHB allowing significant outcomes to be detected for the whole group. Database data were initially assigned diagnostic outcomes electronically, by natural language processing, and then checked manually. Where cases underwent more than one colorectal investigation during the initial follow-up period, or where histology and endoscopic results were available, outcome data were summarised. For neoplasia, only the most advanced lesion was reported for any individual in the following order; cancer, advanced polyp (histologically proven adenoma with villous or tubulovillous architecture, high grade dysplasia, or sessile serrated polyp with dysplasia, or CTC identified polyp ≥10mm), simple polyp (tubular adenoma with low grade dysplasia or sessile serrated polyp without dysplasia or CTC identified polyp <10mm) or hyperplastic polyp. Due to the limitations of electronic data gathering, we were unable to determine the size of resected polyps. The 18-month cut-off for primary analysis was chosen as an arbitrary time point to allow linkage between the initial referral and diagnostic outcomes.

Statistical analysis was performed within SPSS v28.0.1.1. Categorical variables were compared using X²; Fisher’s exact test was used for variables with low numbers (<5). Continuous variables were first checked for normality, then were compared using ANOVA for more than two groups. The significance value was set at 0.05.

Results

A total of 3,201 new referrals were identified. One case was excluded as investigation revealed metastatic malignancy of unknown primary. Con-
The diagnostic yields according to direct access category are shown in Table 2.

For patients who met at least one of the direct access criteria, excluding those referred with a suspicion of IBD, the combined CRC yield was 4.9% (114/2,315), compared with 1.8% (12/671) in those who did not meet direct access criteria. The sensitivity and specificity of the direct access criteria for CRC (excluding those referred with a suspicion of IBD) was 0.90 (114/126), and 0.23 (659/2,860) respectively.

Twenty cases of IBD were detected in 214 patients, referred with suspicion of IBD (yield of 9.3%). Other significant findings were detected in 1.8% of referrals and are detailed in Table 2. In addition, anal fissure or haemorrhoids were found in 197 (7.0%), and diverticular disease in 1,028 (36.3%).

CRC detection rate by age and individual symptom are shown in Table 3.

Discussion

This is the first report of the diagnostic yield of the New Zealand MoH direct access criteria. We found the sensitivity and specificity of these criteria among a primary care referral population to be 90% and 23% respectively, while the rate of detection of CRC varied from 0–15.0%. For patients whose symptoms met at least one criterion (excluding those referred with a suspicion of IBD) the combined CRC yield following investigation was 4.9%, compared with 1.8% for those who were referred on clinical grounds who did not meet criteria. At least 88.5% of referred cases underwent investigation, while 1 in 25 of those referred, and 1 in 22 of those completing investigations was found to have CRC.

Our data show that there is a high rate of colorectal investigation in patients referred by primary care, whether or not they meet the direct access criteria, but 9% of those referred within criteria were not investigated. Due to the limitations of the dataset, we were unable to determine whether this last group were declined investigation, or were not investigated due to patient cancellation or non-attendance. Local data report the non-attendance rate for scheduled endoscopic procedures to be between 1.6–3.8%, with those referrals originating from non-gastroenterologists more likely to miss investigations. We have not investigated whether a similar effect is present in the current cohort. Regarding the high rate of investigation of those outside criteria, we believe this reflects two factors; concern that symptoms cannot accurately distinguish benign from malignant disease, and a well-established mechanism for gastroenterologist triage of referrals to a community CTC pathway.

When considering all referrals, we found a significant difference in the rate of investigation...
Figure 1: Inclusion and diagnostic pathway for referred patients.

![Diagram of inclusion and diagnostic pathway for referred patients]

Table 1: Comparison between ethnic groups.

<table>
<thead>
<tr>
<th></th>
<th>Total n=3,200</th>
<th>NZ European n=2,804</th>
<th>Māori n=186</th>
<th>Asian n=110</th>
<th>Other n=63</th>
<th>Pacific peoples n=37</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>63.6 (15)</td>
<td>64.6 (15)</td>
<td>56.8 (14)</td>
<td>53.8 (12)</td>
<td>58.8 (14)</td>
<td>54.6 (14)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cancer (%)</td>
<td>128 (4.0)</td>
<td>120 (4.3)</td>
<td>3 (1.6)</td>
<td>3 (2.7)</td>
<td>2 (3.2)</td>
<td>0 (0)</td>
<td>.23</td>
</tr>
<tr>
<td>% investigated</td>
<td>88</td>
<td>89</td>
<td>83</td>
<td>84</td>
<td>83</td>
<td>92</td>
<td>0.016</td>
</tr>
<tr>
<td>% of referrals</td>
<td>79</td>
<td>79</td>
<td>75</td>
<td>73</td>
<td>81</td>
<td>81</td>
<td>0.26</td>
</tr>
<tr>
<td>meeting access criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% investigated if</td>
<td>91</td>
<td>91</td>
<td>86</td>
<td>86</td>
<td>86</td>
<td>93</td>
<td>0.12</td>
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<tr>
<td>meeting access criteria</td>
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</table>
### Table 2: Diagnostic yield of the MoH direct access criteria.12

<table>
<thead>
<tr>
<th>Definition</th>
<th>Referred</th>
<th>Investigated</th>
<th>Average age (SD)</th>
<th>Colorectal cancer</th>
<th>Advanced polyp</th>
<th>Simple polyp</th>
<th>IBD</th>
<th>Other significant finding*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected CRC (palpable, or visible on rectal examination)†</td>
<td>88</td>
<td>82 (93%)</td>
<td>63.9 (17)</td>
<td>9 (10.2%)</td>
<td>2 (2.3%)</td>
<td>23 (26.1%)</td>
<td>1 (1.1%)</td>
<td>5 (5.7%)</td>
</tr>
<tr>
<td>Unexplained RB (benign anal causes treated or excluded) with IDA</td>
<td>100</td>
<td>90 (90%)</td>
<td>68.2 (14)</td>
<td>15 (15.0%)</td>
<td>6 (6.0%)</td>
<td>19 (19.0%)</td>
<td>2 (2.0%)</td>
<td>2 (2.0%)</td>
</tr>
<tr>
<td>(haemoglobin below the local reference range)†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABH (looser and/or more frequent) &gt;6 week’s duration plus unexplained RB</td>
<td>350</td>
<td>335 (96%)</td>
<td>65.6 (9)</td>
<td>18 (5.1%)</td>
<td>34 (9.7%)</td>
<td>84 (24.0%)</td>
<td>4 (1.1%)</td>
<td>7 (2.0%)</td>
</tr>
<tr>
<td>(benign anal causes treated or excluded) aged ≥50†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABH (looser and/or more frequent) &gt;6 week’s duration, aged ≥50†</td>
<td>1,061</td>
<td>960 (90%)</td>
<td>69.4 (11)</td>
<td>28 (2.6%)</td>
<td>50 (4.7%)</td>
<td>217 (20.5%)</td>
<td>7 (0.7%)</td>
<td>20 (1.9%)</td>
</tr>
<tr>
<td>ABH (looser and/or more frequent) &gt;6 week’s duration plus unexplained RB</td>
<td>66</td>
<td>61 (92%)</td>
<td>45.7 (3)</td>
<td>2 (3.0%)</td>
<td>4 (6.1%)</td>
<td>32 (48.5%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>(benign anal causes treated or excluded), aged 40–50‡</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unexplained RB (benign anal causes treated or excluded) aged ≥50‡</td>
<td>334</td>
<td>312 (93%)</td>
<td>65.8 (10)</td>
<td>21 (6.3%)</td>
<td>29 (8.7%)</td>
<td>92 (27.5%)</td>
<td>8 (2.4%)</td>
<td>5 (1.5%)</td>
</tr>
<tr>
<td>Unexplained IDA (haemoglobin below local reference range)†</td>
<td>289</td>
<td>247 (85%)</td>
<td>69.5 (13)</td>
<td>21 (7.3%)</td>
<td>14 (4.8%)</td>
<td>42 (14.5%)</td>
<td>1 (0.3%)</td>
<td>7 (2.4%)</td>
</tr>
<tr>
<td>NZGG Category 2 family history plus one or more of ABH (looser and/or more</td>
<td>11</td>
<td>11 (100%)</td>
<td>48.7 (10)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>3 (27.3%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>frequent) &gt; 6 week’s duration plus unexplained RB (benign and anal causes</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>treated or excluded), aged ≥40‡</td>
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</tr>
<tr>
<td>NZGG Category 3 family history plus one or more of ABH (looser and/or more</td>
<td>16</td>
<td>16 (100%)</td>
<td>41.5 (11)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>6 (37.5%)</td>
<td>1 (6.3%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>frequent) &gt;6 week’s duration plus unexplained RB (benign and anal causes</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>treated or excluded), aged ≥25‡</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspected/assessment IBD</td>
<td>214</td>
<td>183 (86%)</td>
<td>50.6 (17)</td>
<td>2 (0.9%)</td>
<td>11 (5.1%)</td>
<td>48 (22.4%)</td>
<td>20 (9.3%)</td>
<td>4 (1.9%)</td>
</tr>
<tr>
<td>Rectal bleeding, aged &lt;50!</td>
<td>144</td>
<td>111 (77%)</td>
<td>37.7 (8)</td>
<td>1 (0.7%)</td>
<td>9 (6.3%)</td>
<td>38 (26.4%)</td>
<td>4 (2.8%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>All other referrals not meeting direct access criteria!</td>
<td>527</td>
<td>424 (80%)</td>
<td>60.6 (16)</td>
<td>11 (2.1%)</td>
<td>17 (3.2%)</td>
<td>92 (17.5%)</td>
<td>1 (0.2%)</td>
<td>6 (1.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>3,200</td>
<td>2,831 (88%)</td>
<td>63.6 (15)</td>
<td>128 (4.0%)</td>
<td>176 (5.5%)</td>
<td>696 (21.8%)</td>
<td>49 (1.5%)</td>
<td>56 (1.8%)</td>
</tr>
</tbody>
</table>

