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Can colonoscopy at peripheral day hospitals meet internationally accepted quality and safety standards?
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Endovascular clot retrieval for acute ischaemic stroke in New Zealand
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This study has shown that by early 2018, 312 patients from 11 of the 20 New Zealand DHBs had been treated with endovascular clot retrieval. This is up from 50 patients treated at four DHBs in 2015. Patients receiving this cutting edge treatment are doing at least as well as seen internationally. However, 3/4 of the patients are treated in one centre and there are still nine DHBs where patients have yet to be treated. Ongoing regional collaboration is essential to achieve equitable access to this life-saving and life-changing therapy.

Are the benefits of aspirin likely to exceed the risk of major bleeds among people in whom aspirin is recommended for the primary prevention of cardiovascular disease?
Vanessa Selak, Rod Jackson, Katrina Poppe, Andrew Kerr, Sue Wells
There is a lot of uncertainty about whether aspirin should be used to prevent someone having a first heart attack or stroke (cardiovascular disease, or CVD). This is because while aspirin reduces the risk of having a CVD event, it also increases the risk of bleeding, particularly from the gut. The latest New Zealand recommendations are to consider the use of aspirin in people aged less than 70 years and with a high (15% or greater) risk of having a first CVD event within the next five years. In this study we found that for most of these people that are recommended to take aspirin, the benefits (preventing a heart attack or stroke) do outweigh harms (having a major bleed). However, caution is needed in people aged 60–69 years as other factors are important to consider (other medications, diabetes, smoking).

Can colonoscopy at peripheral day hospitals meet internationally accepted quality and safety standards?
Mehul Lamba, Steven Ding
This is an independently conducted audit of safety and quality of colonoscopy service offered at Charity hospital, Christchurch, and the quality indicators were compared against the current international standards. Complying with quality indicators is important, as it has been shown to improve diagnosis of polyps (precancerous lesions) at colonoscopy. This study showed that colonoscopies performed during one year at the charity hospital were of high quality and met internationally accepted quality indicators. It also provides confidence that it is possible to provide colonoscopy service of high standard in smaller peripheral centres like the Charity hospital, instead of the public hospitals, supporting a trend that has been seen in the North American countries over the last several years.

Sun protection and shade availability in New Zealand’s outdoor recreation spaces
Ryan Gage, Michelle Barr, James Stanley, Anthony Reeder, Christina Mackay, Moira Smith, Tim Chambers, William Leung, Louise Signal
Our study used wearable cameras to explore sun protection and shade availability in New Zealand’s outdoor recreation spaces at times when sun protection was warranted. Children wore the devices, which captured images of 2,635 people in 16 outdoor recreation spaces (beaches, playgrounds and pools). We assessed the clothing worn and shade used by each person, as well as the amount of shade available in each setting. Only 4.3% of the people observed wore sun-protective hats and only 10.7% were under shade. New Zealand has the highest rate of skin cancer in the world. Our findings highlight the need to encourage sun safety behaviours and increase opportunities for shade in outdoor recreation settings.
Readmissions to hospital in a frail older cohort receiving a community-based transitional care service
Claire Heppenstall, Anne Chiang, Carl Hanger

Readmissions to hospital are generally regarded as a poor outcome and often considered a “failure” of support care services. We performed this study to look in more detail in reasons for readmission in a group of frail older people who had been recently discharged with a community-based support and rehabilitation service. They experienced high rates of readmission, however we found that the majority of these were with new acute medical conditions, not a “failure” of support services. Most people who were readmitted were able to return to their own homes after a period of inpatient treatment.

Feasibility and reliability of clinical coding surveillance for the routine monitoring of adverse drug events in New Zealand hospitals
Jerome Ng, Penny Andrew, Paul Muir, Monique Greene, Sabitha Mohan, Jacqui Knight, Phil Hider, Peter Davis, Mary Seddon, Shane Scahill, Jeff Harrison, Lifeng Zhou, Vanessa Selak, Carlene Lawes, Geetha Galgali, Joanna Broad, Marilyn Crawley, Wynn Pevreal, Neil Houston, Tamzin Brott, David Ryan, Jocelyn Peach, Andrew Brant, Dale Bramley

The routine measurement of adverse drug events (ADE) is important for monitoring and informing improvement, but current detection tools are manual and too resource intensive. Our research, for the first time, shows ADEs can be reliably and sustainably measured using clinical coding surveillance (CCS). Using CCS, almost 12,000 ADEs over two years were detected in hospitalised patients. Most ADEs originated from the community setting.

Preventing cardiovascular disease in New Zealand: making better use of statins but also tobacco control, changing the food supply and other strategies
Nick Wilson, Amanda C Jones, Nhung Nghiem, Tony Blakely

Given that it is very well proven that statins reduce the risk of premature death, in this article we examine how the use of these medicines may be improved for primary prevention of cardiovascular disease (CVD) in New Zealand. We suggest the need to explore such options as fixed-dose combination pills containing statins, three-drug polypills, behind-the-counter dispensing and six-month prescriptions. But in addition to pharmacological prevention of CVD, there is a need for improved population-wide changes to the environment. These include adopting policies to improve tobacco control, the nutrition environment (eg, particularly around sodium), alcohol control, and making walking and cycling easier options.
Unplanned readmissions in frail individuals
Joel D’souza, Simon Richards

Frailty is a critical issue in modern medical practice due to its association with adverse health events, poor patient outcomes and an increased burden on our healthcare system. Frailty is most commonly found in the elderly, and this population is increasing disproportionately worldwide. In New Zealand it is expected to double from 700,000 in 2016 to around 1.4 million by 2040. In 2012 in the US, despite only accounting for 12% of the total population, elderly patients accounted for 35% of all hospital admissions. This cohort also had a significantly longer average hospital stay and an increased average cost per stay.

Frailty can be thought of as a state of increased vulnerability across multiple organ systems, resulting in poor physiologic reserve, and thus inability to respond to stressors. This concept is increasingly recognised as a separate entity from ageing and comorbidity; and when appropriately measured is an independent risk factor for adverse patient outcomes. Multiple large prospective cohort studies have shown frailty is associated with an increased risk of worsening disability, hospitalisation, discharge to a care facility, morbidity and mortality. Fried et al in the Cardiovascular Health Study showed severe frailty was associated with a significantly increased risk of falls (HR = 1.23), worsening disability (HR = 1.79), hospitalisation (HR = 1.27) and death (HR = 1.63) over seven years.

Frailty is a dynamic process; however, without intervention frailty appears to be a progressive process with progression to greater degrees of frailty over time. The development of frailty often leads to a spiral of decline with increasing frailty, worsening disability, multiple hospital admissions and subsequent death. Multiple interventions to modify frailty have been examined, however, few have been shown to be associated with improved patient outcomes. Transitional care has the potential to attenuate or possibly reverse this process of frailty leading to improved patient outcomes, including a reduction in unplanned patient readmissions.

Readmission rate is one of the quality indicators of patient care utilised worldwide as it reflects both the impact of hospital care on a patient’s illness and the coordination of care in the transition period after index discharge. Unplanned readmissions are associated with poor patient outcomes such as mortality and are deemed preventable to a degree. As outlined above, readmission to hospital is often part of a precipitous decline in this population. The preventable nature of unplanned readmission makes this a potential target for improvement.

Heppenstall et al, in their cohort of elderly frail patients undergoing a transitional care intervention, show a high readmission rate of 42% at three months despite intervention. In addition, the majority of these readmissions were comprised of new acute medical or surgical problems and exacerbations of chronic medical conditions, thus highlighting the vulnerable nature of this frail population. Without a control group, it is unclear as to whether transitional care input has modified this readmission risk.

Nonetheless, this significant finding highlights two important considerations with regards to the use of readmission rate as a quality indicator of hospital care. Firstly, the ability to predict patients at high risk of unplanned readmission would facilitate the targeted use of individualised transition care interventions, and potentially improved patient outcomes if successful. The utility of current research in predictive model development is limited by significant heterogeneity in the literature. One of the sources of heterogeneity is the lack of standardisation in the definition of readmission itself. Readmission time intervals used in the literature range from two weeks...
to one year after discharge. This varying definition is a threat to the external validity to this quality indicator of inpatient care, and limits comparison between studies. Previous research has recommended the use of a 30-day time frame after index discharge as a satisfactory balance between capturing readmissions reflective of the index inpatient care and minimising unrelated readmissions, often due to underlying disease progression despite optimal care.

In this study, it is difficult to delineate whether the readmissions from new acute medical problems were due to progression of longstanding illness or were related to circumstances of the index admission. They note a peak in readmissions at 30 days post-discharge. A comparison between 30-day readmissions and 90-day readmissions in the context of readmission diagnosis classification could clarify this further.

Secondly, the reasons for readmission in this cohort were in keeping with international research on readmissions in medical patients. While the proportion of surgical patients comprising the study sample is not specified, research has shown clear differences in readmission risk between medical and surgical patients. This is reflected by the lower readmission rates and reasons for unplanned readmission of the latter. Majority of unplanned surgical readmissions are due to postoperative complications rather than exacerbation of underlying comorbidity. This represents a fundamental difference between the two cohorts and should be considered further.

In conclusion, frailty is an important emerging concept in medical practice encompassing a group of vulnerable individuals with reduced physiological reserves who are at high risk of adverse clinical outcomes, including unplanned readmissions. This study by Heppenstall et al emphasises the ever-increasing impact of frailty on patients, their families and the healthcare system as shown by the high “unavoidable” readmission rate. Further research into methods to modify or attenuate frailty and into the aetiological factors of unplanned readmission in this cohort may help identify high-risk patients and allow targeted transitional care interventions.

Competing interests:
Nil.

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New Zealand’s population is ageing. Currently, Māori make up 6% of those aged 65-plus. By 2038, this number is expected to more than double from 48,500 to 126,000 people, with Māori making up approximately 10% of people in this age group. That the numbers of older Māori are greatly increasing within a short period, Māori are growing as a proportion of those aged 65-plus, and Māori have higher rates of disability and dependency relative to the general population aged 65-plus warrants particular consideration. In April 2018 the New Zealand Government announced the development of a new Positive Ageing Strategy (PAS) to help manage future demographic shifts. The previous PAS was released in 2001 and described the need to affirm the values and strengthen the capabilities of older Māori and their whānau. It largely reflected a “Western” view of the world, however, by not capturing a Māori perspective on ageing. The 2017 Health Ageing Strategy also referred to a number of aspects of ageing well, including achieving equity for Māori. Again however, there was limited consideration of what healthy ageing looks like from a Māori viewpoint.

What are the key aspects of Māori positive ageing and how can we best support good long-term outcomes?

A lifelong process
Māori positive ageing is a lifelong process that begins at the earliest moments of life, well before Māori reach older age. Studies of life course epidemiology suggest that the future burden of disease for Māori will be substantial, but that early and ongoing interventions that prevent disabilities and lengthen life could circumvent this burden. The cumulative effects of lifelong disadvantage result in Māori experiencing disability, ill health and death at an earlier age than non-Māori. Ageing for Māori in today's society has been influenced by the historical impacts of colonisation resulting in land loss, dislocation and trauma. Many of today's older Māori have experienced swift and dramatic changes over their life-course (eg, rapid urbanisation in the 1950s and 1960s, cultural erosion and revitalisation). The combination of these factors likely results in very different health, socioeconomic and other outcomes in later life for Māori relative to those of non-Māori.

Determinants of positive and compromised ageing
On average, Māori have not only fewer years of good health, but shorter lives than do non-Māori. Life expectancy at birth for Māori males and females is estimated to be 73.0 and 77.1 years, respectively, compared to 80.3 and 83.9 for non-Māori males and females. Health disparities result from differentials in access and exposure to determinants of health, both positive (eg, good education, employment opportunities, affordable and quality housing, good income) and negative (eg, racism, exposure to the criminal justice system). Negative differentials increase health risk behaviours (eg, poor nutrition, tobacco use). For these reasons, it is critical to address the structural drivers of compromised Māori ageing. Interventions that focus solely on individuals changing their health behaviours will, therefore, be of limited value.

Positive ageing as Māori
Ageing for Māori should also be considered within the context of community, including hapū (subtribe) and iwi (tribe). Being Māori and engaging with te ao Māori (the Māori world) are elements of positive ageing that are culturally based and distinctive for Māori. Having a secure Māori cultural identity, including a sense of connection to one's marae, hapū and iwi have been described as features of Māori positive ageing. Further, whānau wellbeing and ageing well for Māori are inextricably linked; whānau cohesion, based on quality relationships, intergenerational relations and regular positive interactions are important for ageing well. Conversely, isolation from positive whānau interactions and whānau burden (eg, whānau who are
over-reliant on their older members) can impact negatively on older Māori. Early onset of disability and resulting dependency can also create a burden on whānau, particularly whānau who may already be struggling to meet their own day-to-day needs. Note also that maintaining independence and autonomy within the context of whānau is, therefore, likely to be an important foundation for Māori positive ageing.2,8

Positive interactions within wider Māori contexts and Māori community organisations can support positive ageing. Older Māori are critical and valued for upholding Māori culture and the intergenerational transfer of knowledge and legacy.7 Māori in advanced age, however, can experience a high degree of expectation and demands placed upon them to fulfil leadership roles within te ao Māori.2,7,8 The roles and responsibilities of older Māori often increase if they are speakers of te reo Māori (Māori language), are holders of mātauranga Māori (Māori knowledge), and have a wealth of lived experience.8

Māori positive ageing is reinforced when the needs and desires for social connectedness are met, which includes the capacity to serve others, being valued and included, having purpose and making a contribution.2,9 The wellbeing of older Māori has been conceptualised as balancing active participation and achievement in te ao Māori (including whānau) and te ao whānui (the wider world).9

Older Māori have diverse realities—some are culturally connected and equipped to take on cultural roles and others are less connected, may face greater isolation and have fewer resources to ease their way into old age.9 Understanding how these diverse realities impact differently on positive ageing is important when considering ways to support Māori positive ageing.

Culturally responsive services
Culturally appropriate services and respectful relationships between service providers/professionals and older Māori and their whānau are crucial.2,5,10 Providing culturally responsive activities and services can help to enhance wellbeing, connectedness and quality of life. Health professionals have an important role to play in how they communicate health information and build skills and knowledge to promote health literacy. Health literacy is about the appropriateness of the health information and services provided for Māori, and the organisational systems and processes that help health professionals to build health literacy among older Māori.

Reducing barriers to health and social service utilisation; equitable access to services, including gaining entry into and through services; timeliness and quality in terms of processes and outcomes; and access to user-friendly information are all important for Māori positive ageing.9,11 This includes end-of-life care that maintains and enhances the mana of the person and supports whānau carers.12

Conclusion and implications
Māori positive ageing is important for Māori futures and New Zealand as a whole. Māori perspectives on ageing take a life-course approach, are strengths-based, and inherent is the high value placed on older Māori for the critical roles they fulfil within Māori society. Māori conceptualisations of positive ageing can provide a framework to inform prevention, health promotion and primary healthcare to reduce the impact of ill health and disability for older Māori. Reducing inequalities in the determinants of compromised ageing can enable increased participation of older Māori in te ao Māori and te ao whānui. Strengthening relationships between older Māori and their whānau, as well as service providers, is also key. Importantly, all health professionals have a role in supporting Māori positive ageing; influencing the health and wellbeing trajectories of Māori—young and old—can contribute to better outcomes in old age. This is particularly the case where interventions focus on strengthening whānau and Māori communities.
Competing interests: Nil.

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Endovascular clot retrieval for acute ischaemic stroke in New Zealand

Adam Langton Burnell, Anna Ranta, Teddy Wu, John Fink, Ben McGuiness, James Caldwell, Wayne Collecutt, Stefan Brew, P Alan Barber

ABSTRACT

AIMS: Stroke endovascular clot retrieval (ECR) in patients with large proximal vessel occlusion improves clinical outcomes. We present the New Zealand ECR experience.

METHODS: All New Zealand patients treated with ECR since 2011 were included. Patients were considered eligible if they were independent prior to stroke and had proximal intracranial arterial occlusion.

RESULTS: Three hundred and twelve patients [136 women, mean (SD) age of 64 (17) years] from 11 district health boards have been treated between March 2011 and April 2018. There were 260 (83%) patients with anterior and 52 (17%) with posterior circulation arterial occlusion. One hundred and ninety-three (62%) patients were pre-treated with intravenous alteplase. The median time from symptom onset to groin puncture was 210 (range 65–985) minutes. Complete or near-complete recanalisation (Thrombolysis in Cerebral Infarction scores of 3 or 2b) was achieved in 260 of 300 (87%) and the National Institutes of Health Stroke Scale score improved from a median of 18 at baseline to 7 at 24 hours. By day 90, 55% of the anterior circulation patients and 40% of the posterior circulation patients were living independently at home. Mortality rates were 20% for anterior circulation patients and 30% for the posterior circulation patients.

CONCLUSIONS: This study has shown that stroke endovascular clot retrieval is being provided safely and effectively in New Zealand. However, there remain discrepancies in service provision, and ongoing regional, inter-regional and inter-sector collaboration is essential to implement comprehensive and equitable ECR services across the country.

Stroke endovascular clot retrieval (ECR) for patients with large proximal intracranial artery occlusion has been shown to improve clinical outcomes. An individual patient level meta-analysis of five large randomised-controlled trials showed that for every 2.6 patients treated with ECR, one had a reduction in the modified Rankin Scale (mRS) score of least one point, compared with standard therapy. For every five patients treated with ECR, one more is functionally independent (mRS 0–2). ECR increases quality of life and is highly cost effective.

ECR is time critical, technically challenging and needs to be available 24 hours per day to avoid treatment gaps. Auckland City, Wellington Regional and Christchurch hospitals are the only ones in New Zealand with the resources to provide this therapy at present, and only Auckland provides a 24-hour service. A regional treatment pathway has been developed in the Northern and Midland regions with patients transferred to Auckland for this therapy. Similar pathways centred on Wellington and Christchurch are being developed. The aim of this study was to determine if ECR is being delivered in a safe and effective manner.

Methods

Stroke ECR has been performed in New Zealand since 2011, with early patients treated as part of the Extending the Time for Thrombolysis in Emergency Neurological Deficits—Intra-Arterial (EXTEND-IA) trial, and more recent patients enrolled in the follow-on EXTEND-IA Tenectolplase (EXTEND-IA TNK) and EXTEND-IA TNK2...
All ECR patients are entered into the New Zealand Thrombolysis Register, which is under the auspices of the National Stroke Network. Patients had to be previously independent and have large proximal intracranial arterial occlusion. Patients were treated with 0.9mg/kg alteplase or 0.25mg/kg tenecteplase for those patients enrolled in the EXTEND-IA TNK trial, if indicated.

Anterior circulation strokes are those with distal internal carotid artery (ICA) or M1/proximal M2 segment of the middle cerebral artery (MCA) occlusion. Posterior circulation strokes are those with occlusion of the basilar (BA), intracranial vertebral (VA) or posterior cerebral (PCA) arteries. Most anterior circulation patients were treated within six hours, and posterior circulation patients treated within 24 hours, of symptom onset. The neuro-interventionists used either a Solitaire FR (Covidien) or Trevo (Stryker) stent retriever and/or aspiration thrombectomy. A minority of patients required angioplasty and stenting of the ICA or MCA M1 during the procedure. The neuro-interventionist and anaesthetist decided on the use of a general anaesthetic or conscious sedation in each case. Recanalisation was determined using the Thrombolysis in Cerebral Infarction (TICI) scores where TICI3 is complete recanalisation and TICI2b is restoration of flow to greater than 50% of the affected territory.

The National Institutes of Health Stroke Scale (NIHSS) was used to assess baseline and 24-hour stroke severity. The NIHSS ranges from 0 (normal) to 42 (dead). Early neurologic recovery was defined as either a decrease in NIHSS of ≥8 or a score of 0–1, at 24 hours. The mRS at day 90 was used to determine functional outcomes with 0 normal, 0–2 defined as functionally independent, 4–5 as significantly dependent, and 6 as dead. All adverse outcomes were recorded, with particular focus on symptomatic intracranial haemorrhage (sICH) and death. sICH was defined as parenchymal haemorrhage occupying >30% of the infarct volume and with significant mass effect on CT, and a reduction in NIHSS at 24 hours by ≥4.

Results

Three hundred and twelve patients [136 women, mean (range) age of 64 (16–92) years] with ischaemic stroke from 11 DHBs have been treated with ECR in New Zealand between 2011 and the end of April 2018 (Table 1). Two hundred and forty-one patients were treated at Auckland City hospital, 57 at Christchurch hospital and 14 at Wellington hospital. There were 260 (83%) with anterior and 52 (17%) with posterior circulation occlusion. Thirty (10%) patients had a stroke while already in hospital and 157 (50%) were transferred to an ECR centre from another hospital. One hundred and seventy-six (56%) were admitted out-of-hours (Monday to Friday 17:00 to 08:00, and all day in weekends and holidays). One hundred and ninety-four (62%) were treated with IV alteplase prior to ECR. Day 90 mRS data was available for 227 of 252 (90%) patients treated before 31 January 2018.

Anterior circulation occlusion patients

The 260 anterior circulation patients had baseline median (range) NIHSS scores of 18 (3–40), indicating severe disability. One hundred and seventy-two patients (66%) were treated with intravenous alteplase with a time from stroke onset to alteplase bolus of 123 minutes. One hundred and twenty-four (48%) patients were transferred to an ECR centre from a ‘home DHB’. The time from stroke onset to groin puncture was 200 minutes and ECR was completed by 261 minutes. Two hundred and twelve of 247 (86%) anterior circulation patients had ECR under GA and 29 of 257 (11%) required ICU admission following the procedure. Complete or near complete recanalisation (TICI3 and TICI2b) was seen in 218 of 253 (86%) anterior circulation patients where this information was recorded. Early neurological recovery was seen in 109 of 231 (47%) patients. Day 90 mRS data was available for 176 of 235 (74%) patients, of whom 97 (55%) were functionally independent, 18 (10%) were severely dependent and 35 (20%) were dead. sICH occurred in 9 of 257 (4%) patients. The median length of stay in all healthcare facilities was eight days.
### Table 1: Results.