*Other significant findings: 1 colo-colonic fistula, 5 neuroendocrine tumours, 1 lymphoma, 9 colonic ischaemia, 11 strictures, 14 angiodysplasia, 12 microscopic colitis, 3 radiation proctitis.
†Direct access criteria recommend investigation within 2 weeks.
‡Direct access criteria recommend investigation within 6 weeks.
Outside direct access criteria.
Table 3: Single symptom predictive values for CRC. Patients referred with more than one symptom could be assigned to multiple groups.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Age</th>
<th>n referred</th>
<th>% with CRC (PPV)</th>
<th>OR univariate (95% CI)</th>
<th>OR multivariate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>3200</td>
<td>4.0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&lt;50</td>
<td>572</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>50–&lt;60</td>
<td>668</td>
<td>2.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>60–&lt;70</td>
<td>773</td>
<td>3.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>70–&lt;80</td>
<td>753</td>
<td>5.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>&gt;80</td>
<td>434</td>
<td>12.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>All referrals Palpable rectal mass</td>
<td>All</td>
<td>89</td>
<td>10.1</td>
<td>2.82 (1.39–5.77)</td>
<td>3.02 (1.41–6.49)</td>
</tr>
<tr>
<td></td>
<td>&lt;50</td>
<td>20</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>50–&lt;60</td>
<td>16</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>60–&lt;70</td>
<td>18</td>
<td>11.1</td>
<td>4.16 (0.90–19.23)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70–&lt;80</td>
<td>18</td>
<td>11.1</td>
<td>2.29 (0.51–10.34)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥80</td>
<td>17</td>
<td>29.4</td>
<td>4.04 (1.35–12.06)</td>
<td></td>
</tr>
<tr>
<td>Iron deficiency anaemia</td>
<td>All</td>
<td>504</td>
<td>9.5</td>
<td>3.44 (2.37–4.99)</td>
<td>3.31 (2.19–5.02)</td>
</tr>
<tr>
<td></td>
<td>&lt;50</td>
<td>60</td>
<td>3.3</td>
<td>4.38 (0.78–24.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50–&lt;60</td>
<td>63</td>
<td>1.6</td>
<td>0.73 (0.09–5.71)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60–&lt;70</td>
<td>114</td>
<td>5.3</td>
<td>1.98 (0.77–5.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70–&lt;80</td>
<td>150</td>
<td>8.7</td>
<td>2.02 (1.02–4.03)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥80</td>
<td>117</td>
<td>22.2</td>
<td>4.75 (2.49–9.05)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3 (continued): Single symptom predictive values for CRC. Patients referred with more than one symptom could be assigned to multiple groups.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Age</th>
<th>n referred</th>
<th>% with CRC (PPV)</th>
<th>OR univariate (95% CI)</th>
<th>OR multivariate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rectal bleeding</strong></td>
<td>All</td>
<td>1,122</td>
<td>5.5</td>
<td>1.78 (1.25–2.54)</td>
<td>2.73 (1.86–3.99)</td>
</tr>
<tr>
<td></td>
<td>&lt;50</td>
<td>298</td>
<td>1.0</td>
<td>0.92 (0.18–4.59)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50–&lt;60</td>
<td>267</td>
<td>4.1</td>
<td>5.70 (1.58–20.63)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60–&lt;70</td>
<td>258</td>
<td>4.7</td>
<td>2.04 (0.91–4.62)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70–&lt;80</td>
<td>205</td>
<td>8.8</td>
<td>2.30 (1.21–4.39)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥80</td>
<td>94</td>
<td>19.1</td>
<td>2.86 (1.49–5.49)</td>
<td></td>
</tr>
<tr>
<td><strong>Altered bowel habit (looser/more frequent); any duration</strong></td>
<td>All</td>
<td>2,108</td>
<td>3.5</td>
<td>0.68 (0.47–0.97)</td>
<td>1.06 (0.72–1.57)</td>
</tr>
<tr>
<td></td>
<td>&lt;50</td>
<td>386</td>
<td>1.6</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50–&lt;60</td>
<td>444</td>
<td>1.6</td>
<td>0.50 (0.17–1.43)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60–&lt;70</td>
<td>519</td>
<td>2.5</td>
<td>0.57 (0.25–1.29)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70–&lt;80</td>
<td>498</td>
<td>5.6</td>
<td>1.21 (0.60–2.41)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥80</td>
<td>261</td>
<td>7.3</td>
<td>0.64 (0.25–0.87)</td>
<td></td>
</tr>
</tbody>
</table>

Multivariate analysis variables = age brackets, ethnicity, home deprivation quintiles, sex, palpable rectal mass, IDA, RB, weight loss, ABH (any duration).
between ethnicities. This difference was driven largely by the proportion of patients in each group who were referred outside criteria, as these patients were less likely to be investigated. When considering only those patients referred within criteria, no significant difference was found. It is noteworthy, however, that referral numbers among minority groups were low. Only 5.8% of the referred group identified as Māori, while the 2018 Census indicates that Māori comprise 9.4% of the local population.21 This discrepancy may be accounted for by the younger average age of Māori in Canterbury, but also by the age parameters specified in the direct access criteria, which do not take into consideration that Māori have a peak incidence of CRC 10 years younger than NZ Europeans.22 Furthermore, Māori are known to be less likely to access primary care.23 Overall, Māori have a 29% lower age standardised rate of colorectal cancer, but despite the significantly younger age at diagnosis, there is only a slightly lower mortality, driven by poorer survival once diagnosed; the difference is largely attributable to the stage of disease at diagnosis.24 Introducing ethnicity-specific age thresholds within the direct access criteria could be one way of addressing this inequity, as has recently been announced for the NBSP:25 On review of our dataset, if the age of eligibility for Māori was dropped by 10 years across all categories, an additional 14 Māori patients would meet criteria (30% of those previously outside criteria); likely an underestimate of the unmet need, as patients may not have been referred due to being deemed ineligible.

Stratifying cases as per the direct access criteria found the highest rate of CRC detection to be in those with IDA and RB at any age (15%), followed by in those referred with a palpable rectal mass (10%). Thereafter, the rate of colorectal cancer in the final urgent category, ABH and RB aged ≥50 years, was lower than in two semi-urgent categories (5.1%, compared with 6.3% for RB ≥50 years, and 7.3% for IDA), indicating that the distinction between urgent and non-urgent categories within the criteria is somewhat arbitrary. It is notable that the rate of CRC diagnosis in cases aged ≥50 years presenting with altered bowel habit as the only symptom, while the most frequent category accounting for 33% of referrals yielded CRC in only 2.6% of cases. This yield is below the symptom threshold value of 3%, which underpins the NICE guidance13 on which the New Zealand direct access criteria are based, arguably leading to excessive allocation of finite resources to a low-risk group.

Regarding individual symptoms, multivariate analysis found IDA to be the strongest independent predictor of CRC (OR 3.31), followed by palpable rectal mass (OR 3.02), then RB (OR 2.73), while ABH was not found to be discriminative. These results are highly concordant with a recent analysis of referrals for colorectal investigation made to the Waikato DHB.26 What is more, the raw rates of CRC by individual symptom reported here are highly consistent with those reported from an earlier study in the Canterbury population (11.3% for anaemia, 6.0% for RB, and 4.3% for ABH in the earlier study, compared with 9.5%, 5.5% and 3.5% respectively, reported here).27

There are some limitations to the dataset. Despite the large number of referrals, the small number of outcomes with respect to any given criteria, symptom or age group limits statistical power. In addition, although there was a high level of concordance between clinical free-text and tick-box data, this did not reach 100%. Although all significant colorectal diagnoses are likely to have been captured in this study, it is possible that a small number of patients without significant disease were investigated in a unit not linked to the CDHB electronic record. As reports from the largest private endoscopy unit are automatically uploaded to the electronic record, the effect of these missing investigations is not thought to be significant. Finally, because not all cases underwent further investigation, and some were investigated with only CTC or flexible sigmoidscopy, the rate of polyp detection is underestimated; however, the median follow-up of 33 months means that CRC is likely to have been captured.

Altering diagnostic algorithms for patients with bowel symptoms to detect more CRC (more sensitive), while simultaneously reducing the number needed to investigate to detect one cancer (more specific), and also ensuring patients with significant non-malignant disease are not excluded, is an immediate priority for colorectal services in New Zealand. This will likely be met by incorporating existing biomarkers, such as FIT and calprotectin into diagnostic algorithms, as has just been recommended nationally in the UK.28 This is the only paper reporting the diagnostic yield of the New Zealand direct access criteria. The data are highly comparable with prior studies from the same region, reflect consistent referral practice for colorectal investigation from primary care and can now be used to help develop more sensitive and specific access criteria for patients with symptoms suggestive of CRC in New Zealand.
COMPETING INTERESTS
Nil.

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REFERENCES
Audit of the Southern DHB B4 School hearing screening referral process: is there unmet need?

Thomas Oliver, Paul Joice, Patrick JD Dawes

ABSTRACT

AIM: The B4 School Check aims for early detection and appropriate management of hearing loss prior to school entry. In light of increasing awareness of inequitable health outcomes across a variety of measures in Aotearoa New Zealand, particularly for Māori and Pasifika, we performed an audit of B4 School hearing related referrals.

METHOD: For the census year 2018, we examined the hearing screening data for age, gender, ethnicity, region and locality. For those children whose screening triggered a referral, the district health board (DHB) record was examined to assess whether a referral was received by the public audiology or otolaryngology head and neck surgery (ORLHNS) departments and if any appointment was subsequently attended.

RESULTS: For Otago, but not Southland, there was a mismatch between census and screening programme estimates of the number of children eligible for screening. Māori and Pasifika children were significantly less likely to pass the screening tests (p<.00001) compared to other ethnicities. Referral rates were not significantly different among ethnic groups, but Pasifika children were significantly less likely be assessed by an audiologist or otolaryngologist (p<0.004). Despite an equal distribution of screening and referral, significantly more Māori and Pasifika children will start primary school with potential hearing impairment compared to other ethnicities.

CONCLUSION: While the Southern DHB B4 School hearing screening programme is equal in capturing children of different backgrounds, it demonstrates a greater prevalence of potential hearing impairment among Māori and Pasifika children when entering primary school. This raises the need to consider how to better provide ongoing care for these children.

Early detection and appropriate management of childhood ear disease and hearing loss ensures children have the best opportunities to achieve optimal language development, mitigates potential complications of unmanaged ear disease and assists learning and progress in education.1

Paediatric hearing screening programmes have been developed in many countries around the world with the aim of identifying children with ear disease and enabling appropriate intervention as required. In Aotearoa New Zealand, formal hearing screening occurs at two age points—the newborn hearing screening programme at birth and the B4 School Check at 4 years of age.

The B4 School Check is a broad screening for multiple health, developmental and behavioural problems that may have a negative impact on a child’s ability to learn and take part at school.2 Children are identified from national databases, including the ENROL database, which includes every child enrolled to attend school in the country. All children in our region, aged 4, who are enrolled in preschool (including home-based) care are referred to the programme for hearing and vision screening, and this is cross-referenced against the national database. The ENROL database is then cross-referenced again so any children not identified at age 4 who are subsequently attending school are then captured in their first school year. All children identified are offered hearing screening unless they are reported to be under the care of an audiologist or otolaryngologist.

The hearing component of the screen consists of pure tone audiometry at 0.5, 1, 2 and 4 kHz, and tympanometry. Findings suggestive of a sensorineural hearing loss with thresholds of at least 40dBHL (decibels hearing level) prompt a referral to an audiologist, while children whose findings are suggestive of conductive loss (i.e., type B tympanometry), with thresholds of at least 40dBHL, are referred to their general practitioner (GP). If the child responds to tones at 40dBHL, but not at lower-intensity tones then they are rescreened three months later, and if they again do not pass they are referred to audiology or their GP as above. Any child who is unable to participate in the screen-
ing process, due to developmental, behavioural or other issues is referred to audiology directly.3

Health services (including the B4 School Check) across Aotearoa New Zealand were previously provided and funded by the 20 district health boards (DHBs), now defined as regions within Te Whatu Ora Health NZ. The Southern region covers the largest geographic area in the country but is relatively sparsely populated.

There are inequitable health outcomes across a variety of measures in our country, particularly for Māori and Pasifika and also for rural communities, where socio-economic deprivation can be higher and access to health services more difficult. It has been reported that Māori are over-represented among those children with chronic otitis media and the more serious sequelae of this disease.4,5 More recently it has been shown that despite having higher rates of hospital admission for otitis media, Māori and Pasifika children have lower rates of ventilation tube insertion.6 Interestingly, a recent study did not show any association between deprivation and chronic otitis media in Aotearoa New Zealand; however, this study looked at an urban population and was unable to account for rural locality.7

For a child who does not pass the B4 School hearing screening in the Southern region, the pathway to assessment by an audiologist or an otolaryngology head and neck surgeon (ORLHNS) can be convoluted. In the context of conductive loss, it typically requires attendance at and referral from a GP, and potentially significant travel; all with associated costs, which may disproportionately disadvantage some children. This creates opportunities for children to not progress through the system and ultimately miss out on appropriate and timely management of their ear disease and hearing loss.

To investigate whether there was evidence for children being lost through the screening and referral process, and whether it leads to inequitable outcomes, we conducted an audit of children in the Southern DHB (SDHB) region undergoing hearing checks under the B4 School programme.  

Method

Ethics approval

Ethics approval was received from the University of Otago Ethics Committee for a minimal risk health research audit and audit-related study. Approval recognised that “data will be entered into an audit database in deidentified form from which further analysis will be performed. A separate database will record study number and NHI should data checking be required. This material will be stored in a password protected DHB hard drive”.

Participants

We examined the SDHB records of children who underwent hearing screening at age 4 between 1 January 2018 and 31 December 2018.

The 2018 Census data

Census data from the same year were retrieved and analysed to determine the total number of eligible children in the district and their demographic breakdown.8 This provided an estimate of the number of children who may not have been captured by the screening programme, and therefore not screened at all. Using Chi-squared analysis, differences (significance threshold p=0.05) were assessed between the two databases to determine if there was evidence of potential inequity amongst children being identified for screening.

Inclusion and exclusion criteria

All children and whānau who were contacted for hearing testing were entered into the database.