<table>
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<th>Anterior circulation</th>
<th>Posterior circulation</th>
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<td>Number (%)</td>
<td>260 (83)</td>
<td>52 (17)</td>
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<td>Age, years – mean ± SD (range)</td>
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<td>Ethnicity (%)*</td>
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<td>174 (67)</td>
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<td>37 (14)</td>
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<td>Intravenous thrombolysis (%)</td>
<td>172 (66)</td>
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<td>Hospital arrival (minutes)</td>
<td>60 (0–840)</td>
<td>59 (0–778)</td>
<td>60 (0–840)</td>
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<tr>
<td>IV alteplase</td>
<td>123 (47–425)</td>
<td>148 (90–330)</td>
<td>125 (47–425)</td>
</tr>
<tr>
<td>Groin puncture</td>
<td>200 (65–923)</td>
<td>266 (90–985)</td>
<td>210 (65–985)</td>
</tr>
<tr>
<td>Procedure completion</td>
<td>261 (110–1,065)</td>
<td>345 (125–1,105)</td>
<td>270 (110–1,105)</td>
</tr>
<tr>
<td>Complete (TICI3) or near complete (TICI2b) recanalisation*** (%)</td>
<td>218/253 (86)</td>
<td>42/47 (89)</td>
<td>260/300 (87)</td>
</tr>
<tr>
<td>NIHSS score†† – median (range)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On admission</td>
<td>18 (3–40)</td>
<td>20 (3–38)</td>
<td>18 (3–40)</td>
</tr>
<tr>
<td>24 hours</td>
<td>7 (0–42)</td>
<td>7 (0–42)</td>
<td>7 (0–42)</td>
</tr>
<tr>
<td>mRS, 90 days‡‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>2 (0–6)</td>
<td>3 (0–6)</td>
<td>2 (0–6)</td>
</tr>
<tr>
<td>mRS 0–2 (%)</td>
<td>97/176 (55)</td>
<td>19/47 (40)</td>
<td>116/223 (52)</td>
</tr>
<tr>
<td>mRS 4–5 (%)</td>
<td>18/176 (10)</td>
<td>8/47 (17)</td>
<td>26/223 (12)</td>
</tr>
<tr>
<td>mRS 6 (%)</td>
<td>35/176 (20)</td>
<td>14/47 (30)</td>
<td>49/223 (22)</td>
</tr>
<tr>
<td>Length of stay [median (range)]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute stroke unit (days)</td>
<td>2 (0–24)</td>
<td>3 (0–31)</td>
<td>2 (0–31)</td>
</tr>
<tr>
<td>All healthcare facilities</td>
<td>8 (0–99)</td>
<td>7 (0–96)</td>
<td>7 (0–99)</td>
</tr>
</tbody>
</table>

*New Zealand Ministry of Health Level 1 Ethnic Groups, and includes South Asians.
†Internal carotid artery (ICA), includes one bilateral occlusion, denominator 261.
‡First division of middle cerebral artery (M1).
§Second division of middle cerebral artery (M2).
/uni2016Includes one vertebral artery occlusion and one posterior cerebral artery occlusion.
¶Endovascular clot retrieval (ECR).
***Thrombolysis in Cerebral Infarction (TICI).
††National Institute of Health Stroke Scale (NIHSS).
‡‡Modified Rankin Scale (mRS).
Posterior circulation occlusion patients

The 52 posterior circulation patients had a baseline median (range) NIHSS score of 20 (3–38), indicating severe disability. Twenty-two patients (42%) were treated with intravenous alteplase with a time from stroke onset to alteplase bolus of 148 minutes. Thirty-three (63%) patients were transferred to an ECR centre from a ‘home DHB’. The time from stroke onset to groin puncture was 266 minutes, and ECR was completed by 345 minutes. Fifty-one (98%) of posterior circulation patients had ECR under GA and 36 (70%) required ICU admission following the procedure. Complete or near-complete recanalisation was achieved in 42 of 47 (89%) patients. Early neurologic recovery was seen in 19 of 39 (49%) patients where this information is recorded. Day 90 mRS data was available for 47 patients, of whom 19 (40%) were functionally independent, eight (17%) were severely dependent and 14 (30%) were dead. sICH occurred in 2 of 50 (4%) patients. The median length of stay in all healthcare facilities was seven days.

Discussion

This study has found that stroke endovascular clot retrieval is being implemented in a safe and effective manner in New Zealand. Anterior circulation patients had a complete or near-complete recanalisation rate of 86%, and 55% of patients were functionally independent at three months. This compares with a large meta-analysis where 71% had complete or near complete recanalisation and 46% of patients were functionally independent.

The onset to ECR completion time was similar at 261 minutes in New Zealand compared to 285 minutes. The New Zealand mortality rates were higher at 20% versus 15% but our numbers are relatively small and patients had higher baseline NIHSS scores. The number of treated patients has grown exponentially from 30 in 2015 to 133 in 2017, with 250 patients projected for 2018.

Randomised-controlled trials of ECR in patients with occlusion of the basilar or posterior cerebral arteries are still underway. However, the use of ECR is considered reasonable for carefully selected patients, with a treatment window of up to 24 hours after symptom onset in Australian and New Zealand guidelines. In this study, basilar occlusion patients were severely disabled at baseline and had longer times to ECR completion than the anterior circulation patients. Basilar occlusion patients were also less likely to be functionally independent (40%), and had a higher mortality rate (30%) at three months. However, basilar occlusion patients receiving standard therapy alone have mortality rates as high as 80%.

Endovascular clot retrieval is cost effective. A UK study reported upfront costs are high but quality-adjusted life expectancy is improved, and clot retrieval has a 100% probability of being cost effective at the minimum willingness to pay. The Australia/New Zealand EXTEND IA study, which provides important ‘local’ data, showed that the costs of consumables, staffing and inter-hospital transfer were offset by significantly shorter hospital stays. Clot retrieval patients spent a median of 73 (IQR 47–86) of the first 90 days at home, compared with only 15 (IQR 0–69) days in the standard care patients (p=0.006). There are also societal savings resulting from more people being independent and avoiding long-term care.

This study has a number of limitations. No resources are provided to maintain the database and we were dependent on the local centres recording all ECR patients and entering the data accurately. Outcome measures were not determined by an independent assessor. Follow-up data was missing in 10% of patients, reflecting the fact that many patients are transferred to home DHBs for ongoing care. This study highlights important achievements in the provision of ECR services in New Zealand. The numbers of ECR patients has grown, reflecting an expansion of services, with patients from 11 DHBs now treated, compared with only four prior to 2015. However, three quarters of the patients were treated at a single centre with major discrepancies in service provision across the country. Treatment figures per centre are due in part to differences in metropolitan population catchment areas, and there is still significant work required to fully implement regional treatment pathways in the Midland, Central and South Island regions. The DAWN and DEFUSE 3 studies have shown benefit in treating patients up to 24 hours, and 12 of the 312 patients were treated in this extended
Patient selection beyond six hours requires advanced imaging that is currently available at only four large urban hospitals.

To meet these challenges, the Ministry of Health has established a National ECR Service Improvement Programme to help facilitate implementation efforts. Ongoing regional, inter-regional and inter-sector collaboration will be essential to implement comprehensive and equitable ECR services across all of New Zealand.

Competing interests:
Dr McGuinness reports personal fees from Stryker outside the submitted work.

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Are the benefits of aspirin likely to exceed the risk of major bleeds among people in whom aspirin is recommended for the primary prevention of cardiovascular disease?

Vanessa Selak, Rod Jackson, Katrina Poppe, Andrew Kerr, Sue Wells

ABSTRACT

AIM: The 2018 New Zealand Consensus Statement on cardiovascular disease (CVD) risk assessment and management recommends the use of aspirin in people aged less than 70 years with a five-year CVD risk ≥15% but without prior CVD. We determined whether the estimated number of CVD events avoided by taking aspirin is likely to exceed the number of additional major bleeds caused by aspirin in this patient population.

METHOD: Major bleeding rates were obtained from the PREDICT primary care study, a large New Zealand cohort of people eligible for CVD risk assessment, after excluding those with no other indications for (eg, established CVD) or contraindications/cautions (eg, prior major bleed) to aspirin use. We modelled the benefits (CVD events avoided) and harms (additional major bleeds) of aspirin for primary prevention of CVD over five years using hypothetical populations aged 40 to 79 years, stratified by sex, age-group and estimated five-year CVD risk. Two clinical scenarios were modelled, according to whether or not optimisation of lipid- and blood pressure-lowering therapy was required prior to aspirin initiation.

RESULTS: In both clinical scenarios the number of CVD events prevented by aspirin over five years was estimated to be, on average, more than the number of bleeds caused by aspirin among people aged less than 70 years with estimated five-year CVD risk of ≥15%. However, the magnitude of the net benefit of aspirin was modest among people aged 60–69 years, particularly if lipid- and blood pressure-lowering therapy had not already been optimised.

CONCLUSION: The benefits of aspirin are likely to exceed the risk of major bleeds among people in whom aspirin is recommended for the primary prevention of CVD. A more cautious approach to the use of aspirin is appropriate for people aged 60–69 years who are likely to have a smaller net benefit from aspirin, particularly those in whom lipid- and blood pressure-lowering therapy has not already been optimised or who have other bleeding risk factors, such as diabetes or smoking. More specific recommendations will be possible when bleeding risk equations are developed to complement the recently developed New Zealand CVD risk equations.

Cardiovascular risk assessment has been an integral component of New Zealand efforts to prevent cardiovascular disease (CVD) for over a decade.1 Nationally, about 90% of eligible people have had their CVD risk assessed in the last five years. Decisions about the use of medicines known to prevent CVD in New Zealand are therefore able to be based on CVD risk, rather than simply dichotomising people according to whether or not they have had a prior CVD event or using levels of individual risk factors.2
Aspirin reduces the risk of CVD, but is also associated with an increased risk of bleeding.\textsuperscript{3,4} For people who have already had a cardiovascular event, the benefits of aspirin generally outweigh its harms, but the balance of benefits and risks is less clear in the case of primary prevention.\textsuperscript{5}

The 2018 Ministry of Health Consensus Statement on the assessment and management of CVD in primary care recommends that aspirin be considered in people under 70 years with a five-year CVD risk of $>15\%$.\textsuperscript{2} The Statement notes that the potential benefits and harms of aspirin “must be carefully assessed and discussed during shared decision-making” but do not offer resources to support decision-making regarding the harms of aspirin.\textsuperscript{2}

The purpose of this study is to determine whether the estimated number of CVD events avoided is likely to exceed the number of additional major bleeds caused by aspirin among people in whom aspirin is recommended for primary prevention, using data on bleeding rates from a large New Zealand cohort of people in whom aspirin for primary prevention may be considered.\textsuperscript{6}

**Method**

We estimated the benefits (CVD events avoided) and harms (additional major bleeds) of aspirin for the primary prevention of CVD over five years among hypothetical populations of 1,000 people in whom aspirin for primary prevention may be considered, stratified by sex, 10-year age-groups between 40 and 79 years and estimated five-year CVD risk. Two clinical scenarios were modelled to take into account the strong New Zealand recommendations for lipid-lowering therapy and blood pressure-lowering therapy for people with five-year CVD risk of $\geq 15\%$.\textsuperscript{2} In clinical scenario 1, people were assumed to already be receiving optimal lipid-lowering therapy (ie, achieving low density lipoprotein cholesterol of $<1.8$mmol/L)\textsuperscript{2} and blood pressure-lowering therapy (below 130/80mmHg).\textsuperscript{2} In clinical scenario 2, people were assumed to be on no or suboptimal lipid-lowering therapy and blood pressure-lowering therapy.

In clinical scenario 1, no adjustments were made to account for either the effect of lipid lowering or blood pressure reduction because the New Zealand CVD risk equation includes variables for each medication type as well as the level of lipids (ratio of total cholesterol to high-density lipoprotein cholesterol) and blood pressure (systolic blood pressure).\textsuperscript{7}

New Zealand recommendations on the use of lipid- and blood pressure-lowering therapy are stronger than those for the use of aspirin in people with five-year CVD risk of $\geq 15\%$ for the primary prevention of CVD. Therefore, in clinical scenario 2, adjustments were first made for the effect of optimising lipid-lowering and blood pressure-lowering therapies before considering the effect of adding aspirin. The proportional benefit of a statin on CVD events was based on the estimate obtained by an individual participant data meta-analysis of randomised controlled trials by the Cholesterol Treatment Trialists Collaboration, which was a 21\% proportional reduction in CVD events with a 1mmol/L reduction in low density lipoprotein with a statin.\textsuperscript{4} The proportional effect of blood pressure-lowering therapy on CVD events was based on the estimate obtained by a meta-analysis of randomised controlled trials by Ettehad and colleagues, which was a 20\% proportional reduction in CVD events with a 10mmHg reduction in blood pressure with blood pressure-lowering therapy.\textsuperscript{9}

The number of CVD events likely to be avoided with aspirin within each sex/10-year age-group/five-year CVD risk stratum over five years was estimated by multiplying the number of expected CVD events (based on five-year CVD risk, estimated by the 2018 New Zealand CVD risk equation$^7$) by the proportional benefit of aspirin on CVD events.\textsuperscript{10} CVD events included in the New Zealand CVD risk equation are admissions or deaths from ischaemic heart disease (including unstable angina), ischaemic or haemorrhagic cerebrovascular events (including transient ischaemic attacks), peripheral vascular disease or congestive heart failure, or other ischaemic cardiovascular disease death.\textsuperscript{7}

The New Zealand CVD risk equation was developed from the New Zealand PREDICT cohort, which included 401,752 people of whom 15,386 (4\%) had a first CVD event, 1,507 (10\%) of which were fatal. CVD events included myocardial infarction (34\%), unstable angina (15\%), ischaemic stroke.
(15%), haemorrhagic stroke (4%), transient ischaemic attack (7%), peripheral vascular disease (6%) and congestive heart failure (12%). The proportional effect of aspirin on CVD events was based on the estimate obtained by the Antithrombotic Trialists’ Collaboration individual participant data meta-analysis of six primary prevention trials (n=95,000; 660,000 person-years), which found a 12% proportional net reduction in CVD events (including haemorrhagic stroke) with aspirin. 

The likely number of additional major bleeds with aspirin within each sex/10-year age-group/five-year CVD risk stratum over five years was estimated by multiplying the number of expected major bleeds by the proportional effect of aspirin on major bleeds. The annual expected rate of major bleeds was obtained from a subset of the PREDICT cohort study that followed 240,254 people for a median of 2.8 years (interquartile range 1.8 to 5 years) after cardiovascular risk assessment in primary care. People had been excluded from that cohort if they were already receiving aspirin (or other antiplatelet/anticoagulant medication), if they had an indication for aspirin (or other antiplatelet/anticoagulant medication) (ie, prior CVD, congestive heart failure, atrial fibrillation, chronic kidney disease, diabetes with renal disease) or if they had any contraindications/cautions to the use of aspirin (ie, prior major bleed, peptic ulcer disease, chronic liver disease, chronic pancreatitis, chronic alcohol-related disease, thrombocytopenia; receiving nonsteroidal anti-inflammatory, corticosteroid or selective serotonin reuptake inhibitor medication). Major bleeds were defined as hospital admissions or deaths associated with a significant non-cerebral bleed. Admissions were only included if a bleed was the principal diagnosis (ie, the main reason for the admission) or, if the bleed was not the principal diagnosis, when there was also a blood transfusion of whole blood or a transfusion of packed cells. Bleeds associated with trauma and procedures were excluded. Intracerebral bleeds were excluded from this analysis because haemorrhagic stroke was included as an outcome within the New Zealand CVD risk equation, and the proportional effect of aspirin on CVD events incorporates the net effect of aspirin on haemorrhagic strokes. A total of 1,768 first major bleeding events (1,473 gastrointestinal, 295 other—respiratory, ocular or bleeding into a joint, the pericardium or peritoneum) were identified during follow-up, of which 62 (4%) were fatal. The expected number of major bleeds over five years was obtained by multiplying these annual rates by five as there was no statistically significant difference in the annual risk of bleeding over a five-year period in that study.

The proportional effect of aspirin on major bleeds was based on the estimate obtained by the Antithrombotic Trialists’ Collaboration meta-analysis, which found a 54% proportional increase in major extracranial bleeds with aspirin.

**Results**

Among people aged less than 70 years with estimated five-year CVD risk of ≥15%, the estimated number of CVD events prevented by aspirin exceeded, on average, the number of additional bleeds caused by aspirin among those already receiving optimal lipid-lowering therapy and blood pressure-lowering therapy (clinical scenario 1, Table 1) and among those in whom lipid-lowering and blood pressure-lowering therapy would need to be optimised prior to adding aspirin (clinical scenario 2, Table 2). The magnitude of the net benefit of aspirin was however minimal among people aged 60–69 years around the 15% five-year risk threshold, particularly those in whom lipid-lowering and blood pressure-lowering therapy had not already been optimised. The number of estimated CVD events averted was more than twice the number of estimated major bleeds caused by aspirin among all people recommended for aspirin therapy in clinical scenario 1, but was as little as 40–50% more than the number of estimated major bleeds among people aged 60–69 years in clinical scenario 2. In men aged 70–79 years there were more events caused by aspirin than prevented by aspirin in those with a CVD risk below 20% and minimal benefit in women in scenario 2 (Table 2).
Table 1: Estimated number of CVD events prevented by and additional major bleeds caused by aspirin over five years in hypothetical populations of 1,000 people in sex-specific 10-year age groups already receiving optimal lipid- and blood pressure-lowering therapy (clinical scenario 1).

<table>
<thead>
<tr>
<th>Five-year risk of CVD</th>
<th>Expected number of CVD events</th>
<th>Estimated number of CVD events prevented by aspirin per 1,000 people treated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Additional medication</td>
<td>Men</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40–49 years</td>
</tr>
<tr>
<td>1–4%</td>
<td>None</td>
<td>1.2–4.8</td>
</tr>
<tr>
<td></td>
<td>+ Aspirin</td>
<td>0.8–3.0</td>
</tr>
<tr>
<td>5–9%</td>
<td>50–90</td>
<td>6.0–10.8</td>
</tr>
<tr>
<td></td>
<td>44–79</td>
<td>3.8–6.8</td>
</tr>
<tr>
<td>10–14%</td>
<td>100–140</td>
<td>12.0–16.8</td>
</tr>
<tr>
<td></td>
<td>88–123</td>
<td>18.0–22.8</td>
</tr>
<tr>
<td>15–19%</td>
<td>150–190</td>
<td>24.0–34.8</td>
</tr>
<tr>
<td></td>
<td>132</td>
<td>24.0–34.8</td>
</tr>
<tr>
<td>20–29%</td>
<td>200–290</td>
<td>24.0–34.8</td>
</tr>
</tbody>
</table>

The grey shaded areas represent sex/age-group/five-year CVD risk group strata in which the estimated number of additional major bleeds is equal to or greater than the estimated number of CVD events averted with aspirin. The black horizontal bar is the level at which aspirin is recommended for the primary prevention of CVD among people aged less than 70 years.

Table 2: Estimated number of CVD events prevented by and additional major bleeds caused by aspirin over five years in hypothetical populations of 1,000 people in sex-specific 10-year age groups on no or suboptimal lipid- and blood pressure-lowering therapy (clinical scenario 2).

<table>
<thead>
<tr>
<th>Five-year risk of CVD</th>
<th>Expected number of CVD events</th>
<th>Estimated number of CVD events prevented by aspirin per 1,000 people treated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Additional medication</td>
<td>40–49 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Men</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2–4.8</td>
</tr>
<tr>
<td></td>
<td>+ Aspirin</td>
<td>0.8–3.0</td>
</tr>
<tr>
<td>1–4%</td>
<td>None</td>
<td>6–25</td>
</tr>
<tr>
<td></td>
<td>+ Statin (1mmol/L reduction in LDL)</td>
<td>8–32</td>
</tr>
<tr>
<td></td>
<td>+ BP-lowering treatment (10mmHg reduction in systolic BP)</td>
<td>3.8–6.8</td>
</tr>
<tr>
<td>5–9%</td>
<td>50–90</td>
<td>7.6–10.6</td>
</tr>
<tr>
<td></td>
<td>40–71</td>
<td>7.6–10.6</td>
</tr>
<tr>
<td></td>
<td>119–150</td>
<td>15.2–22.0</td>
</tr>
</tbody>
</table>

The grey shaded areas represent sex/age-group/five-year CVD risk group strata in which the estimated number of additional major bleeds is equal to or greater than the estimated number of CVD events averted with aspirin. The black horizontal bar is the level at which aspirin is recommended for the primary prevention of CVD among people aged less than 70 years.
Discussion

Among people aged less than 70 years with estimated five-year CVD risk of >15% and no other indications for or contraindications/cautions to aspirin use, the number of CVD events avoided are estimated to exceed the number of additional major bleeds, whether or not lipid- and blood pressure-lowering therapy need to be added and/or optimised. However, in the 60–69 year age group, the net benefit was small, emphasising the need to be cautious about prescribing aspirin in this age group if they are smokers or have other risk factors associated with increased bleeding rates.

Bleeding rates were obtained from a large, contemporary New Zealand cohort of people who were likely to be considered for aspirin for the primary prevention of CVD as they did not already have CVD (or congestive heart failure, atrial fibrillation, chronic kidney disease, diabetes with renal disease), were not already receiving aspirin, anti-platelet or anticoagulant medication and did not have contraindications/cautions to the use of aspirin (ie, prior major bleed, peptic ulcer disease, chronic liver disease, chronic pancreatitis, chronic alcohol-related disease, thrombocytopaenia; receiving nonsteroidal anti-inflammatory, corticosteroid or selective serotonin reuptake inhibitor medication).

While it is not possible to directly equate experiencing a CVD and a bleeding event, the severity of the events in this study are reasonably comparable. CVD events included in the New Zealand CVD risk equation are admissions or deaths from ischaemic heart disease (including angina), ischaemic or haemorrhagic cerebrovascular events (including transient ischaemic attacks), peripheral vascular disease or congestive heart failure, or other ischaemic cardiovascular disease death. Major bleeding events included in this study were admissions or deaths associated with a non-cerebral bleed. Admissions were only included if a bleed was the main reason for the admission or, if not the main reason, there was also a transfusion of whole blood or packed cells during the admission. Fatal events comprised 10% of the total number of CVD events used to develop the New Zealand CVD risk equation, and 4% of the total number of major non-cerebral bleeds from the bleeding study.

The United States Preventive Services Task Force (USPSTF) recommends aspirin for people aged 50 to 59 years (Grade B recommendation) and those aged 60 to 69 years (Grade C recommendation) for the primary prevention of CVD and colorectal cancer among people with 10-year CVD risk of ≥10% (equivalent to a five-year CVD risk of ≥5%). Although the USPSTF guideline CVD risk threshold for recommending aspirin is lower than that used in the New Zealand Consensus Statement (five-year CVD risk of ≥15%), the USPSTF guidelines take into account the beneficial effect of aspirin on colorectal cancer.

This study did not take into account the growing body of evidence indicating that aspirin is also associated with a reduction in the risk of cancer, in particular colorectal cancer. Appropriate synthesis of the effects of aspirin on CVD, bleeding as well as cancer outcomes is particularly challenging given that the time course of these effects vary from several years for bleeding and CVD to over a decade for cancer. We were able to use more appropriate bleeding risk data than was available to the USPSTF. The USPSTF, noting the paucity of absolute bleeding risk data from community cohorts, used an indirect measure of bleeding risk from people not taking aspirin who had been identified by propensity matching to people who were taking aspirin. Instead, we used data that directly measured bleeding risk in people not receiving aspirin and who also had no other indications for aspirin and no contraindications or cautions to the use of aspirin.

The main limitation of this study is the implicit assumption that bleeding risk is homogeneous within a sex and 10-year age-group stratum, irrespective of CVD risk. The individual participant data meta-analysis of randomised controlled trials of aspirin for the primary prevention of CVD has demonstrated, however, that many of the same risk factors that are associated with an increase in the absolute risk of CVD (eg, diabetes, smoking) are also associated with an increase in the absolute risk of a major bleed, and may not contribute the same weight to each outcome. A clinical prediction model that estimates absolute bleeding risk by taking into account multiple risk factors at the same time, as with CVD,
is required in order to optimise the individualised assessment of the balance of absolute benefits and harms of aspirin for the primary prevention of CVD, and such a model is currently in development.6

Conclusion

These data provide assurance to clinicians and patients regarding the use of aspirin for primary prevention as recommended by the New Zealand Consensus Statement, as the estimated number of CVD events averted was more than twice the estimated number of major bleeds caused by aspirin among all people recommended for aspirin therapy in whom lipid- and blood pressure-lowering therapy is optimised, and those aged less than 60 years in whom lipid- and blood pressure-lowering therapy needs to be optimised before considering aspirin. A more cautious approach to the use of aspirin should be taken among those with a smaller estimated net benefit from aspirin (ie, those aged 60–69 years and in whom lipid- and blood pressure-lowering therapy has not already been optimised), particularly if they have other bleeding risk factors, such as diabetes or smoking, as these have not been taken into account when estimating bleeding risk in the present analysis.