Audit protocol

Each child’s demographic data including age, gender, ethnicity, region (Otago or Southland) and locality (urban or rural, defined as living within the Dunedin or Invercargill city boundaries, or not) were collated.

For those children whose hearing screening triggered a referral for further assessment, the DHB record was examined to assess whether a referral was ultimately received by the public audiology or ORLHNS departments (either directly from the screening programme or via the child’s GP) and if any appointment was subsequently attended.

The private clinic records of all otolaryngologists practicing in the two regions were also assessed to determine if any referrals and assessments had been received and carried out, bypassing the public system. The clinical records in both public and private clinics were otherwise not further examined.

Data collection and analysis

The data were entered into a deidentified database from which further analysis was performed. Sub-group Chi-squared analysis was conducted...
for each demographic dataset to explore differences in terms of screening pass rates, referrals received by tertiary services and patients actually seen in clinic by these specialty groups (audiology and/or ORLHNS).

Results

On census night in March 2018, 3,753 4-year-old children were identified as being usually resident in the Southern DHB region. The screening programme identified 3,406 4-year-old children for hearing screening that year, shown in Table 1. The table shows the population of 4-year-old children normally resident in the Southern DHB at the time of the 2018 Census, with demographic breakdown, by total number (n) and percentage. This is compared with the numbers of those in the hearing check database, and percentage relative to the number in that sub-group identified by the census. Statistical comparisons using Chi-squared analysis within each demographic are also shown.

Significantly more children in Otago (p=0.003) were identified in the census but not screened when compared with those in Southland. There was no difference between rural and urban populations. When analysing data from Otago alone, significantly more rural children were identified by the census than the screening programme compared with urban children (p=0.026). Significantly more Māori (p=0.0005) and Pacific (p=0.0016) children were identified on the census than underwent screening when compared with children of other ethnicities.

Figure 1 shows how children passed through the screening programme. Of those identified for hearing checks, 135 were reported to be under the care of either an audiologist or ORLHNS, and nine declined screening; 3,262 children proceeded for hearing checks. A total of 326 (10%) did not pass the screen and were referred to either audiology or their GP. Of these, 223 (68%) had at least one type B tympanogram, suggesting otitis media with effusion (OME).

Public audiology services and/or public and private ORLHNS services in the region received referrals for 207 of these children (63.5% of those who did not pass). Appointments were not

Table 1: Comparison of census data and hearing screening data across demographics in the Southern DHB region.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Census</th>
<th>% (of total)</th>
<th>B4 School hearing screen</th>
<th>% (of census population)</th>
<th>Potentially missed</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td></td>
<td>n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2,823</td>
<td>75</td>
<td>2,707</td>
<td>96</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>750</td>
<td>20</td>
<td>581</td>
<td>77</td>
<td>169</td>
<td>* p=0.0005</td>
</tr>
<tr>
<td>Pasifika</td>
<td>180</td>
<td>5</td>
<td>118</td>
<td>66</td>
<td>62</td>
<td>* p=0.0019</td>
</tr>
<tr>
<td>Southland</td>
<td>1,305</td>
<td>35</td>
<td>1,305</td>
<td>100</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Otago</td>
<td>2,430</td>
<td>65</td>
<td>2,101</td>
<td>86</td>
<td>329</td>
<td>* p=0.003</td>
</tr>
<tr>
<td>Urban</td>
<td>1,977</td>
<td>53</td>
<td>1,816</td>
<td>92</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>1,776</td>
<td>47</td>
<td>1,590</td>
<td>90</td>
<td>186</td>
<td>p=0.588</td>
</tr>
<tr>
<td>Total</td>
<td>3,753</td>
<td>100</td>
<td>3,406</td>
<td>91</td>
<td>347</td>
<td></td>
</tr>
</tbody>
</table>

* denotes statistical significance at threshold <0.05.
Table 2: Differences in screening “did not pass” (DNP) and subsequent assessment rates within different demographic subgroups (% of total screened).

<table>
<thead>
<tr>
<th>Demographic</th>
<th>‘DNP’ rate</th>
<th>Assessed after ‘DNP’ screen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Other (79.6%)</td>
<td>218</td>
<td>8.4</td>
</tr>
<tr>
<td>Māori (16.9%)</td>
<td>85</td>
<td>15.4</td>
</tr>
<tr>
<td>Pasifika (3.5%)</td>
<td>23</td>
<td>20.4</td>
</tr>
<tr>
<td>Southland (38.6%)</td>
<td>142</td>
<td>11.3</td>
</tr>
<tr>
<td>Otago (61.4%)</td>
<td>184</td>
<td>9.2</td>
</tr>
<tr>
<td>Urban (52.9%)</td>
<td>189</td>
<td>11.0</td>
</tr>
<tr>
<td>Rural (47.1%)</td>
<td>137</td>
<td>8.9</td>
</tr>
<tr>
<td>Male (51.0%)</td>
<td>187</td>
<td>11.2</td>
</tr>
<tr>
<td>Female (49.0%)</td>
<td>139</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Table 3: Prevalence of type B tympanometry at screening, in total and by ethnicity.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Type B tympanogram</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Other</td>
<td>144</td>
</tr>
<tr>
<td>Māori</td>
<td>62</td>
</tr>
<tr>
<td>Pasifika</td>
<td>17</td>
</tr>
</tbody>
</table>

*p denotes statistical significance at threshold <0.05.

Table 4: Potentially unmanaged hearing loss at school following the hearing screening and referral process, in total and by ethnicity.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Unmanaged hearing loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Other</td>
<td>92</td>
</tr>
<tr>
<td>Māori</td>
<td>39</td>
</tr>
<tr>
<td>Pasifika</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>147</td>
</tr>
</tbody>
</table>

*p denotes statistical significance at threshold <0.05.
**Figure 1:** Progress through the screening process. The diagram shows the numbers of children not progressing through each stage in the hearing screening and referral process and the numbers for each end point (not screened, passed, seen by tertiary services or not seen by tertiary services). Note that the number not screened is an estimate using census data as a correlate only, and also includes 135 children who were reported to be under audiology/ORLHNS care and so were not screened.
attended by 19 children, so 188 children were seen by audiology or ORLHNS.

Therefore, 42% of children who did not pass the hearing screen were not further assessed by either of these two specialty groups in the public system (or ORLHNS in private).

Table 2 shows subgroup analyses performed for ethnicity, gender, region (Otago or Southland) and locality (urban or rural). Māori and Pasifika children were significantly less likely to pass the screening tests (p<0.00001 in both groups) compared to other ethnicities; and as shown in Table 3, were also more likely to have signs of OME as suggested by type B tympanometry (p<0.001 in both groups). The table shows the total number (n) that did not pass the hearing screen and percentage relative to the total number screened for that demographic, and the number and percentage (relative to the total number that did not pass) that were ultimately assessed by either otolaryngology or audiology as a result. Statistical comparisons using Chi-squared analysis within each demographic are also shown.

Referral rates through to ORLHNS and audiology services among children who had not passed were not significantly different among ethnic groups. When attendance rates at subsequent appointments are examined, Pasifika children were significantly less likely to be assessed by an audiologist or otolaryngologist (p<0.004).

There were no significant differences in “did not pass” rates, referrals or specialist review between Otago and Southland, or between urban and rural populations. Males were less likely to pass the screening, however, had no difference in referral or clinic review rates when compared with females.

Table 3 shows the total number (n) that had type B tympanometry at screening and did not pass, and percentage relative to the total number screened for that demographic. This provides an estimate of the prevalence of otitis media with effusion causing hearing loss amongst the screened population. Statistical comparisons using Chi-squared analysis within each demographic are also shown.

Table 4 shows the numbers of children that either did not pass the hearing screening and were not subsequently assessed by either ORLHNS or audiology, or declined screening altogether, and the percentage relative to the total number identified for screening, by ethnicity. This represents the total number, and proportion, of children starting school with a potential hearing loss that has not been managed. Statistical comparisons using Chi-squared analysis within each demographic are also shown.

In total, 147 children identified for screening by the programme did not pass and subsequently were not seen by either audiology or ORLHNS, or declined screening altogether, which represents 4.3% of all children identified in the database; these children then start school with potentially unmanaged hearing loss. These rates are significantly higher in Māori (7%, p<0.0002) and Pasifika children (14%, p<0.0001) when compared with other ethnicities (Table 4).

Discussion

We have reviewed the performance of the hearing screening programme as part of the B4 School Checks across the Southern DHB. It is of note that the databases used appear to underestimate the number of eligible children residing in Otago when compared to census data from the same year. This was an unexpected finding and warrants further examination. It was not within the remit of this audit to undertake this; however, it is likely that some of these children are captured in the subsequent year (once they start school) via the ENROL database.

Figure 1 shows the times at which a child may not participate in the screening programme; the majority being those who are not screened either because they were not captured in the database, declined screening or were reported to have other care arrangements. These children are effectively left out of a process which aims to ensure that when children start school their hearing needs have been addressed. Subsequently, referrals for a further 138 children recommended for further management of their ear condition (4.2% of all those screened, or 42% of those who did not pass the screening test) were either not received by public audiology or regional ORLHNS or did not attend a specialist assessment; this is addressed further below.

Support for the efficiency of the screening programme lies in the similar proportions screened both in urban and rural settings. The male predominance of those not passing the screening is consistent with findings of the Dunedin Study which identified 57% male preponderance of persistent or transient otitis media with effusion. It should be noted that the ethnic composition of the Dunedin Study participants was different from that of our group and comparison cannot be made in this respect.
In accordance with previous reports\textsuperscript{5,10–11} the prevalence of probable middle ear disease is higher among Māori and Pasifika children. For the Southern region, the proportion of Māori receiving specialist attention following a failed screen is similar to “other ethnicities”. This is encouraging in that, for Māori, there appears to be equal outcomes from the “screening process”. However, the number of “at risk” children is carried forward into the numbers of these children at risk of hearing impairment when entering school. That is, Māori and Pasifika children have a greater risk of entering school with hearing impairments that will potentially hinder their early schooling experience. In making this assessment we have assumed that similar proportions of those who were not screened will not pass the screen.

When considering how this audit helps optimise outcomes for children there are points to address. These are: optimising capture by the screening programme, maximising participation at the initial assessment and improving the transfer of care between screening and specialist assessment. The first we cannot address readily, however, the second and third may be addressed through modest changes to the screening programme protocol. Simple changes could be to, by default, undertake a screen unless the child’s guardian specifically declines this service regardless of whether they are already “under care”, and for onward referral from the screening programme to be directed to the local audiology service (or to specified private care) directly, regardless of the modality of their hearing loss. It is important to highlight that the problem does not appear to necessarily be related to onwards referral from the screening programme itself (which follows a robust protocol) but rather the pathway through which children must progress after this stage to then ultimately be referred and seen by specialist services. These changes could be easily made and documented, so enabling future audit.

What is less easily addressed, and not part of this audit, is the optimal specialist management strategy for Māori and Pasifika children. It is recognised that there are barriers to accessing such care\textsuperscript{6,12,13} and also to optimising specialty access in rural settings. Across Otago and Southland, private audiologists provide services in rural communities and funding for B4 School-referred children, while already in place, could be expanded with the potential to improve attendance to a more localised service. Engagement with appropriate stakeholders is essential for improving access and outcomes. In conjunction with local Iwi, the ORLHNS Department in the Bay of Plenty runs a successful rural clinic in Kawerau. The population is predominantly Māori and with a high deprivation index; between 2016 and 2019 clinic attendances were 94% compared to 83% at Tauranga Hospital.\textsuperscript{13}

Within Central Otago there is availability for people to be seen locally by a private ORLHNS through a Central Otago Health Board funding stream, although our data suggest that this is little used for those who do not pass their hearing screen and the pathway would require changes to the funding model.

**Strengths and limitations**

The structure of the hearing component of the B4 School screening programme provides an excellent starting point for addressing the detection of hearing impairment among children about to enter primary school. There is sound data from which comparisons can be drawn, and this has allowed an assessment of the “bigger picture” within the Southern region. We deliberately selected a data collection period that coincided with the 2018 Census; this helped identify the probable number due for hearing screening. However, the census only records the numbers of people normally resident in Otago and Southland on one night and this introduces inaccuracy when determining how many children should have been identified for screening. Despite this, it is notable that the census proved accurate for Southland, but not for Otago. Additionally, a reasonable number of these children may be subsequently identified during their first year of school, although these children will have potentially had treatment delayed by a year as a result.