Competing interests:
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Can colonoscopy at peripheral day hospitals meet internationally accepted quality and safety standards?
Mehul Lamba, Steven Ding

ABSTRACT

AIMS: To perform an independent review of the quality and safety of colonoscopy service at the Canterbury Charity Hospital (CCH).

METHODS: Demographic, endoscopy and histology data on all colonoscopies performed at CCH between 1 October 2016 and 31 September 2017 were collected. Quality indicators ascertained were caecal intubation rate, mean withdrawal time and adenoma detection rate (ADR). These were assessed using current recommendations by the Joint American College of Gastroenterology and American Society of Gastrointestinal Endoscopy task force.

RESULTS: Thirty-four patients, mean age 44 years (range 21–62), underwent colonoscopy. The most common indications were rectal bleeding and/or altered bowel habit (19 patients). Eight asymptomatic patients underwent colonoscopy because of a family history of CRC or a personal history of colorectal polyps; six of these were over 50 years old. Twelve patients had haemorrhoids and seven patients had adenomatous polyps. The caecal intubation rate was 97.1%. Among asymptomatic patients over 50 years undergoing colonoscopy, mean withdrawal time was 7.5 minutes (range 5–10) and ADR was 33.3%. No complications were recorded.

CONCLUSION: The colonoscopy service at CCH was safe and complied with the accepted quality indicators. Our data suggest that delivery of high-quality colonoscopy services might be possible in similar peripheral and day hospitals around New Zealand. Increasing colonoscopy services in such centres would reduce the excessive workload of larger public hospitals and reduce the level of unmet need for colonoscopy services.

Gastrointestinal (GI) endoscopy is playing an ever-increasing role in the management of GI disorders. Colonoscopy is one of the most effective tools in screening for colorectal carcinoma (CRC), hence there has been an increase in demand for the procedure. There is, however, limited availability of colonoscopy in public hospitals in New Zealand, in part because of its associated high costs. Trends to centralise the delivery of colonoscopy services while limiting access to public hospitals has resulted in a substantial level of unmet need for patients with GI symptoms. The provision of colonoscopy services in peripheral or day hospitals could help to resolve this problem. However, concerns have been raised regarding the quality and safety of colonoscopy services in peripheral ambulatory centres.

Access to colonoscopy services in Canterbury is based on the Canterbury colorectal symptom pathway (CCrSP), whereby patients deemed at high risk of CRC are prioritised. Patients with lower gastrointestinal symptoms who do not meet the CCrSP ‘cut-off score’ are not currently offered colonoscopy as a routine. While private colonoscopy services are easily
accessible, they are not affordable for many such patients. In order to cater for this unmet need, the Canterbury Charity Hospital (CCH) has been providing free colonoscopy to these patients upon receiving a referral from their general practitioner.

The aim of our independent study was to review the quality of the colonoscopy service provided at the CCH, based on internationally accepted quality indicators.

**Methods**

The history and functioning of the CCH is described elsewhere. It relies entirely on community-based charitable funding and is largely staffed by a volunteer medical, nursing and support workforce. It offers a variety of services including general surgery, medical subspecialties, ophthalmology, gynaecology, orthopaedics, oral surgery and dentistry to patients who have been unable to access care in the public hospital system and cannot afford private care. Endoscopists working at the CCH are accredited by the New Zealand Conjoint Committee for Recognition of Training in Gastrointestinal Endoscopy and their endoscopic work is reviewed regularly by the hospital's clinical board.

Records of all colonoscopies undertaken at the CCH during a 12-month period (1 October 2016 to 31 September 2017) were collected. Demographic data, indications for colonoscopy and findings at colonoscopy were available in all cases. Histology reports were reviewed for those who underwent colorectal biopsies or polypectomies and the following colonoscopy quality indicators were collected: caecal intubation rate, withdrawal time and adenoma detection rate (ADR). The CCH adverse events records, which list in-hospital and follow-up data, were also reviewed. The data were analysed descriptively.

**Results**

During the year under investigation, colonoscopies were performed by two endoscopists in 11 sessions, the average number of colonoscopies per session being three (range 2–4). Eighteen patients (53%) were male and their mean age was 44 years (range 21–62). Time of insertion of the colonoscope, time to reach the caecum and procedure end-time were recorded in 31 patients, from which “withdrawal time” was calculated.

As shown in Table 1, the most common indications for colonoscopy were: rectal bleeding; rectal bleeding and altered bowel habit; a family history of CRC; altered bowel habit; and personal history of colorectal polyps.

<table>
<thead>
<tr>
<th>Indication</th>
<th>n (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal bleeding</td>
<td>11 (35.4%)</td>
</tr>
<tr>
<td>Rectal bleeding and altered bowel habit</td>
<td>8 (25.8%)</td>
</tr>
<tr>
<td>Family history of colorectal cancer (CRC)</td>
<td>4 (12.9%)</td>
</tr>
<tr>
<td>Altered bowel habit</td>
<td>3 (9.7%)</td>
</tr>
<tr>
<td>History of colorectal polyps</td>
<td>4 (12.9%)</td>
</tr>
<tr>
<td>Not specified</td>
<td>2 (9.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
</tr>
</tbody>
</table>

Colonoscopy was not tolerated by one patient and was therefore abandoned. Among the remainder, the most common pathology detected were haemorrhoids of mild to moderate severity (12 patients), adenomatous polyps (seven patients), diverticulosis (four patients), and hyperplastic polyps (four patients). No pathology was found in seven patients.

Quality indicators for colonoscopy utilised routinely at the CCH are shown in Table 2. Caecal intubation was achieved in 33 of 34 patients and ileal intubation was documented in nine. The mean withdrawal time for all non-interventional colonoscopies (excluding polypectomy or banding haemorrhoids) was 8.9 minutes (range 3–21). Only 3 of 20 non-interventional colonoscopies had mean withdrawal time less than six minutes. The average withdrawal time for non-interventional colonoscopies in asymptomatic patients undergoing colonoscopy because of a family history of CRC or a personal history of colorectal polyps was 7.5 minutes (range 5–10).

Among six patients >50 years, who underwent colonoscopy for surveillance of CRC, adenomatous polyps (with low grade dysplasia) were detected in two patients and hyperplastic polyps in one patient. No advanced adenomas (high-grade dysplasia, villous histology, size >10mm) or carcinomas were detected. No immediate or delayed complications were recorded.
Discussion

With growing public awareness of bowel diseases and associated symptoms, thanks in part to roll-out of the New Zealand national bowel cancer screening program, requests for colonoscopy procedures have increased in recent years. Colonoscopy, however, is a scarce resource in the public health system and is not routinely offered to patients who are deemed to be at low risk of CRC. A substantial proportion of such patients cannot afford colonoscopy in private and therefore contribute to the high level of unmet healthcare need in New Zealand.

In Christchurch, the CCH offers colonoscopy service to patients who have gastrointestinal symptoms or are at increased risk of CRC, but do not qualify for investigation in the public hospital and who cannot afford private healthcare. We considered that if colonoscopies performed at the CCH were safe and complied with internationally accepted quality indicators, then the procedure could likewise be performed at similar other peripheral and day hospitals throughout the country, thereby reducing the current burden on larger city hospitals.

In this study, we demonstrate that colonoscopies performed at the CCH over a one-year period detected significant pathology, including adenomatous polyps in seven patients who had been refused the service in the local public hospital. Importantly, internationally accepted quality indicators for colonoscopy published by the joint American Society of Gastrointestinal Endoscopy (ASGE) and the American College of Gastroenterology (ACG) task force in 2015 were met. The mean withdrawal time for all non-interventional colonoscopies was 8.9 minutes, while that for non-interventional screening colonoscopies was 7.5 minutes.

The ASGE/ACG guidelines recommend a mean withdrawal time of six minutes to improve polyp detection. A prospective study of colonoscopy withdrawal time at Christchurch hospital by Lim et al showed improved ADR if the withdrawal time was greater than six minutes. Furthermore, the ADR rate for those undergoing colonoscopy because of a family history of CRC or a past history of colorectal polyps, and over 50 years of age at the CCH was 33.3%, which complies with the current ASGE/ACG recommendation. Both, ADR and caecal intubation rate have been identified as priority indicators by the ASGE and ACG, complying with which is strongly associated with improved clinical outcomes. Of note, no complications were observed.

The main limitation of our study is relatively small sample size due to low number of colonoscopies performed at the CCH during a previous one-year period. As the service expands, it would be prudent to carry out similar audits for safety and quality parameters in future.

Colonoscopy services are increasingly provided in peripheral ambulatory centres in the west, however these are largely restricted to secondary and tertiary public hospitals in New Zealand. Increasing demand for colonoscopy service is expected to put yet further strain on the existing infrastructure. Decentralisation and reallocation of colonoscopy to smaller peripheral centres is an alternative solution, provided that the services are of high quality and meet internationally accepted quality and safety standards. The current independent study provides reassurance that it is indeed possible to provide colonoscopy service that is safe and of high quality in an ambulatory setting.

Table 2: Quality indicators of colonoscopy provided at CCH.

<table>
<thead>
<tr>
<th>Quality indicators</th>
<th>CCH</th>
<th>ASGE/ACG recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caecal intubation rate</td>
<td>97.1%</td>
<td>&gt;90%</td>
</tr>
<tr>
<td>Mean withdrawal time in negative result colonoscopies in asymptomatic patients* &gt;50 years</td>
<td>7.5 minutes (range 5–10)</td>
<td>&gt;6 minutes</td>
</tr>
<tr>
<td>Adenoma detection in asymptomatic patients* &gt;50 years</td>
<td>33%</td>
<td>Males &gt;30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Females &gt;20%</td>
</tr>
</tbody>
</table>

CCH—Canterbury Charity Hospital; ASGE—American Society of Gastrointestinal Endoscopy, ACG—American College of Gastroenterology

*Asymptomatic patients undergoing colonoscopy because of a family history of CRC or a personal history of colorectal polyps.
Competing interests:
Nil.

Acknowledgements:
Colonoscopies in this study were performed by P Bagshaw and I Kolossa, volunteer specialist surgeons working at the Canterbury Charity Hospital.

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REFERENCES:
Sun protection and shade availability in New Zealand’s outdoor recreation spaces

Ryan Gage, Michelle Barr, James Stanley, Anthony Reeder, Christina Mackay, Moira Smith, Tim Chambers, William Leung, Louise Signal

ABSTRACT

AIMS: We aimed to investigate sun protection behaviours and shade availability in outdoor recreation spaces using images captured by children who, in 2014/15, wore wearable cameras for four consecutive days.

METHODS: The 168 participants visited 16 outdoor recreation spaces between 10am and 4pm, capturing 378 images, on average, in each setting. People observed in the images (n=2,635) were coded for age, sex, clothing worn (38 clothing types) and shade used. Mean temperature and ultraviolet index (UVI) values were linked with the time-stamped and geo-referenced images.

RESULTS: The UVI in most settings was high enough to warrant sun protection, but only 4.3% of people wore sun-protective hats (broad-brim, bucket and legionnaire styles) and 10.7% used shade. Areas most popular with children, including playground equipment, beach sand and pool areas, had little or no shade available.

CONCLUSIONS: Despite New Zealand having the highest incidence of melanoma skin cancer in the world, the results indicate that few New Zealanders wear hats and seek shade in outdoor recreation settings. The findings highlight the need to improve policy and environmental support for skin cancer prevention activities.

Skin cancer accounts for up to 80% of total cancer cases in New Zealand. Each year, there are over 2,000 incident cases and 350 deaths from melanoma, and over 90,000 incident cases of keratinocyte carcinomas (formerly known as non-melanoma skin cancers). The estimated annual cost of skin cancer in New Zealand (from a societal perspective) in 2006 was $123.1m (at 2008 prices). Given that exposure to the sun causes most cases of skin cancer, prevention activities in New Zealand have focused on discouraging excessive sun exposure and encouraging sun protection.

Outdoor recreational spaces, including beaches, outdoor pools and playgrounds, are important settings for sun protection behaviour. Visits to these settings can result in excessive exposure to UVR that increases the risk of sun burning and skin cancer. This UVR exposure can have an intermittent pattern (eg, beachgoers in summer) or continuous, chronic pattern (eg, surf lifeguards). In recent years, evidence suggests that both intermittent and chronic exposure patterns may play a role in the development of melanoma. The Community Preventive Services Taskforce recommends sun safety interventions in outdoor recreational settings due to strong evidence of their effectiveness on reducing sunburns and improving sun protection behaviour.

However, there is limited observational evidence of sun protection behaviours in New Zealand’s outdoor recreational settings. The 2016 triennial Sun Exposure Survey (SES) found that 17% of respondents aged ≥13 years reported sunburn in the weekend prior to survey completion, and about half reported hat wearing. However, the survey had a low response rate (27%), and did not assess the sufficiency of shade that was available in each setting, nor people's interaction with it. Moreover, the sampling frame did not include children under 13 years of age, who are perceived to be more vulnerable to UVR skin damage.
Wearable cameras provide a unique opportunity to explore sun protection behaviours. In 2014/2015, the Kids'Cam project provided 168 children in the Wellington region with wearable cameras. The devices captured an objective sample of images from the camera wearer’s perspective, without the bias of self-report data or researcher intrusion. Although the Kids’Cam project was primarily focused on food marketing, participants were blinded to the study’s purpose, thus allowing an objective analysis of other health behaviours/exposures. In a feasibility study, the cameras were found to be a practical tool for studying the sun-safety behaviours of children observed in the images. In the current study, we explore sun protection of children and adults in the outdoor recreation spaces visited by the Kids’Cam children, using image data captured on their wearable cameras. The aim of this paper is to describe the shade available, clothing worn and the shade used by children and adults in these settings.

Methods

Study sample
The Kids'Cam participants were 168 randomly-selected children age 11 to 13 years (Year 8), from 16 randomly-selected schools in the Wellington region of New Zealand. Each child wore a wearable camera and GPS unit on lanyards around their necks for four consecutive days (Thursday, Friday, Saturday and Sunday) in 2014/15. The cameras passively recorded images of the child’s environment every seven seconds from their perspective. In total, the cameras captured approximately 1.3 million images in many settings, including schools, sports grounds and shopping malls. Image data was successfully linked with GPS data to provide geo-referenced image data. The participants were not informed of the purpose of the study, nor asked to modify their behaviour in any way. More detail on the Kids’Cam methods are available elsewhere.

As part of the primary research study (food marketing), all images were manually coded for setting of image capture (eg, school, street, outdoor recreation space). For the current study, we extracted all images captured in outdoor recreation spaces between 10 am and 4pm during weekends on school terms 1 and 4 during which the SunSmart Schools programme operates. Images captured outside these hours or at any time during the May to August period were excluded because sun protection is not generally recommended in New Zealand at these times.

Measures

Coding for shade availability
All extracted images were viewed and assessed for the presence of shade. Built shade was classified as either permanent (eg, shade sails) or temporary (eg, sun umbrellas). The composition of built shade canopies was categorised as solid (eg, timber or metal sheeting), plastic, fabric or other. Trees were classified as having light, medium or heavy foliage using the canopy density guide. Built shade and trees were excluded if their canopy appeared to be less than two metres wide.

Coding for sun protection behaviours
A 10% systematic sample of images captured in each setting (ie, 1 in 10) was extracted for the study of sun protection among third parties (those people captured in the images). The child wearing the camera was excluded since his/her clothing was not visible in images. Duplicates, defined here as people who appeared in more than one image across a sequence, were not excluded. This approach was used because of the difficulty distinguishing people captured in the images, and because people can often add or remove clothing layers. Based on our prior assessment of sun-safety in schools, we estimate that approximately 5% of the sample were duplicated.

Clothing worn by each person was classified with respect to 38 items, including five types of hats, sunglasses, collars, five types of sleeves, 10 types of anterior/posterior trunk protection and four types of leg coverings. Sun-protective hats included broad-brim, bucket and legionnaire styles. People were recorded as using shade if they were standing directly under a shade structure, or had more than three-quarters of their body shaded. To help assess the context of sun protection behaviour, the activity in which each person engaged was also recorded (eg, sitting, playing, sunbathing). The demographic information recorded included estimates of age (under 18 years (excluding infants) or 18 years and over) and gender.
Coding reliability
In a feasibility study, the coding procedure was found to have excellent reliability (greater than 90% agreement between three coders) for classifying gender, shade use, and hat and sleeve wearing, and high reliability (greater than 80% agreement) for classifying collar wearing.\(^1\) To help achieve rigour in the current study’s coding, the coders saved images containing sun protection or demographic information they were unsure about. Saved images were cross-checked by an additional researcher. The images were then discussed until a consensus about the classification was reached.

Analyses
Mean body coverage from clothing was calculated for people within each setting using the coverage assessment procedure (CAP). The CAP links the clothing items worn with established coverage values to calculate the body surface area covered.\(^1\)\(^4\) For descriptive purposes only, results for clothing coverage are reported as the percentage of body surface area covered. For example, 10% coverage at the head means that 10% of the head area is covered by clothing. Other descriptive analyses include comparisons of sun protective clothing and shade use by gender and age. To give context on the weather conditions, the time-stamped and geo-referenced images were linked with temperature and ultraviolet radiation index (UVI) values, extracted from the National Institute of Climate and Atmospheric Research database.\(^1\)\(^5\) The UVI is a measure of UVR at the earth’s surface. The WHO recommends sun protection when UVI levels exceed UVI 3.\(^1\)\(^6\)

Results
Twelve Kids’Cam participants (7.4% of the total sample of 168 children) visited 16 outdoor recreation settings during the study period between 10am and 4pm, including eight beaches, one outdoor pool complex (with a 25-metre main pool, toddlers’ pool, waterslide, eight eating areas and open grass areas), one fairground (containing a play area, open grass area and court area with food stalls) and six playgrounds. Participants spent 44 minutes, on average, in each setting (range: six minutes to three hours), capturing an average of 378 photos (range: 49 to 1,537). Mean temperatures were similar across settings, ranging from 16.5 to 20°C at the pool (between 10am and 3.30pm), 16.5 to 22.7°C at the beaches, 15.3 to 19.1°C at the fairground and 15.6 to 20.8°C at the playgrounds. The mean UVI across all settings was 6.2 (range 1.8 to 9.5). Only one area (a playground) had a UVI below 3.

Sun protection environment—shade and signage
Shade varied considerably between setting types. The outdoor pool complex had the most comprehensive shade, including a combination of trees and built structures covering spectator areas, eating areas and parts of the toddlers’ pool (Figure 1A). However, the area most popular for swimming (the main pool) was uncovered. There was relatively less shade in the beach, playground and fairground settings. Shade in beaches was limited to trees in grass areas adjacent to beach sand, which were less popular sites for people (Figure 1B). Shade in the playgrounds was limited to natural shade that did not cover any play equipment, seats or tables (Figure 1C and 1D). No sun-safety signage was observed in any setting.

Sun protection—clothing and shade use
In the 10% systematic image sample, 2,635 people were observed across all areas. Use of sun protective clothing was poor across all setting types; only 4.3% of people wore sun protective hats (broad-brim, bucket and legionnaire styles), 5.6% wore sunglasses and 18.0% wore collars. Mean total body clothing coverage was 69.9%. Body regions with the lowest clothing cover were the hands (5.8% covered), head (8.9% covered), neck (12.4% covered), lower arms (50.8% covered) and lower legs (57.9% covered). A greater proportion of people at the beaches and pool wore collars, long sleeves and long pants than those at the fairground and playgrounds (37.3% vs 7.3% for collars, 78.2% vs 26.4% for long sleeves and 67.6% vs 27.1% for long pants), and thus had greater total body coverage (82.7% vs 59.1%) and coverage for the neck, arms and legs (Table 1). Moreover, a greater proportion of people at beaches and pools were topless (6.3% of observations vs. 0% in the fairground and playground) and barefoot.
(41.1% of observations). Use of sun-protective hats and sunglasses was low across all setting types.

Only 10.7% of people were under shade. Shade use was proportionately higher among people in the outdoor pool complex (17.2%) and beaches (9.2%) than those in playgrounds (2.0%). This was not surprising as the playgrounds had limited shade covering the most popular areas, i.e., the playground equipment, seats and tables. Greater shade use at the pool was explained by the abundance of sun umbrellas surrounding the pool. However, those swimming in the pool were in full exposure to the sun.

A smaller proportion of children than adults wore hats of any style (23.9% vs 8.0%), sun-protectives styles of hats (8.9% vs 1.3%) and sunglasses (12.4% vs 0.8%) (Table 2). As a consequence, on average the head area of children had approximately one-third of the coverage of adults (4.9% vs 14.3%). A smaller proportion of children than adults used shade (8.4% vs 12.6%) because of their tendency to play in unshaded areas (i.e., beach sand, play equipment areas and the pool area).

With the exception of bathing suits, clothing cover between males and females was relatively similar. Exceptions included a greater proportion of males who used hats (specifically caps) (22.8% vs 7.8%) and shade (13.4% vs 7.2%).

Figure 1: Kids’Cam image examples.
### Table 1: Proportion of people using sun protective clothing and clothing coverage, by setting type.

<table>
<thead>
<tr>
<th>Sun-protective clothing (% wearing item)</th>
<th>Beaches and pool (n=1,525)</th>
<th>Playgrounds and fairground (n=1,110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hats (all styles)</td>
<td>16.8</td>
<td>12.2</td>
</tr>
<tr>
<td>Hats (sun protective)¹</td>
<td>6.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Sunglasses</td>
<td>6.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Collars</td>
<td>7.3</td>
<td>37.3</td>
</tr>
<tr>
<td>Long sleeves</td>
<td>26.4</td>
<td>78.2</td>
</tr>
<tr>
<td>Long pants</td>
<td>27.1</td>
<td>67.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clothing coverage by body region (% of area covered)</th>
<th>Beaches and pool (n=1,525)</th>
<th>Playgrounds and fairground (n=1,110)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>9.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Neck</td>
<td>7.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Upper arms</td>
<td>61.0</td>
<td>94.5</td>
</tr>
<tr>
<td>Lower arms</td>
<td>29.0</td>
<td>79.7</td>
</tr>
<tr>
<td>Anterior trunk</td>
<td>90.6</td>
<td>95.4</td>
</tr>
<tr>
<td>Posterior trunk</td>
<td>90.2</td>
<td>99.8</td>
</tr>
<tr>
<td>Thighs</td>
<td>80.0</td>
<td>92.5</td>
</tr>
<tr>
<td>Lower legs</td>
<td>37.8</td>
<td>73.7</td>
</tr>
<tr>
<td>Hands</td>
<td>3.2</td>
<td>9.3</td>
</tr>
<tr>
<td>Feet</td>
<td>40.9</td>
<td>89.9</td>
</tr>
<tr>
<td>Total body</td>
<td>59.1</td>
<td>82.7</td>
</tr>
</tbody>
</table>

¹Broad-brim, bucket and legionnaire styles.