We are fortunate that the private ORLHNS working across SDHB are all based in Dunedin and agreed to inform us of any children they had seen following a screening referral. For practical reasons we could not extend this to GP and private audiology services across our DHB and this has likely led to an overestimate of the number of children who had unmanaged hearing loss. Children may have attended their GPs and been managed appropriately, and similarly in rural locations pathways for referrals to private audiologists directly from the screening program are in place in certain circumstances, and the findings and outcomes of these referrals have not been accounted for. While this may have caused overestimates in the total numbers being lost through
the referral pathways, it may be reasonable to assume that the relative disparities between subgroups would persist.

The audit protocol is fairly straightforward and could be used by other DHBs to assess the effectiveness of hearing screening and identification of children at risk, with a view to optimising subsequent management.

**Conclusion**

The Southern region hearing screening programme is effective at engaging with children and whānau identified within the databases they use, and follow robust protocols. The management of children identified at risk of hearing loss follows recommended guidelines but these do not necessarily specifically direct children to either audiology or ORLHNS for ongoing management. This may increase the likelihood of ongoing unmanaged hearing loss due to a potentially convoluted referral pathway; Māori and Pasifika children are at higher risk. There is scope to consider modest changes to the referral process that may optimise the management of children that do not pass their hearing screening.
COMPETING INTERESTS
Nil.

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REFERENCES
The effect of COVID-19 on orthopaedics in Aotearoa New Zealand—a survey of orthopaedic surgeons and training registrars

Matthew J Bowman, Scott M Bolam, Mark Wright

ABSTRACT

AIM: This study aimed to assess the impact of COVID-19 on orthopaedic practice in New Zealand, with a focus on training and mental health.

METHODS: An online survey was sent to the 385 consultant orthopaedic surgeons and registrars in New Zealand registered with the New Zealand Orthopaedic Association (NZOA). The survey consisted of 27 questions relating to demographics, the effects of COVID-19 on orthopaedic departments, on training, on mental health and the utilisation of telehealth and online teaching.

RESULTS: In total, 189 of 385 NZOA members (49%) completed the survey. Of the 51 orthopaedic registrars surveyed, 55% felt that their training had been moderately affected, while 17% felt it had been significantly affected. Of those surveyed, 65% felt the pandemic had at least a mild effect on their mental health. Seven percent of registrars described a significant impact on their mental health compared to 2% of consultants (p=0.029). Overall, 46.5% felt they were more burnt out because of the pandemic, which was significantly higher in registrars compared to consultants (51% vs 44%, respectively; p=0.029).

CONCLUSIONS: Despite the comparatively low number of COVID-19 cases, hospitalisations and deaths, the effects for orthopaedic surgeons and training registrars have been significant.

A new type of viral pneumonia was recognised in Wuhan, China in December 2019. By January 2020, this was identified as a type of coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The first case of SARS-CoV-2 detected in Aotearoa New Zealand was on 28 February 2020, and on 11 March 2020 the World Health Organization formally declared a coronavirus disease 2019 (COVID-19) pandemic. Many health systems around the world were quickly overwhelmed with high rates of hospitalisations and deaths. In many countries elective surgery was suspended in order to rationalise staff and resources.\(^1\)\(^-\)\(^4\)

In 2020, it was estimated that during the 12 weeks of peak disruption of all elective surgery across 190 countries, 28,404,603 operations would be cancelled or postponed.\(^5\) This represents a cancellation rate of all elective surgeries of 72.3%. Using surgical data collected during 2020, Heckmann et al.\(^6\) estimated that the nationwide volume in the United States of elective hip and knee arthroplasty cases decreased by 46.5% to 47.7% from the prior 3-year average. Furthermore, the elective hip and knee arthroplasty case volume for April 2020 was 1.9% of the volume for the same month in 2017 through 2019.

Although the New Zealand healthcare system has not been affected to the same extent as many other countries, the pandemic has still had a significant impact on most specialties and many patients. At the time of this survey—21 November 2021—there had been 9,608 cases of COVID-19 and 46 deaths with 83 patients in hospital, 5 of whom were in the intensive care unit/high dependency unit (ICU/HDU).\(^7\) In comparison to most other countries, these are relatively low numbers, which is the result of multiple factors including the geography of our island nation, the high vaccination rate (83% double vaccinated as of 21 November 2021) and the control measures implemented by the government.

Mental health issues including burnout are prevalent in orthopaedics, particularly among registrars.\(^8\)\(^-\)\(^10\) In a recent study, Verret et al.\(^8\) found that 34% of orthopaedic residents reported high levels of depersonalisation compared to 9% of consultants. In a survey to assess the impact of the pandemic on the mental health of the orthopaedic workforce, Thakrar et al.\(^11\) found significantly
higher rates of generalised anxiety disorder and major depressive episodes when compared to the general population.

We hypothesised that COVID-19 had significantly impacted the training of Surgical Education and Training (SET) registrars. We also hypothesised that the pandemic has had a detrimental effect on the mental health of surgeons and registrars. The purpose of this study was to assess the impact of COVID-19 on orthopaedic practice in New Zealand, including the impact on orthopaedic training and the mental health of surgeons and registrars.

Methods

With the assistance and permission of the New Zealand Orthopaedic Association (NZOA), consultant orthopaedic surgeons and SET orthopaedic registrars were asked to complete an electronic survey relating to the impact of COVID-19 on their practice, training and wellbeing. This nationwide survey was conducted in November 2021 and was sent to all 385 members of the NZOA, the organisation with which all practising orthopaedic surgeons and SET registrars in New Zealand must be registered. The survey was administered using Survey Monkey (Palo Alto, CA, USA). Following the initial email, two reminder emails were sent one and two weeks later.

The survey was comprised of 27 questions relating to demographics, the effects of COVID-19 on orthopaedic departments, on orthopaedic training, on mental health and the utilisation of telehealth and online teaching. The option of adding comments as free text after each question was made available. Demographic data collected included age, training level, and location of practice. Data was collected from both the public health sector as well as the private health sector. The public sector is managed by Te Whatu Ora – Health New Zealand with funding from the Government. The private sector is funded by insurers, the Accident Compensation Corporation (ACC) or the individual. Prior to distribution, the survey was validated by a consultant orthopaedic surgeon and two orthopaedic registrars. The survey was anonymised with a response window of one month.

Significance testing was performed with Prism 8 (GraphPad, San Diego, CA, USA). Differences were determined with Fisher’s exact test or Chi-squared tests and a p-value of <0.05 was considered significant. The study methodology was reviewed by the Health and Disability Ethics Committees (HDEC) and did not require a formal ethical review.

Results

Demographics

The nationwide survey received 189 responses from the 385 NZOA members, a response rate of 49%. Responses were received from 135 of 320 orthopaedic consultants (42%), 51 of 62 SET orthopaedic registrars (82%) and 3 orthopaedic fellows. Demographic details are shown in Table 1.

Effect on practice

All respondents were vaccinated, with 188 of the 189 respondents being double vaccinated. One person had only received a single dose of the vaccine. At the time of the survey, 10.8% of respondents had treated a patient with an active COVID-19 infection and 15% had been stood down from work to self-isolate due to COVID-19 exposure. None of the respondents had tested positive for COVID-19.

Of those surveyed, 1.6% had been re-deployed to work in an area outside of orthopaedics (two consultants and one SET registrar). Overall, 14.8% felt they had been adequately trained to work outside their scope of practice, while 85.2% believed they had not received adequate training. Overall, 35.7% would be willing to be re-deployed, 30.3% stated they would not be willing to be re-deployed and 34% were unsure. Significantly fewer consultants would be willing to be re-deployed compared to registrars (31% vs 45%, respectively; p<0.05).

Effect on productivity

Overall, 51% of those surveyed felt there had been a significant reduction in theatre productivity (delays, reduced volume, longer wait times) due to COVID-19, while only 5% felt there had been no change. Of those who worked in Auckland, 70% felt there had been a significant reduction in theatre productivity compared to 41.2% of those who worked throughout the rest of New Zealand (Figure 1) (p<0.001).

Hospital preparedness

In total, 4% rated their hospital preparedness for COVID-19 as excellent, 21% as good, 48% as average and 27% as poor. Of those who worked in the North Island of New Zealand, 23% believed preparedness was good compared to 12% in the
### Table 1: Demographic data of respondents.

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Frequency, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>164 (86.8)</td>
</tr>
<tr>
<td>Female</td>
<td>25 (13.2)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
</tr>
<tr>
<td>20–30</td>
<td>7 (3.7)</td>
</tr>
<tr>
<td>31–40</td>
<td>59 (31.2)</td>
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<tr>
<td>41–50</td>
<td>45 (23.8)</td>
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<tr>
<td>51–60</td>
<td>52 (27.5)</td>
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<tr>
<td>60+</td>
<td>26 (13.7)</td>
</tr>
<tr>
<td><strong>Position</strong></td>
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</tr>
<tr>
<td>Consultant</td>
<td>135 (71.4)</td>
</tr>
<tr>
<td>Registrar</td>
<td>51 (27)</td>
</tr>
<tr>
<td>Fellow</td>
<td>3 (1.6)</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
</tr>
<tr>
<td>North Island</td>
<td>147 (77.8)</td>
</tr>
<tr>
<td>South Island</td>
<td>42 (22.2)</td>
</tr>
<tr>
<td><strong>Auckland vs rest of New Zealand</strong></td>
<td></td>
</tr>
<tr>
<td>Auckland</td>
<td>70 (37)</td>
</tr>
<tr>
<td>Rest of New Zealand</td>
<td>119 (63)</td>
</tr>
<tr>
<td><strong>Size of District Health Board (patients)</strong></td>
<td></td>
</tr>
<tr>
<td>&gt;200,000</td>
<td>151 (79.9)</td>
</tr>
<tr>
<td>&lt;200,000</td>
<td>38 (20.1)</td>
</tr>
<tr>
<td><strong>Private vs public</strong></td>
<td></td>
</tr>
<tr>
<td>Full time public</td>
<td>65 (34.4)</td>
</tr>
<tr>
<td>Full time private</td>
<td>26 (13.7)</td>
</tr>
<tr>
<td>Public and private</td>
<td>98 (51.9)</td>
</tr>
</tbody>
</table>
Figure 1: Effect of COVID-19 on operating theatre productivity.

![Reduction in Operating Theatre Productivity](image1)

Figure 2: The effect on orthopaedic training due to the COVID-19 pandemic.

![Effect on Orthopaedic Training](image2)

Figure 3: Effect of the pandemic on mental health of orthopaedic consultants and SET registrars.

![Effect on Mental Health](image3)
South Island. In the North Island, 6% believed it was excellent, while in the South Island no respondents felt their hospital preparedness was excellent, however, this did not reach a significant difference (p=0.147). Overall, 74% believed that health innovation (rapid tests, surveillance testing) had been used ineffectively in their hospitals.

Effect on training

Of the 51 training orthopaedic registrars surveyed, 55% felt that their training had been moderately affected, while 17% felt it had been significantly affected (Figure 2). Of the consultants surveyed, 36% and 17% felt training had been moderately and significantly affected, respectively. Of the 15 training registrars working in the Auckland region who responded to the survey, 93% felt that their training had either been moderately or significantly affected compared to 67% of training registrars throughout the rest of New Zealand, however, this did not reach statistical significance (p=0.262).

Of those surveyed, 86% had been utilising online teaching and 80% felt that these sessions were less useful than traditional in-person teaching sessions, while only 6% felt they were more useful. Remote access was felt to be the most useful aspect of online teaching (56%) followed by the ability to record the teaching sessions (34%). Only 10% felt more comfortable during online teaching, while 44.9% felt less comfortable and 45% felt there was no difference. However, 86% felt that these online sessions should continue to play a role in orthopaedic education.