### Table 2: Sun protection across all settings by gender and age.

<table>
<thead>
<tr>
<th>Sun-protective clothing (% wearing item)</th>
<th>Males</th>
<th>Females</th>
<th>Age &lt;18</th>
<th>Age 18+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hats (all style)</td>
<td>22.8</td>
<td>7.8</td>
<td>8.0</td>
<td>23.9</td>
</tr>
<tr>
<td>Hats (sun protective)¹</td>
<td>5.6</td>
<td>3.2</td>
<td>1.3</td>
<td>8.9</td>
</tr>
<tr>
<td>Sunglasses</td>
<td>4.5</td>
<td>6.7</td>
<td>0.8</td>
<td>12.4</td>
</tr>
<tr>
<td>Collars</td>
<td>18.7</td>
<td>12.6</td>
<td>14.9</td>
<td>16.4</td>
</tr>
<tr>
<td>Long sleeves</td>
<td>44.2</td>
<td>46.8</td>
<td>48.6</td>
<td>36.1</td>
</tr>
<tr>
<td>Long pants</td>
<td>39.0</td>
<td>44.3</td>
<td>42.5</td>
<td>46.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clothing coverage by body region (% of area covered)</th>
<th>Males</th>
<th>Females</th>
<th>Age &lt;18</th>
<th>Age 18+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total body</td>
<td>67.3</td>
<td>68.2</td>
<td>67.7</td>
<td>68.0</td>
</tr>
<tr>
<td>Head</td>
<td>12.9</td>
<td>5.3</td>
<td>4.9</td>
<td>14.3</td>
</tr>
<tr>
<td>Neck</td>
<td>10.6</td>
<td>11.1</td>
<td>9.5</td>
<td>12.9</td>
</tr>
<tr>
<td>Upper arms</td>
<td>77.4</td>
<td>70.9</td>
<td>73.5</td>
<td>67.4</td>
</tr>
<tr>
<td>Lower arms</td>
<td>44.8</td>
<td>49.7</td>
<td>50.6</td>
<td>39.0</td>
</tr>
<tr>
<td>Anterior trunk</td>
<td>89.8</td>
<td>97.1</td>
<td>93.8</td>
<td>93.8</td>
</tr>
<tr>
<td>Posterior trunk</td>
<td>90.0</td>
<td>97.0</td>
<td>93.8</td>
<td>94.0</td>
</tr>
<tr>
<td>Thighs</td>
<td>87.1</td>
<td>84.2</td>
<td>83.4</td>
<td>90.2</td>
</tr>
<tr>
<td>Lower legs</td>
<td>43.4</td>
<td>58.0</td>
<td>50.6</td>
<td>56.8</td>
</tr>
<tr>
<td>Hands</td>
<td>5.3</td>
<td>5.6</td>
<td>5.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Feet</td>
<td>61.1</td>
<td>47.2</td>
<td>60.3</td>
<td>56.1</td>
</tr>
<tr>
<td>Shade use (% under shade)</td>
<td>7.2</td>
<td>13.4</td>
<td>8.4</td>
<td>12.6</td>
</tr>
</tbody>
</table>

¹Includes bucket, broad-brim and legionnaire styles.
Discussion

The results indicate a poor use of sun protective clothing and shade in outdoor recreation spaces, and limited shade availability in the most popular areas. The findings are consistent with recent observations of sun protective behaviour in Wellington primary schools, and shade audits of playgrounds, beaches and outdoor pools in Auckland, Wellington, Christchurch and Dunedin. The findings have applicability for other New Zealand cities, given that past sun-safety campaigns have been national in scope and because most councils, including Wellington, do not have sun safety policies supporting shade development and sun protection in outdoor recreation spaces.

When compared to the self-reported sun protection behaviours of the 2016 SES, our study found a markedly lower use of hats (8% vs 34% among youth; 24% vs 43% among adults) and sunglasses (1% vs 23% among youth; 12% vs. 53% among adults). This is consistent with prior studies that have compared field observations of sun protection behaviour with self-report data. Part of this difference may be due to methodological differences between the studies. The 2016 SES sampled a broader demographic area, which may differ to the Wellington population for sun protection behaviours and outdoor activity. The SES also only samples when sunny weather was forecasted, whereas our study investigated all weekends between September 2014 and April 2015. Moreover, the 2016 SES asked respondents whether they were wearing a clothing item ‘most of the time’ over the last weekend. In contrast, our study recorded observed behaviours at one time point, regardless of prior behaviour (eg, a hat that was removed was not counted). Biases inherent in survey design may also help explain this discrepancy, such as social desirability bias, which leads to over-representation of behaviours perceived to be healthy.

Children were less likely to use hats, sunglasses and shade than adults. This finding is consistent with SES findings. Poor rates of sun protection among New Zealand children is a significant public health issue, as children are perceived to be more vulnerable to UVR skin damage. Moreover, from a health promotion perspective, it is important to establish healthy sun protection habits from a young age. Future research could investigate the barriers to sun protection among New Zealand youth, and the types of strategies that could best support sustained sun protection behaviour change.

This study provides further evidence to support sun protection activities in water-based recreation settings, given that people in these settings had substantial skin area exposed to the sun. International research proposes the particular risk posed by visits to such settings, characterised by high UVR levels (due to reflections off water and the openness of the sites), intentional sunbathing and the need to reapply sunscreen after swimming. Strategies for supporting sun protection in these settings could include establishing minimum standards for shade and displaying signs about sun protection.

Strengths and limitations

This is one of the first studies to objectively assess sun protection in New Zealand’s outdoor recreation spaces. Using wearable cameras allowed an analysis of sun protection without the risk of researcher obtrusion, nor the bias associated with self-report methods, and enabled us to explore people’s interaction with shaded environments.

Nonetheless, the methodology has some limitations. We did not quantify the level of cloud cover in each setting, which may influence people’s intention to use sun protection, as well as the shade observed in the images. However, we note that shadow patterns were visible for most built structures and trees in at least one image (most images were captured in clear-sky conditions, except for one playground visit that had a mean UVI value below 3). Image capture also depended on where the participant spent their time, which may have resulted in over-sampling of some areas and people. Moreover, we could not determine whether people actively sought shade or whether they were shaded by chance (eg, by passing through a shaded area). We also could not ascertain whether people wore sunscreen, which may have underestimated actual levels of sun protection. However, New Zealand surveys suggest that only about half of New Zealanders apply...
sunscreen over the weekend in summer, and overseas evidence suggests that sunscreen is often insufficiently applied. Thus, assessment of shade use and clothing coverage remains an important indicator of sun safety.

Conclusions

Most people observed in the outdoor recreation spaces did not use sun-protective clothing or shade, despite potentially damaging levels of UVR. The findings highlight the need to increase environmental and policy support for sun protection in outdoor recreation spaces. Encouraging local councils to adopt sun safety policies would be a useful first step for achieving this. Moreover, planting trees or building shade in popular recreational areas, eg, play equipment in playgrounds, beach sand and pool areas, could help reduce the risk of UVR over-exposure.

Competing interests:

Dr Stanley and Dr Leung report grants from New Zealand Health Research Council during the conduct of the study. Dr Reeder reports grants from Cancer Society of NZ Inc and Cancer Society of NZ Inc, non-financial support from University of Otago, outside the submitted work.

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Readmissions to hospital in a frail older cohort receiving a community-based transitional care service
Claire Heppenstall, Anne Chiang, Carl Hanger

ABSTRACT

AIMS: To investigate frequency of and reasons for hospital readmission in a frail older cohort receiving a community-based, multidisciplinary, transitional care service.

METHODS: A prospective cohort study with descriptive analysis of reasons for readmission in a cohort of frail older people discharged from hospital with the service. Measures of frailty, comorbidity, cognition, quality of life and function were recorded at discharge. Readmissions were recorded within three months after index discharge. Discharge summaries were reviewed and reasons for readmission categorised. Outcomes following readmission were recorded.

RESULTS: Readmission rates were high (42%) in our cohort, despite the intervention. People readmitted had worse functional ability and a greater burden of comorbidities. Half of the readmissions were classified as being new, acute medical problems requiring inpatient treatment, and a quarter as exacerbations of chronic medical problems. Eighty-six percent of those readmitted were able to return home following their readmission.

CONCLUSIONS: Our study showed high readmission rates despite the community supports. This high readmission rate does not imply failure of the intervention as the majority of these were with new or acute medical problems requiring inpatient treatment which were not preventable. Most were able to recover and return to their own homes.

The transition between hospital and home for frail older people can be a difficult and challenging time. Studies have shown that up to 40% of this group are readmitted within three months.1-3 Readmissions to hospital are associated with poorer outcomes such as functional decline, longer length of stay and discharge to Aged Residential Care (ARC) facilities. Studies have shown that many readmissions are with the same condition as the index admission.1 Readmissions are often seen as unnecessary, a “failed discharge” or attributed to a lack of support services in the community and therefore something that should be reduced.2 Schwarz3 describes the relationships between carer support, burden, depressive symptomatology and readmissions. In their review Garcia-Perez et al4 find that functional abilities are significant. Several studies have included physical comorbidities, including cardiovascular disease, heart failure, respiratory conditions, diabetes and renal disease;5-8 and geriatric conditions such as dementia, functional decline and falls;9,10 as associations with readmissions, but also broader community and health service issues such as underlying admission rates and length of stay,11 or problems with physician follow-up.1

In a New Zealand study Minnee and Wilkinson12 assessed return visits to the emergency department (ED) by older people. They found high levels of comorbidities and polypharmacy, and conclude that most return visits were with acute medical problems, such as cardiac problems, and not “failure to cope”. They also found the oldest and most frail people were actually least likely to re-present, and they suggest this
may be due to better assessment and longer length of stay for their index admission. Similarly in the UK, Kee and Rippingale13 assessed patients presenting with “acopia” in the ED. They found that the majority had an acute medical problem and multiple underlying comorbidities.

 Transitional care (TC) is a concept which is growing in popularity and being developed across the world in recent years. TC programmes have varied widely in their target population (with many focusing on specific syndromes such as heart failure),14 structure, length of intervention and content, but key components seem to include self-management,15-19 discharge planning,14,20,21 continuity of care,14 multidisciplinary team input,15,17,19,22 structured follow-up, and co-ordination of community services.19,23 TC interventions have demonstrated conflicting results on hospital readmissions.13 Some have found reduced readmission rates,14,17-20,22,23 while others found no difference.5,16,24 A recent systematic review17 has shown clear benefits in readmission rates, while another24 showed no clear benefit in Comprehensive Geriatric Assessment (CGA) interventions in older people being discharged after short admissions. A recent New Zealand study25 evaluated total time spent in hospital (rather than number of readmissions) and found a significant decrease with a supported discharge intervention for those being discharged from acute care.

 The Community Rehabilitation, Enablement and Support Team (CREST) was introduced in our region of New Zealand in 2011. It is an intensive, short-term or transitional community-based service which aims to support frail older people living in their own homes and maximise independence. A major part of the service is a TC service for people being discharged from hospital for whom it is considered that a further period of support and rehabilitation would be of benefit. Since introduction it had never been formally evaluated, and this is the reason for this study (overall evaluation in preparation). The specific aims of this sub-study were to record readmission rates in older people receiving the service, and to describe reasons for readmissions; particularly whether they represent problems with the service design or provision, or reflect acute or unstable medical conditions.

**Methods**

Participants in this study were referred by their inpatient team, then assessed by the CREST liaison team prior to discharge. CREST eligibility criteria are shown in Table 1. Once discharged they were seen by a specialised case-manager within 24 hours, and an individualised goal-directed plan agreed. Participants then received up to four visits per day for an average of six weeks. These included support with basic and extended Activities of Daily Living (ADLs) and an exercise and mobility programme. Key Support Workers (KSW) receive specific training to deliver the service and are asked to “do with” rather than “do for”.

**Table 1:** Eligibility criteria for CREST (CDHB).

<table>
<thead>
<tr>
<th>No.</th>
<th>Eligibility Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The client is over 65 years or close in age and interest (55y for Māori and Pacific Islanders).</td>
</tr>
<tr>
<td>2.</td>
<td>The client does not require acute inpatient treatment.</td>
</tr>
<tr>
<td>3.</td>
<td>The client consents to being treated at home by the team.</td>
</tr>
<tr>
<td>4.</td>
<td>The client is considered to have potential for partial or complete recovery with suitable home rehabilitation for six weeks.</td>
</tr>
<tr>
<td>5.</td>
<td>The client is able to stand and transfer with one person.</td>
</tr>
<tr>
<td>6.</td>
<td>The client’s home is judged to be safe for the client and visiting staff.</td>
</tr>
<tr>
<td>7.</td>
<td>The client has had a recent acute illness or injury and is at borderline level of function with an associated reduction in personal (PADL) and/or extended (EADL) activities of daily living and who without input from the team is:</td>
</tr>
<tr>
<td>a.</td>
<td>Likely to fail to recuperate full potential of functional recovery</td>
</tr>
<tr>
<td>b.</td>
<td>Likely to fail to manage satisfactorily at home despite conventional community support, and therefore would be at risk of hospital re-admission or institutionalisation.</td>
</tr>
</tbody>
</table>
This study was a prospective cohort study. Older people due to be discharged from hospital within the next 48 hours with the CREST service were referred by the clinical liaison team. The lead researcher then visited the person in hospital. The study was explained and written consent obtained. The Reported Edmonton Frail Scale (REFS)\(^26\) and Montreal Cognitive Assessment (MoCA)\(^27\) were then completed. The Charlson Index of comorbidities (CI)\(^28\) was completed from their medical records. The EuroQOL, EuroQOL self-rated health visual analogue scale (VAS)\(^29\) and Nottingham Extended Activities of Daily Living (NEADLs)\(^30\) scores were completed by the case manager as part of the initial assessment after discharge. These were provided to the research team.