Mental health

The effects of the pandemic on the mental health of those surveyed are shown in Figure 3. Sixty-five percent of all respondents felt the pandemic had had at least a mild effect on their mental health, while 3% stated COVID-19 had significantly impacted their mental health. This number was significantly higher in registrars compared to consultants (7% vs 2%; p=0.029). There were no differences between Auckland and the rest of New Zealand in terms of effects on mental health, with 24.3% of those in Auckland having a moderate or significant effect on their mental health compared to 19.3% in the rest of the country (p=0.362). Of the 135 consultants surveyed, 19.3% stated that the COVID-19 pandemic had led them to consider retirement.

Overall, 46.5% felt they were more burnt out because of the pandemic. Significantly more registrars surveyed felt more burnt out compared to consultants (51% vs 44%; p=0.029). There were no differences in the rates of burnout between consultants aged under 50 years and those over 50 years, with 46% and 44% feeling more burnt out respectively (p=0.676). Those working in a smaller district health board (DHB) region (population <200,000) reported higher rates of feeling burnt out compared to those working in a larger DHB; however, this did not reach statistical significance (58% vs 43%; p=0.259). There was no significant difference in the rates of burnout between Auckland and the rest of New Zealand (44% vs 47%, respectively; p=0.062).

With respect to concerns, 35% felt the reduction in productivity was the greatest concern, followed closely by concerns of passing COVID-19 on to family members and the impact on training (30% and 13%, respectively).

Telehealth

Of all respondents, 81% stated that telehealth phone consultations with patients were less effective than in-person consultations but still found they were valuable, while 11% felt telehealth was not useful.

Discussion

COVID-19 has had a significant effect on training and mental health for orthopaedic surgeons and registrars in New Zealand. Around the world, elective orthopaedic surgery has mostly been suspended to reduce the spread of the virus and ensure health resources are used appropriately.²–⁴ In New Zealand, up until the Omicron outbreak, there had been relatively few hospitalisations and deaths when compared to the rest of the world. As of 21 November 2021, when this survey was conducted, there had been 9,608 cases of COVID-19 and 46 deaths; at that time 83 patients were in hospital, 5 of which were in the intensive care unit/high dependency unit (ICU/HDU).⁷ These comparatively low numbers were largely due to high vaccination rates and the response from the New Zealand Government, which involved the suspension of many business operations, strict social distancing measures, travel restrictions and the enforced use of quarantine.

Surgery for those who are positive for COVID-19 involves additional planning, extra equipment and intensive operating theatre cleaning, which is significantly time and resource consuming. Many hospitals have converted operating rooms
to “COVID theatres”, dedicated to the treatment of only those with COVID-19. This is necessary to keep patients safe but comes at the expense of reduced operating capacity, resulting in delayed or cancelled surgery for other patients. We found that 51% of those surveyed felt there had been a significant reduction in theatre productivity. Several other studies from multiple countries have also shown significant reductions in both elective and trauma orthopaedic case volumes during the pandemic.\textsuperscript{1,12,15-18} A study of 43 Hong Kong public hospitals found a reduction in elective orthopaedic operations of 73.5%.\textsuperscript{19} In Europe, survey results from orthopaedic surgeons suggested that 68.4% of elective orthopaedic surgery and 92.6% of arthroplasty surgery had been suspended.\textsuperscript{2} In the United States, there are estimates that 30,000 arthroplasty operations have been cancelled each week.\textsuperscript{4} It has been estimated that the backlog of patients around the world needing elective surgery could take over one year to clear.\textsuperscript{5} Delayed or cancelled surgeries have a substantial physical and/or emotional impact on patients.\textsuperscript{19}

Reductions in orthopaedic surgical and clinical volume also has a detrimental effect on training and education.\textsuperscript{2,5,12,13} In our study, 72% of registrars and 53% of consultants felt that their training had been affected either moderately or significantly. In the United Kingdom, 69% of orthopaedic trainees felt the pandemic would result in a delay in completion of their orthopaedic training.\textsuperscript{16} Similar surveys of orthopaedic trainees have found that 45.5% felt they would not acquire the expected surgical skills and as many as 25% believed an additional year of training was necessary.\textsuperscript{17} Orthopaedic residency directors have expressed concerns about the negative impact of COVID-19 on training.\textsuperscript{12,20} Education has also suffered through the cancellation of conferences and courses; online teaching has become commonplace during the pandemic, but both our study and others have found satisfaction with this is lower than traditional in-person teaching.\textsuperscript{21}

The issue of surgeon burnout has received significant attention in recent years. As a specialty, orthopaedics has one of the highest rates of burnout with rates ranging from 40% to 60%.\textsuperscript{9,10,22,23} Orthopaedic surgeons also have the highest prevalence of surgeon suicides among surgical specialties, comprising 28.2% of surgeon suicides from 2003 to 2017.\textsuperscript{24} Our study found that nearly half of those surveyed felt more burnt out because of the pandemic. This is a significant finding given the already high rates of burnout in orthopaedics.

Recent research shows the stress and social isolation brought about by the pandemic has had a negative impact on the mental health of healthcare workers.\textsuperscript{25-27} Chang et al.\textsuperscript{21} found that the quality-of-life score for an orthopaedic registrar in South Korea decreased from 68.9 out of 100 prior to the pandemic to 61.7 during the pandemic. Our findings are similar to the current literature with 65% of consultants and registrars stating the pandemic had a mild or moderate effect on their mental health.

Our study also found that 75% of orthopaedic surgeons and training registrars believed their hospitals preparedness for COVID-19 was either average or poor. In a survey of the Polish Society of Orthopaedics and Traumatology in 2020, 82.6% believed the Polish healthcare system was not well prepared for the pandemic.\textsuperscript{12} We also found that 84.9% of those surveyed felt they had not been adequately trained to provide non-orthopaedic care in the case of redeployment. In a survey of 327 orthopaedic and trauma trainees throughout Europe, 60.3% had not been given any COVID-19 specific training.\textsuperscript{2} Fortunately, only 1.6% of respondents in our study had been re-deployed—significantly fewer than many other institutions around the world, where between 15% and 25% of orthopaedic residents were re-deployed.\textsuperscript{1,12-14}

There are limitations to this study. Despite the high response rate, response bias is inherent to any survey. Those affected by burnout may be less likely to respond as they are too busy. Conversely, they may be more likely to respond as they are most affected. The COVID-19 virus and the response to the pandemic are rapidly evolving and this survey provides only a snapshot of one point in time. This survey was completed approximately one month prior to the first community case of the Omicron variant and prior to the removal of the “red traffic light” restrictions. Now, the impact of service delivery and training has been felt across wider areas of New Zealand. Therefore, the results of this survey may not reflect the current situation in New Zealand. We intend on repeating this survey to gain further insight into this changing landscape.

This is the first study assessing the effects of COVID-19 on orthopaedic practise and training in New Zealand. Despite the comparatively low number of COVID-19 cases, hospitalisations and deaths by the time of this study, it is clear that the effects on orthopaedic surgeons and training registrars have been significant. It is crucial that
as we work during this stressful and often frustrating time, there is an awareness of the impact the pandemic has had on the mental health of healthcare workers. Counselling services such as the Employment Assistance Programme need to be promoted and utilised. Additional counselling services and courses on managing stress and anxiety would be greatly beneficial.

The reductions in surgical efficiency and volume will have a significant impact on the New Zealand health system and the training of the next generation of surgeons. Strategies to facilitate training include online “virtual” teaching sessions which have now become commonplace in many hospitals and training programmes, including orthopaedic training in New Zealand. There are also significant learning opportunities in the private sector that have the potential to provide valuable experience for training registrars given the significant reduction in elective surgery in the public health system. In order to continue to provide the highest quality care to our patients, we must create innovative solutions and adapt to this ever-changing situation.
COMPETING INTERESTS
All authors have nothing to disclose. This research received no external funding. The study has been performed in accordance with the ethical standards in the 1964 Declaration of Helsinki.

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REFERENCES


Microvascular reconstruction outcomes from a New Zealand Oral and Maxillofacial Surgery Unit

Hannah Maher, Ellen Simpson, Thasvir Singh

ABSTRACT

AIM: The Oral and Maxillofacial Surgery (OMS) Department at Waikato District Health Board (WDHB) is the only current OMS unit within New Zealand to reconstruct oral cavity defects with microvascular free flaps. The primary objective of the study was to retrospectively analyse the demographics, outcomes and complications of free flap surgery patients at WDHB. 

METHOD: An OMS reconstruction database was developed and data collected retrospectively. Seventy-five free flaps were performed on 74 patients between 2012 and 2020.

RESULTS: There were 34 females and 40 males, with a mean and median age of 62 and 64 respectively. The tongue was the most common site of resection, and squamous cell carcinoma was the most frequent diagnosis. The radial forearm free flap was used most often followed by the fibula and anterolateral thigh flaps. The Clavien–Dindo classification was used to classify complications, with 10 patients having “major” complications and 34 patients having “minor” complications.

CONCLUSION: Flap success rate was 98.7%, which meets internationally accepted standards of care.

The Oral and Maxillofacial Surgery (OMS) department at Waikato District Health Board (WDHB) is unique, as it is the only OMS unit in New Zealand to independently reconstruct oral cavity defects with microvascular free flaps. This unit has been reconstructing major oral cavity defects since 2012 with fasciocutaneous radial forearm, composite fibula, and anterolateral thigh free flaps (ALT). There is no study to date that analyses the demographics, complications or outcomes of patients who have undergone free flap reconstruction surgery within the OMS specialty in New Zealand.

Reconstruction of oral cavity defects poses many challenges. The overall aims are to restore orofacial function and aesthetics, while improving, or maintaining, a patient’s quality of life. It has been shown that free tissue transfers can assist with achieving these goals. As such, microvascular free flaps have become the “gold standard” for reconstructing large head and neck defects. Complications can occur and are often associated with a high level of morbidity or even mortality.1–3 In general, free flap reconstruction in the overall head and neck region have good outcomes with reports of success rates ranging between 90–98.8%4 while the reported complication rate can range from 34–85%.5 Specific data on oral cavity free flap reconstruction outcomes in New Zealand are limited.

The primary objective of this study is to retrospectively provide an overview of complications and outcomes of patients who underwent free flap reconstruction by the OMS Department at WDHB (Hamilton, New Zealand). This information can then be compared with national and international results to ensure an adequate level of patient care is being provided, while contributing to scarce data for head and neck reconstruction in New Zealand. It will also serve as a valid baseline for further local research endeavours.

Method

The study was accepted and registered with the WDHB Research Committee, and local Māori consultation was completed. Health and Disability Ethics Committee approval was also obtained.

Patients were identified through past head and neck multidisciplinary team meetings and then confirmed with the yearly logbooks from 2012–2020. Patients were included if they had a free flap transfer for reconstruction of an oral cavity defect by the OMS team only. A total of 74 patients were identified and included.

A database was created that incorporated entry points similar to other major head and neck units. Standardised de-identified data collection was...
Results

A total of 75 free flap reconstructions were completed on a total of 74 patients between 2012 and August 2020 (Figure 1). There were 51 (68%) radial, 22 (29.3%) fibula and 2 (2.7%) ALT microvascular free flaps performed (Figure 2). One patient received two free flaps during one surgery, a fibula and a radial forearm flap, to treat an extensive squamous cell carcinoma involving both the lower lip and mandible.

The study population comprised 34 (46%) females and 40 (54%) males with a mean age of 61.9 years. Fifty-eight (78.4%) of the patients were NZ European, and 40 (54%) males with a mean age of 61.9 years.

The primary diagnosis requiring resection was squamous cell carcinoma (SCC) consisting of 56 (75.7%) patients followed by 11 (14.9%) with other malignancies, 5 (6.8%) ameloblastomas and 2 (2.7%) cases of osteomyelitis/osteoradionecrosis of the jaw. Anatomical sites resected and then reconstructed are demonstrated in Figure 3. 20 of the 74 (27%) patients had had previous surgery to the head and neck region and 12 had previous radiotherapy.

A temporary surgical tracheostomy was conducted in 44 (59.5%) patients; the remainder (30 patients) had nasal endotracheal tubes. 23 of these patients (77%) were extubated at the end of the case, and 7 patients (23%) spent at least one night intubated in ICU. Tracheostomy patients had a longer total inpatient stay than patients that did not (16 days compared with 11 days, p<0.001). Although tracheostomy patients had more complications (p=0.008), there was no statistical significance (p=0.566) when comparing tracheostomy versus no tracheostomy free flap outcomes overall.

Nutrition was managed with a pre- or post-operative gastrostomy in 23 patients. The other 51 patients had a fine bore feeding nasogastric tube placed at time of surgery for temporary nutritional support, and transitioned to an oral diet when able.

Sixty-six patients were discharged from hospital directly to their residence while two required rehabilitation prior to hospital discharge. Six patients were discharged to convalescence care in their local hospitals due to the relatively isolated geographical location of their residence.

Twenty-seven (36.5%) patients received a transfusion during their inpatient stay, and 15 (16.2%) patients required a vasopressor agent post-operatively to meet haemodynamic targets. The most commonly used vasopressor agent was phenylephrine (n=12).

Using the Clavien–Dindo Classification, 10 (13.5%) patients had a score of IIIb or more as seen in Table 1. These patients required an unexpected return to theatre during their inpatient stay, and thus were classified as having had a “major” complication. Two patients were taken back to theatre more than once. The reasons for returning to theatre included: reanastomosis or clot removal (n=4), post-operative infection (n=2), haemorrhage (n=2), failed extubation requiring surgical tracheostomy (n=1), debridement of skin paddle (n=1), and total flap failure (n=1).

A total of 34 patients (45.9%) had minor complications and 30 (40.5%) had no complications.
**Figure 1:** Number of free flaps performed per year.

![Bar chart showing the number of free flaps performed per year from 2012 to 2020.](image)

**Figure 2:** Types of free flap reconstructions.

![Pie chart showing the distribution of free flap reconstructions.](image)

**Figure 3:** Site of resections.

![Pie chart showing the distribution of resection sites.](image)
Minor infection was the most common minor complication (n=6). Treatment for minor infection was debridement, drainage and/or aspiration under local anaesthetic. Debridement of a non-viable portion of the flap under local anaesthetic was the next most common minor complication (n=2).

The most common minor complications requiring medical management were low post-operative blood pressure requiring vasopressor support, post-operative anaemia requiring red blood cell transfusion, pneumonia, delirium and fluid overload.

Radial forearm free flaps were complicated occasionally by venous congestion requiring thrombus evacuation and reanastomosis (n=4). This was followed by infection (n=2), tracheostomy site bleed (n=2) and neck haematoma (n=1). One patient had a bleed from the tracheostomy site as well as venous congestion, requiring two separate returns to theatre.

There were only two major postoperative complications in patients receiving a fibula free flap. These were infection requiring incision and drainage of a collection in the neck and one case of venous congestion requiring reanastomosis.

To date, five free flaps have had partial flap loss and one complete flap failure. Partial flap loss in four cases was due to partial or complete loss of the skin paddle and the other was due to an internal jugular vein thrombosis. This occurred in 9% (n=2) of fibula, 2% (n=1) of radial forearm free flaps, and in one ALT free flap. The only complete flap loss was in a fibula in a smoker with an infected, pathological mandibular fracture secondary to osteoradionecrosis, and who had previously undergone a radial forearm free flap for reconstruction of a tongue SCC. This was also the only free flap used for a salvage.

When comparing the three different free flaps, ALT flaps had to be excluded due to numbers, which meant a meaningful comparison for that group could not be produced. Radial and fibula free flaps complications were compared and there was no statistical significance between groups.

### Discussion

The Waikato OMS Unit in New Zealand provides an independent microvascular free flap reconstructive service for the reconstruction of complex maxillofacial defects. The unit services a population of over 930,000 covering the large geographical midland region. The 14.9% of patients who identified as NZ Māori is representative of New Zealand’s population and the population included in recently published New Zealand head and neck literature.²³

An adequate number of procedures is required to ensure surgeons, theatre and ward staff are familiar with the peri-operative, intra-operative and post-operative cares required. Previous research has suggested that an increased number of cases correlates with a decrease in the number of post-operative complications and more successful outcomes for patients.⁸ Since 2012 the number of free flaps per year has increased, particularly since 2017, when a second OMS surgeon started (Figure 1), and although numbers are small currently there appears to be a proportionately lower number of complications thus far.

International literature shows that the success rate of free flap transfers varies from 90% to 98.8%.⁴⁻⁶⁻¹⁰ WDHB OMS results are at the upper limit of that range with a success rate of 98.7%.

<table>
<thead>
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<th>Complications</th>
<th>Cases</th>
<th>Percentage (%)</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Clavien–Dindo I</td>
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<tr>
<td>Clavien–Dindo IIb</td>
<td>10</td>
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</tr>
<tr>
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<td>73</td>
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</tr>
<tr>
<td>Flap failure</td>
<td>1</td>
<td>1.4</td>
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Published data regarding head and neck free flaps from New Zealand is scarce. Results from Hutt Hospital (Wellington, New Zealand) in 2010 suggest that outcomes from Waikato OMS unit are comparable. Their overall success rate was 93.7%, however, the study was not limited to head and neck reconstructions. Six out of 13 flap losses were in head and neck cases. A more recent New Zealand study focusing on head and neck reconstructions had an unexpected return to theatre rate of 13% and an overall success rate of 96.6%, which are both similar to the outcomes found in this study.

The Clavien–Dindo classification of surgical complications can be readily applied to study populations, and aids future research by providing a useful objective outcome measure. The major complication rate (Clavien–Dindo IIIb) was lower (13%) when compared with a similar study that used the same classification system and found that 32% of patients had a major complication. Reasons for this could include patient selection, a multidisciplinary approach during treatment planning and the use of a small, regular and specialised surgical, nursing and post-operative care team.

Research suggests that age, BMI, ASA, Kaplan-Feinstein Index, pre-existing hypertension, pre-operative low haemoglobin and tracheostomy were independent predictors of major complications. Our results suggest that having a tracheostomy was the only statistically significant predictor of complications including an unexpected return to theatre, post-operative pneumonia and a longer inpatient stay. This is consistent with other studies comparing patients that underwent free flap reconstruction with a tracheostomy versus endotracheal tube.

Multiple variables including surgical defect size and composition, function and surgeon familiarity are considered when deciding on a donor site. The radial forearm free flap was the most popular flap used in the study for reconstructing oral cavity defects, likely due to its predictability, long pedicle and the diameter of the vessels. The literature shows that the radial forearm is the most commonly used flap for oral cavity reconstruction as it is also extremely reliable and consistent, and has the ability to be concurrently harvested using a two-team approach. The most frequent complication requiring a return to theatre associated with this flap in this study was venous congestion. The most common major complication of the WDHB fibula free flaps was a partial loss of the skin paddle, although this did not affect the patient’s long-term outcome. This again is consistent with the literature, with other studies reporting a significant rate of skin paddle loss from fibula free flaps of approximately 10%. ALT free flaps could not be properly compared as there were only two, partially due to patient body habitus and slightly reduced predictability compared with the radial forearm free flap.

Research suggests that administering heparin intra-operatively and post-operatively is associated with decreased venous thrombosis without the increased risk of haematoma. Since the OMS department started routinely using 5000u of subcutaneous heparin intra-operatively there have been no cases of venous congestion or skin flap failures. Due to the small numbers, no statistical significance could be found; however, the department will continue to monitor this area in the future. Studies also found longer ischaemic times were associated with flap failures. Unfortunately, this data wasn’t accurately recordable retrospectively, but is a data point that will be added for future patients.

The major limitation of this study was its retrospective nature, but a live database has been developed for future prospective research to improve the quality of data collection and patient outcomes.

Conclusion

The OMS unit at WDHB provides a comprehensive maxillofacial free flap reconstruction service for patients who require significant head and neck resections. The demographics of patients within this study is similar to that of other free flap reconstruction studies, and in general appears to reflect the make-up of the New Zealand population.

The overall success rate of free flap transfers within the department is 98.7%, confirming that free flaps by the OMS department are extremely reliable in achieving successful reconstruction of oral cavity defects.

The study confidently concludes that both minor and major complications rates are low, and the overall success rate is high.
COMPETING INTERESTS
This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

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REFERENCES


Radiology and Te Whatu Ora – Health New Zealand in 2022. Why we should all care

Anthony James Doyle

ABSTRACT

Radiology is a key enabler of clinical activity and has been shown to be highly cost effective. Demand and activity have increased over time, with demand for computed tomography (CT), magnetic resonance imaging (MRI) and ultrasound (US) growing faster than population growth. Complexity has also increased over time. Resources in the public sector have not kept up with demand, exacerbated by the COVID-19 pandemic. A reliance on an overseas trained workforce has resulted in critical shortages. Waiting times for CT, MRI and US across Aotearoa New Zealand remain well below targets and have not improved over 10 years. Robust links between clinical activity and radiology resourcing are needed to address the deficits and thereby maintain clinical safety.

Generally speaking, patients and clinicians in the public health service in Aotearoa New Zealand are fortunate in having reasonably ready access to a wide range of medical imaging, from basic radiographs through mammography, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), Nuclear Medicine, Interventional Radiology (IR) and other modalities. This access is vital for many clinical activities, including:

1. Confirming the presence of a clinically suspected condition.
2. Excluding a condition clinically thought unlikely to be present.
4. Performing surveillance for disease recurrence, complications of treatment, or ensuring stability of a process presumed to be benign.
5. Screening an asymptomatic population for clinically occult disease.
6. Treatment of an increasing range of conditions in a minimally invasive manner.

Demand for radiology in the public system continues to increase and, in recent years, has exceeded both population growth and the ability of the existing services to cope with that demand. The following figure illustrates the relative growth in radiology activity within the public system from 2015–2019.¹ (The data on which this figure is based, along with other data relating to public radiology services in this article, are in the public domain and were gathered by the author through personal communication with public radiology departments during the course of the author’s work as national clinical leader in radiology with the Ministry of Health from January 2020 to the present time.)

These trendlines indicate that, for example, activity for CT will double in fewer than ten years. The public health system is not currently prepared for this increase; in fact, it has not kept up with demand for a long time. Regular reports submitted to the Ministry of Health since 2013 show that the waiting time targets for outpatient CT and MRI have never been met and that the gaps between the achieved times and the targets (15% for CT and 25% for MRI) have not changed.² Ultrasound has not grown at the same rate but recent data show that waitlists for US have also burgeoned, partly because of the effect of the COVID-19 pandemic (see below). This article aims to summarise the current situation and to provide a framework for addressing anticipated future needs.

Why so much growth?

Modern medicine, appropriately, is reliant on diagnostic tests to facilitate early, accurate and efficient diagnosis. MRI, since its first use for brain imaging in the 1980s, has become standard for the evaluation of spine, joints, biliary tract, complex gynaecological conditions and much else.
CT—after being partly supplanted by MRI—has undergone a massive and continuing resurgence because of its powerful ability to evaluate trauma and cardiovascular disease rapidly and comprehensively, in addition to its previous role in chest, abdominal and skeletal imaging. It is also now a first-line tool for stroke management. CT scanners continue to get faster, use lower radiation doses and offer more in terms of tissue analysis, all pointing to further increase in use and usefulness. Radiology activity growth closely follows clinical activity growth, a phenomenon that has also been documented elsewhere.3

The personal and population health benefits of early detection and diagnosis for entities such as cancer are intuitively obvious, but the economic gains can also be quantitated: a recent Lancet Commission calculated a benefit of $179 for every $1 spent on imaging of 11 common cancers worldwide.4 Although this magnitude of cost/benefit ratio is unlikely to be achieved in Aotearoa, there is little doubt of the highly positive societal and economic value of appropriately utilised diagnostic imaging.

The effect of COVID-19

One feature of radiology that was highlighted early on in the pandemic is that it necessitates hands-on personal contact. Whatever the possibilities of telehealth may be elsewhere, every X-ray, mammogram, CT, MRI or US involves the patient attending the radiology facility and a staff member positioning them for imaging or, in the case of US, being in close contact in the same room for up to 30 minutes.5 This is a significant infection risk for the staff (even using protective equipment) and has only recently been ameliorated by vaccination. The strain has particularly been felt by sonographers in centres where infection rates have been high.

The first lockdown in 2020 led to severe curtailment of radiology activity for a long period, with subsequent backlogs that have yet to be fully addressed, and which have been exacerbated by the more recent Delta and Omicron outbreaks. At the time of writing, there are waiting lists for MRI and US amounting to over 30,000 and 40,000 hours, respectively, of technologist working time, with only slightly smaller waiting lists for CT and X-ray. The inevitable delays in, for example, mammographic screenings have received local public attention and are the subject of ongoing investigations here and overseas.6,7

Workforce

As mentioned above, every radiology examination involves hands-on work by a medical imaging technologist (MIT), MRI technologist, Nuclear Medicine technologist or sonographer. The public system has roughly 1,000 MITs, 200 MRI technolo-
gists and 220 sonographers. Even before COVID-19, the numbers of MRI technologists and sonographers were estimated to be 20–25% lower than needed. Local training programmes have never completely met needs and the workforce has always been supplemented by overseas trainees. For sonographers this has been pronounced; over the last two decades, two-thirds of the roughly 70 new sonographer licences issued annually by the Medical Radiation Technologist Board (MRTB) have been to overseas graduates, but that supply has been severely curtailed. Added to the prolonged close patient contact and demanding physical nature involved in sonography, this has led to a critical shortage of sonographers.

Currently, there are four tertiary providers of MIT qualifications, but only one provider for postgraduate diplomas in US, MRI and nuclear medicine. Although these diplomas are open to graduates other than MITs, the vast majority of diploma students have MIT qualifications. All of these qualifications require clinical placements, most of which are in public hospitals. Some (but not all) private practices provide training for MITs and postgraduate students. Finding clinical placements is the principal constraint on increasing training numbers at present.

The specialist radiologist workforce in the public service includes just over 200 full-time equivalent (FTE) senior medical officers (SMO; 320 individuals, most of whom split their time between public and private) and 100 resident medical officers (RMO). The five-year RMO training programme results in an output of just under 20 SMOs per year, the withdrawal rate being extremely low. Approximately two-thirds of SMOs are locally trained, but the numbers are marginally sufficient at best and will need considerable increases over the next decade or two to cope with increasing demand. Predictions based on a robust mathematical model suggest that the number of MIT qualifications, but only one provider for postgraduate diplomas in US, MRI and nuclear medicine. Although these diplomas are open to graduates other than MITs, the vast majority of diploma students have MIT qualifications. All of these qualifications require clinical placements, most of which are in public hospitals. Some (but not all) private practices provide training for MITs and postgraduate students. Finding clinical placements is the principal constraint on increasing training numbers at present.

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Clinical impact

A high proportion of clinical activity in Aotearoa involves radiology one way or another. Best estimates are that patients have radiology examinations as part of their healthcare journey in 40% of emergency department encounters, 70% as an inpatient and around 50% over time during care as an outpatient or in the community. In many instances, radiology is indispensable for diagnosis and treatment planning; suspected spinal cord compression, bowel obstruction or a simple undisplaced fracture are among hundreds of examples. Lack of or delayed access to these examinations can result in severely adverse consequences, not just clinical frustration. The long-term personal, social and economic effects of an overlooked fetal anomaly or a stroke that could have been reversed with early treatment are enormous.

Appropriate use of diagnostic imaging can sometimes be a challenge for clinicians. There may be situations in which the suitability is not clear, or where imaging might seem to be useful but in reality adds little value to immediate management. Most public facilities engage in vetting and prioritisation of radiology requests to some degree, often in collaboration with clinicians, but the concept of this as a “gatekeeping” role is seriously outmoded. Overall, somewhere between 90–95% of requested imaging ends up being performed one way or another. This means that engagement in and refinement of appropriate clinical pathways by clinicians and radiology facilities is vital for ensuring that the use of imaging is optimised.

Funding

The funding of public radiology in New Zealand is too complex, inconsistent and illogical to encompass in this article. Suffice it to say that, although demand for radiology services is almost entirely driven by clinical activity, there is no linkage between that demand and the funding for increased services in most areas. This inevitably leads to multiple instances in which demand exceeds capacity without the funding resources to increase capacity in terms of workforce or facility. An example is Section 88, the legislation covering maternal US; the remuneration per examination provided under this has not changed in 20 years.

Funding for training is, similarly, highly variable and, importantly, is neither ring-fenced nor linked to realistic need. It is hoped that the funding structures will become more coherent and appropriate under Te Whatu Ora and Te Aka Whai Ora. The recent announcement by the Minister of Health regarding increased radiology trainee numbers under Te Whatu Ora is a step in the right direction.

Private sector role

The private sector plays a significant role in servicing public radiology demands, particularly for elective imaging. Considerable volumes of CT and MRI are outsourced to private providers, along with smaller volumes of US and reporting. Although there are no comprehensive figures available, the overall rate of outsourcing over the last decade has made up a small fraction of total public radiology activity, except in some smaller districts where, for example, all MRI or CT is contracted to the private sector. Outsourcing has recently been increased as a deliberate strategy to offset the effects of the COVID-19 pandemic, but the private sector also has finite capacity. Teleradiology services worldwide are, essentially, at capacity.

All PET/CT in Aotearoa New Zealand is performed in private, since the public system has not yet acquired this modality. Many maternity US, including for pregnancies handled by public lead maternity providers, are performed in private. However, as indicated above, the remuneration for this has fallen behind and there is a high risk of private providers exiting this service, with no public capacity to compensate for that.

Summary

Public radiology in Aotearoa provides a high-quality service for patients and clinicians but is marginally sustainable, even without the effects of the COVID-19 pandemic.

Recommendations and next steps

Workforce

Local training must be increased, particularly for sonographers, MRI technologists and radiologists. Increasing clinical placements in public and private and encouraging non-MIT graduates to train in US or MRI are priorities. RMO numbers and private sector RMO training need to increase significantly. The “train to retain” principle should be followed.
Facilities
CT capacity needs to double over the next 5–10 years, with smaller increases in MRI and US. Mobile units should be set up to supplement fixed sites and improve equity of access.

IT systems need to be upgraded and to have improved connectivity. There is a realistic prospect of this being accomplished within Te Whatu Ora, although it will take time.

Funding
Equitable funding of publicly provided radiology services, independent of geography and demographic, needs to be achieved. A more coherent, consistent and equitable national approach is needed for the funding of workforce, facilities and training. A national pricing model for contracting outsourcing is being worked on and needs to be agreed.

Clinical activity
There need to be robust links to ensure that any increase in clinical activity is accompanied by matching increases in radiology resources. Collaborative development of clinical pathways should continue, in order to foster appropriate use of imaging.
COMPETING INTERESTS
Nil.

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REFERENCES
12. OECD (2022), Computed tomography (CT) scanners (indicator), Magnetic resonance imaging (MRI) units (indicator). doi: 10.1787/1a72e7d1-en.
Severe cutaneous reaction to the messenger RNA (mRNA) BNT162b2 (Pfizer–BioNTech) vaccine

Sabrina Sapsford, Blair Wood

ABSTRACT

The pathway out of the COVID-19 pandemic has been reliant on uptake of vaccination. In New Zealand, we have access to the messenger RNA (mRNA) BNT162b2 (Pfizer–BioNTech) vaccine. In this case report we discuss a patient who presented to an acute general medical service with a severe cutaneous adverse reaction (SCAR) after the vaccine with features of both Stevens–Johnson syndrome and acute generalised pustulosis. Early recognition and management of SCARs is required to prevent morbidity and mortality.

The pathway out of the COVID-19 pandemic has been reliant on the uptake of vaccination. For the majority of the New Zealand population, we have access to the messenger RNA (mRNA) BNT162b2 (Pfizer–BioNTech) vaccine, which provides excellent protection from the most severe manifestations of COVID-19 infection.\(^1\) However, like any medical intervention, there are some patients who are affected by adverse reactions. In this case report we discuss a patient who presented with a severe cutaneous adverse reaction (SCAR) after the vaccine.

A 60-year-old woman presented to her general practitioner with a rash which began within 24 hours of her first dose of the Pfizer–BioNTech vaccine. She was usually independent with no prior admissions to hospital. She had a background of hypertension, dyslipidemia, impaired glucose tolerance, obstructive sleep apnoea, hepatic steatosis and high body mass index.

Her regular medications were chlorthalidone, losartan, atorvastatin and amlodipine. She had no known allergies and no prior history of drug reactions. There were no new or changed medications, including over the counter preparations, for at least two months prior to vaccination.

The eruption started on her right shoulder, chest and upper thighs with associated fever and fatigue. She had also noted some tiny pustules on the worst affected skin of the flexures, which would come and go from day-to-day. Five days later, when her symptoms did not abate, she presented to her GP. She was prescribed 40mg (0.5mg/kg) of morning prednisone, topical hydrocortisone butyrate (Locoid) and Pinetarsol solution for bathing. The rash continued to spread to involve much of her trunk and limbs. During phone consultation with her GP the following day, the patient reported worsening cutaneous pain and myalgia. She was referred to hospital on day six of her rash.

On admission she was alert and conversant, afebrile and haemodynamically stable. Her weight was 83.6kg. Blood pressure was 126/63mmHg, heart rate 105bpm, and oxygen saturations were 98% on air.

She had extensive confluent erythema involving approximately 70% of her body surface area. There were many areas of superficial peeling (Figure 1), but less than 10% deeper, full thickness epidermal loss. Nikolsky sign was negative. There were myriad scattered targetoid lesions (Figure 2) over the trunk and limbs with vesicular and bullous areas on the proximal limbs (Figure 3). Notably her face was spared but her scalp was crusted. Three small 3mm diameter erosions were noted on her hard palate. Her lips were not crusted, but there were macules present on the vermilion. Two small vulvar erosions, 5mm in diameter, were also present. There was no conjunctival injection. At one stage early in her admission she had a few scattered, non-follicular superficial pinpoint pustules in the flexures.

Admission bloods showed haemoglobin 161g/L (115–155) and haematocrit of 0.46 (0.35–0.46). WBC 38.5xE9/L (4–11) and neutrophils 28.7xE9/L (1.9–7.5). Electrolytes revealed sodium 130 mmol/L (135–145), potassium 3.4mmol/L (3.5–5.2) and creatinine 127µmol/L (45–90). Fasting glucose was 10.4mmol/L (3–11). Liver function tests were
normal. Notably CRP was 129mg/L (0–5). Eosinophil count was 0.0xE9/L (0–0.5); this increased to 0.6xE9/L by day 3 of her admission.

The initial clinical impression was of Steven Johnson Syndrome (SJS) with minor mucosal involvement secondary to COVID-19 vaccination. The adverse drug reaction probability scale (Naranjo) score was 7, indicating a probable causal association between the rash and vaccination. Treatment was supportive, including intravenous fluid, careful fluid balance, topical betamethasone valerate (Beta) ointment, emollients and hydrating eye drops. Prednisone 40mg (0.5mg/kg) daily was continued. Assessment by the National Burns Service was sought and the patient was deemed appropriate for ward-based care initially, with ongoing burns unit remote monitoring.

Skin biopsies were taken from multiple sites. Histopathological evaluation showed a spongiotic epidermis containing subcorneal and intraepithelial pustules with abundant neutrophils (Figure 4). No epidermal necrosis was present. There was prominent papillary dermal oedema (Figure 5) forming vesicles in places. The vesicles contained neutrophils and some lymphocytes. There was a mild perivascular lymphocytic infiltrate in the superficial dermis. Lymphovascular spaces appeared somewhat ectatic and there was swelling of endothelial cells. The histological features were those of acute inflammation with pustules, favouring acute generalised exanthematous pustulosis (AGEP). Direct immunofluorescence was negative. Histologic features were not typical of erythema multiforme, SJS or toxic epidermal necrolysis (TEN). In SJS/toxic epidermal necrolysis, one would expect epidermal necrosis and subepidermal bullae with minimal inflammatory infiltrate, which was not the case here. Therefore, while histology was much more characteristic of AGEP than SJS, clinical appearances were arguably more consistent with SJS. A diagnosis of SCAR to COVID-19 vaccination with features of both AGEP and SJS was made.

During the patient’s hospital stay there was some extension of the rash onto the face and lower legs, but slow overall improvement. On day 4 of her admission, her prednisone was increased to 60mg daily (0.75mg/kg) and betamethasone valerate ointment was continued. Epidermal loss remained below 10% and was predominantly in flexural areas. The patient had inpatient monitoring from the ophthalmology service; there was no

**Figure 1:** Confluent erythema with superficial peeling.

**Figure 2:** Targetoid lesions becoming confluent by admission.
**Figure 3:** Targetoid lesions on thighs with confluence displaying bullous character and deeper erosive peeling.

![Figure 3: Targetoid lesions on thighs with confluence displaying bullous character and deeper erosive peeling.](image)

**Figure 4:** Pustules, papillary dermal oedema and perivascular lymphocytic infiltrate.

![Figure 4: Pustules, papillary dermal oedema and perivascular lymphocytic infiltrate.](image)

**Figure 5:** Re-epithelialisation, dermal papillary oedema, but no epidermal necrosis as would be seen in SJS/TEN.

![Figure 5: Re-epithelialisation, dermal papillary oedema, but no epidermal necrosis as would be seen in SJS/TEN.](image)
evidence of conjunctivitis and there were no corneal erosions but esterified hyaluronic acid (Hylofast) eye drops were advised.

The patient improved and was discharged after 11 days to continue a weaning course of prednisone and topical treatment. Her complete cutaneous recovery took many months. A report was filed with the Centre for Adverse Reactions Monitoring (CARM). In this case we found no triggers to explain this patient’s SCAR except recent vaccination with Pfizer–BioNTech vaccine.

Discussion

Both AGEP and SJS are considered SCARs. AGEP is usually a drug eruption characterised by superficial pustules and associated with eosinophilia, which was present in this patient (0.6xE9/L by day 3) despite high dose corticosteroids. The onset of AGEP is usually within 2 days of exposure to the culprit medication and it may overlap clinically with other CD8+ T cell hypersensitivity reactions such as SJS. Other differentials include generalised pustular psoriasis, which has recently been reported after the Pfizer vaccine, as well as small vessel vasculitis and cutaneous lupus. These were thought to be less likely clinically as the rash was not psoriasiform and resolved with no sequelae. Histology was also more in keeping with AGEP as discussed. It is worth noting that immunofluorescence was negative, as were other features of a systemic connective tissue or vasculitic disease.

SJS is often a more severe mucocutaneous reaction usually triggered by medications, particularly antibiotics and anticonvulsants. Onset can occur within a few days but is frequently delayed by a week or two, even up to a month after starting a medication. Targetoid lesions are a feature. It is on a spectrum with toxic epidermal necrolysis (TEN) which has the same underlying pathology but is defined as detachment of >30% of the skin surface.

In this case, the clinical diagnosis of SJS did not match with the histological findings, which favoured AGEP. Clinically and temporally this case is consistent with a severe form of AGEP. However, due to the features of SJS with risk of progression to TEN, early multidisciplinary input was requested. Often, as in our patient, SJS skin eruptions have a prodromal phase of malaise and fever followed by worsening cutaneous lesions and mucosal involvement, including genital mucosa. This can be significant, resulting in scarring and morbidity. There can be ocular lesions, but fortunately early ophthalmological assessment during the patient’s inpatient stay confirmed no ocular involvement; this was monitored closely and outpatient follow-up confirmed no ocular sequelae. Liver derangement is also common and renal impairment can occur. Evolving cutaneous lesions can lead to fluid loss due to breakdown of the skin barrier and thus increased risk of sepsis. Treatment is ideally managed in a specialist unit with multidisciplinary input. However, access to such units remains an issue in New Zealand, where burns unit beds are limited.

While in this case the cause of SCAR has been attributed to the BNT162b2 vaccine, reactions due to vaccination are rare. A recent report outlined a case of SJS after a patient received his first dose of the recombinant ChAdOx1 nCoV-19 (AstraZeneca’s Covishield, manufactured by the Serum Institute of India). The patient recovered after a short course of cyclosporin.

Timely recognition and treatment of SCARs is required to minimise patient morbidity and mortality. This requires adequate training of healthcare staff to appreciate the urgency of diagnosis, obtaining early dermatologist input and liaison with a burns unit. Finally, early dermatology input is reliant on a funded and effective public dermatology service.
COMPETING INTERESTS
Nil.

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REFERENCES
Spindle cell lipoma of the epiglottis: a potential airway emergency

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Lipomas are benign tumours arising from mature white fat cells (adipocytes or lipocytes) derived from mesenchymal origin. Lipomas in the head and neck region account for 15–20% of lipomas with laryngeal lipomas accounting for less than 1% of benign laryngeal tumours. To date, approximately 125 cases of laryngeal lipomas have been reported, with only 6 of those cases being reported as spindle cell lipoma. We present a case of laryngeal spindle cell lipoma presenting with symptoms of snoring and globus pharyngeus.

**Case report**

A 56-year-old man was referred to an outpatient clinic with a five-month history of globus sensation. He also reported new onset snoring with some restriction to breathing when lying flat. Clinically, he demonstrated a muffled “hot potato” voice with no evidence of stridor or airway distress. Flexible nasolaryngoscopy was performed, which showed a large lobulated, partially compressible soft tissue mass with complete obstruction of the supraglottic region, which appeared to arise from either the epiglottis or vallecula (Figure 1). The glottis and subglottis were unremarkable in appearance.

The patient was referred to the Emergency Department due to the size of the lesion, with risk of airway obstruction. Computed tomography (CT) imaging with intravenous contrast was performed, demonstrating a large heterogenous lesion in the laryngopharynx with a mean Hounsfield unit of -40 (Figure 2). The patient underwent an awake fibreoptic intubation with Lindholm suspension microlaryngoscopy and excisional biopsy. The lesion appeared well encapsulated and was able to be removed *en bloc* with Precise Laryngeal Wand coblation technique (Figure 3). He was admitted for monitoring with immediate return to normal diet and was discharged day 2, post-operatively.

Histopathology demonstrated a deep-seated, well-circumscribed lesion composed of a mixture of mature adipocytes, bland fibroblast-like spindle cells and ropey collagen. Immunohistochemical stains demonstrated strong staining for CD34 consistent with spindle cell lipoma. Follow-up at three months demonstrated a normal epiglottis with no evidence of recurrence.

**Figure 1:** Nasolaryngoscopic view of supraglottis demonstrating large lobulated mass.
Figure 2: Sagittal CT image demonstrating a supraglottic mass obstructing the airway.

Figure 3: Supraglottic soft tissue mass removed en bloc.
Discussion

Most patients with laryngeal lipomas present in the sixth decade of life with a male to female ratio of 5:1. Symptomatology depends on the site and size of tumour within the larynx and pharynx. As most lipomas are slow growing, symptoms may be gradual onset but progressively worsening.\textsuperscript{4,5} Symptoms are secondary to obstruction of the upper aerodigestive tract, and can include dysphagia, dysphonia, globus pharyngeus and airway obstruction in advanced cases.\textsuperscript{6–10}

Definitive management of lipomas is surgical excision. Most laryngeal lesions can be removed endoscopically given the well-encapsulated nature of the lesion. Large tumours may require an external approach. External approaches usually require a transverse neck incision with either a pharyngotomy (lateral or transhyoid) or laryngofissure to gain access.

Laryngeal lipomas are rare benign tumours that warrant special attention given the complexity of the region. Spindle cell lipoma is an even rarer subtype of lipoma that may resemble liposarcoma. This case highlights the need to perform a nasendoscopy on every individual who presents with globus sensation. Furthermore, new onset of snoring serves as a “red flag” symptom and should not be ignored. Prognosis is good with complete resolution of symptoms following a complete excision either endoscopically or via external approach.
COMPETING INTERESTS
Nil.

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REFERENCES
An Aspect of the Anaesthetic Question

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100 years ago

Much has been written, and many discussions have taken place in recent years as to trouble with anaesthetics. Important research work has been carried out with the object of ascertaining the cause of:—1. Cyanosis in anaesthesia, and how it occurs; 2. the cause of respiratory trouble, and why it occurs; 3. the logical treatment of collapse under anaesthetic; 4. the cause of post-operative vomiting; 5. how best to avoid all these troubles and to safeguard the patient. Before proceeding to deal with the matters enumerated above, it is necessary to explain that chloroform and ether are manufactured from:—Alcohol and sulphuric acid in the case of ether (C\(_4\)H\(_{10}\)O) ; alcohol and bleaching powder (calcium oxychloride, (Ca O Cl\(_2\)) in the case of chloroform (trichlormethane, CH Cl\(_3\)) or from acetone. In the investigations before us, the acids prove to be of no interest, all the interest centring around the type of alcohol used in manufacture. Alcohol has several distinct types, but the two types we are concerned with in anaesthetics are:—Methyl alcohol (industrial methylated spirits or wood alcohol obtained by distillation), and ethyl alcohol (obtained by fermentation from grain). It is now only necessary to examine the chemical formulae of each before proceeding to answer the questions set above: Methyl alcohol, (CH\(_3\)OH); ethyl alcohol, (CH\(_3\)CH\(_2\)OH) derived from entirely different sources. It should here be explained that the chemical actions and reactions involved in the manufacture of chloroform and ether are very complicated, and it is not proposed to give these in detail.

1. **Cyanosis in Anaesthesia and How it Occurs.**—Most anaesthetics at present in use are prepared from methyl alcohol. Methyl alcohol, in conjunction with sulphuric acid, produces a methyl ester. This methyl ester is present in solution, together with free methyl alcohol, oil of ether, and S\(_2\)O\(_3\). Washing with milk of lime will eliminate most of these side-products of the reactions, but the methylic ester is not completely reduced, and methyl alcohol is still present. The latter, by oxidation, forms formaldehyde (CH\(_2\)O). Formaldehyde has a strong toxic action on nitrogenous organic substances. Formaldehyde will further oxidize into formic acid in the human system. Formic acid has a marked action in the system, causing fatty degeneration of the sheaths of the choroid membrane and optic nerve. In both these last two reactions the oxygen is obtained from the only available place—the human system. This is a cause of cyanosis, and it occurs as a result of the absorption of oxygen as shown above.

2. **Respiratory Trouble and Why it Occurs.**—In anaesthesia, the quantity of free air in the patient's lungs is of necessity restricted. Add to this the fact the absorption of oxygen by the decomposition product as shown above, and respiratory trouble is aggravated.

3. **The Logical Treatment of Collapse under Anaesthetic.**—The answer to this question becomes obvious from the answer to the two preceding questions, i.e., remove the mask and administer oxygen—the real object in resorting to artificial respiration.

4. **The Cause of Post-operative Vomiting.**—The now known presence in the system of formaldehyde, and later formic acid, and later still oxalic acid, successfully accounts for this.

Before dealing with the question No. 5, it here becomes necessary to consider ethyl alcohol (CH\(_3\)CH\(_2\)OH). Ethyl alcohol, in conjunction with sulphuric acid, produces an ethyl ester, made up in accordance with the following formula:—C\(_2\)H\(_5\)OH plus H\(_2\)SO\(_4\) equal C\(_2\)H\(_2\)(HSO\(_4\))H\(_2\)O. The compound italicized represents the ethyl ester, or ethyl-sulphuric acid. The final ether product after elimination leaves only traces of ethyl alcohol and ethyl esters. The products of decomposition, however, only form water, carbon dioxide and sulphur dioxide. They are harmless, as the former escapes into the atmosphere, and the latter is eliminated by the subsequent washing with milk of lime, needing only the one atom of oxygen to final resolution into water. Formaldehyde and formic or oxalic acid are never formed at any stage.
1. How Best to Minimise these Troubles and to Safeguard the Patient.—It has been shown that the two principal ingredients employed differ very materially, and that in the case of an anaesthetic prepared from methyl alcohol, cyanosis, respiratory failure and post-operative vomiting almost invariably occur from the causes shown, whereas in the case of an anaesthetic prepared from ethyl alcohol, none of these factors are present: added to this, the experience of the use of the latter preparations amply demonstrates that the answer to this question lies in the use only of an anaesthetic prepared from ethyl alcohol.