The outcome of readmission to hospital over the next three months was recorded from the hospital computerised patient management system. All admissions to hospital in the region are recorded on this system. Discharge summaries were assessed independently by two clinically trained researchers. The diagnosis leading to readmission to hospital was recorded. This was then further classified into five groups: 1) new acute medical or surgical problem (for example pneumonia); 2) acute exacerbation of existing chronic medical condition (for example congestive cardiac failure); 3) same condition as was treated during the index admission; 4) geriatric syndromes (for example falls or functional decline) not caused by an acute illness and 5) elective. This was a subjective definition and some decisions had to be made. Where there was disagreement between the two coders (AC, HCH), these cases were debated until mutual consensus reached. The mode (or symptoms) of presentation were also recorded, which included geriatric “syndromes” falls, decreased mobility, not managing at home, non-specifically unwell, collapse and delirium. It also included medical and surgical symptoms such as pain and shortness of breath. For example, pneumonia may have presented as falls, decreased mobility or as shortness of breath.

Admissions were then further classified as “avoidable” or “unavoidable” admissions. “Unavoidable” was defined as requiring inpatient monitoring, investigation, medical or surgical treatment, or rehabilitation. Finally, the discharge destination from hospital for that person was recorded.

Descriptive statistics were used to describe the demographics and outcomes for the cohort. The relationship between readmission and the scales recorded at initial discharge were examined using univariate analysis. Variables within a p-value of <0.10 were then entered into a forward stepwise multiple logistic regression analysis. Significance of the variables and Odds Ratio (OR) were calculated.

**Results**

Two hundred and thirty-two people were recruited into the study. Of these, eight subsequently declined CREST services, leaving a cohort of 224. The mean (SD) age was 82.3 (6.5) years, 56% were female. They were moderately frail, mean (SD) REFS was 7.9 (2.8); the majority had some degree of cognitive impairment, mean MoCA 21.9 (4.6); they had a mean of 2.4 comorbidities (1.5); mean EuroQOL 11.8 (1.4); mean VAS score 54.8 (13.8); and mean NEADLs 29.1 (10.6). Mean length of stay for their index admission was 8.2 days and for those discharged from specialist inpatient geriatric care, 24.1 days.

Within the three months of discharge, 93 people (42%) had been readmitted. Mean time from index discharge to readmission was 23.5 days. There was a particularly rapid increase in the numbers readmitted early, over the first six weeks. Readmissions over time are shown in Figure 1. Mean length of stay for readmissions was 11.2 days.

Of the 93 readmissions, 57 (62%) were classified as a new acute problem; 12 (13%) as an acute exacerbation of an existing medical problem; and 15 (16%) as the same as the index discharge, four (4%) as a geriatric syndrome without other diagnosis, and four patients (4%) had an elective admission (e.g., planned eye surgery). One person died during their admission and a discharge summary was not completed, so could not be classified. These results are illustrated in Figure 2. From the 88 unplanned or emergent readmissions, 83 (95%) were considered unavoidable.
The mode of presentation is illustrated in Table 2. There were approximately equal numbers of falls, pain (including chest pain), shortness of breath and other medical conditions. There were smaller numbers of other geriatric syndromes: generally unwell, collapse and decreased mobility. While a third presented as a “geriatric syndrome” most of these were due to underlying medical problems, and hence the reason for admission was coded as such. No one was classified on their mode of presentation on discharge summaries as having delirium, although for a number this was diagnosed later. Also no one presented with the only presenting issue being failure to manage at home.

Figure 1: Numbers of readmissions over three months.

![Graph of readmissions over three months.](image)

Figure 2: Readmission category.

![Bar chart of readmission categories.](image)
From the 88 unplanned readmissions, the majority, 75 (85%), were able to return home after their readmission. Twenty-seven (31%) did so with existing supports (formal or informal); 26 (30%) with further CREST input; seven (8%) were discharged with new long-term supports; and 15 (17%) after a period of inpatient rehabilitation. Of the remainder, 10 (12%) entered ARC, (6 (7%) directly from acute care, four (5%) from inpatient rehabilitation) and five (6%) died during the hospital admission.

Univariate analysis identified a number of variables as significant in those readmitted in the first three months. These were longer index length of stay (p=0.015), greater comorbidities (p=0.005), increased frailty (p=0.002), poorer QOL (p=0.010) and greater EADL dependence (p=0.010). These variables were then entered into the multivariate analysis. Two factors remained significant as predictors of readmission—lower functional abilities (NEADLs): OR= 0.97 (0.93-0.99) per point, p=0.017; and increased comorbidities (CI): OR=1.30 (1.07–1.59) per point, p=0.009.

Discussion

This study explores the issue of hospital readmissions in a frail, older cohort, discharged from hospital with the support of a community-based rehabilitation and support service. There are a number of key findings.

1. The readmission rate was high despite the CREST intervention bridging the transition to home.
2. The majority of readmissions were new acute medical or surgical problems or exacerbations of existing chronic medical conditions, not “failure to manage” or “failure” of CREST supports.
3. The majority of those readmitted were able to return home after treatment.
4. Predictors of readmission were increased comorbidities and lower functional status.

A key feature of this intervention is the targeting of a particularly frail group. Our group were older than the START study, which used a similar intervention, and most had frailty and cognitive impairment. This group have complex and unstable health and disability needs. This may have contributed to the high early readmission rates despite the intervention. This is in keeping with other studies of readmission rates in frail populations. In previous New Zealand studies with a similar frail group we found 40.7% three month readmission rate, and others 28-day readmission rates of 26.5%. In this observational study, the CREST intervention does not seem to have reduced readmission rates compared with these previous studies, but neither have readmission rates increased. Without a
control group, we do not know whether the rates without intervention would have been different.

From our findings we have demonstrated that about three-quarters of the readmissions in our group could be classified with acute new conditions or acute exacerbations of existing chronic conditions. Only about a quarter were for the same condition as the index discharge. While about one-third presented with geriatric syndromes, particularly falls, we found that there were usually underlying medical conditions. These findings reflect the medical instability of this population, and many of their admissions to hospital are with significant medical conditions, rather than a “failure” of support services, or “failed discharge.” This finding is supported by the New Zealand study of Minnee and Wilkinson, who assessed reasons for representation to the ED, and found most were acute medical problems. Similarly others have found readmissions to be due to acute or chronic medical conditions even when initially triaged as “acopia”. We considered over 95% of readmissions to be unavoidable; that is they required inpatient monitoring, investigation, management or rehabilitation.

Another key finding was that the majority of those readmitted (85%) were able to return back to their own homes, with or without further CREST input. This again supports the finding that people were readmitted with acute, treatable problems from which people could recover with appropriate care. It also argues against the use of pejorative labels such as “failure to cope” or “acopia” or blaming the support structures. It is recognised that most older patients given these labels have acute, serious medical problems that need addressing.

In our multivariate regression analysis we performed analysis of a number of scales recorded at the time of initial discharge. Significant predictive factors in people who were readmitted at three months were comorbidities (the CI) and function (NEADLs). The significance of the CI supports the idea that this population are medically unstable, and therefore at risk of readmission, and is in keeping with other studies which have shown medical comorbidities to be significant. However the finding that functional abilities are also significant is important. It is widely recognised that this frail population is very precariously balanced between independence and dependence, and that even an apparently minor insult or illness can tip that balance. The relevance of this, is that even small gains in function are worthwhile and can make the difference between remaining at home or not.

When we examine our patients’ mode of presentation, about one-third of them presented with “geriatric syndromes” secondary to acute medical problems, which supports the suggestion of frailty and decompensation of function being important. In their review Garcia-Perez also found functional ability to be important.

Unfortunately we do not have any data on whether our cohort had any primary care follow-up prior to readmission. Others studies found half of their study population had not had a physician visit between index discharge and readmission. We do not know whether, with earlier primary care follow-up or other intervention, medical conditions may have been detected sooner, and be treated in the community setting. In a recent study Legrain found that discharge planning, self-management coaching and medication review by geriatricians with detailed transition-of-care communication to primary care reduced readmissions and ED attendances. The CREST service may need to incorporate increased specialist and generalist medical input to address these needs, and/or review how we communicate with primary care. It supports the need for rapid access for older people to acute assessment, diagnostic and management services. Scheduling an early primary care review at the time of discharge is another option.

There are a number of limitations to this study. First it was not a controlled trial, so we do not know the underlying readmission rates in people of equivalent frailty who did not receive the CREST service. Second, it was descriptive, and judgement calls had to be made about which diagnostic group to place people in when there were co-existing problems. There was also potential for bias, for investigators to classify admissions to “improve” outcomes of the study.
We addressed this by having two clinicians separately coding the reasons for readmission, then comparing these codes. When they did not agree, cases were discussed and consensus reached.

Our study has found that in a population of frail older people discharged from hospital with a community rehabilitation and support service readmission rates were high. Readmissions in this group are commonly seen as preventable or unnecessary, and that they represent a failure of services or an inability of the older person to manage at home. However, the majority of our cohort were readmitted with acute problems, from which they were able to recover and return home after treatment. These findings suggest that this model of service should not have prevention of readmissions as its primary outcome goal, rather improvement of function and maintenance of independence. We will report on these outcomes in a separate paper.

The question remains whether readmissions in this group can be prevented. Further research is needed on whether specialist follow-up, early primary care input or better communication with primary care services would enable medical issues to be identified and managed earlier in a community setting.

Competing interests:
Nil.

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Feasibility and reliability of clinical coding surveillance for the routine monitoring of adverse drug events in New Zealand hospitals

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ABSTRACT

AIM: To explore the feasibility and reliability of Clinical Coding Surveillance (CCS) for the routine monitoring of Adverse Drug Events (ADE) and describe the characteristics of harm identified through this approach in a large district health board (DHB).

METHOD: All hospital admissions at Waitemata DHB from 2015 to 2016 with an ADE-related ICD10-AM code of Y40-Y59, X40-X49 or T36-T50 were extracted from clinical coded data. The data was analysed using descriptive statistics, statistical process control and Pareto charts. Two clinicians assessed a random sample of 140 ADEs for their accuracy against what was clinically documented in medical records.

RESULTS: A total of 11,999 ADEs were identified in 244,992 admissions (4.9 ADEs per 100 admissions). ADEs were more prevalent in older adults and associated with longer average length of stays and medicines such as analgesics, antibiotics, anticoagulants and diuretics. Only 2,164 (18%) of ADEs were classified as originating within hospital. Of ADEs originating outside of the hospital, the main causes were poisoning by psychotropics, anti-epileptics and anti-parkinsonism agents and non-opioid analgesics. Clinicians agreed that 91% of ADE positive admissions were accurately classified as per clinical documentation.

CONCLUSION: CCS is a feasible and reliable approach for the routine monitoring of ADEs in hospitals.
diagnoses and procedures using the International Classification of Disease 10th Edition, Australian Modification (ICD-10AM). In New Zealand, there is mandatory submission of ICD-10AM coded data to the Ministry of Health (MoH) for National Minimum Dataset (NMDS) collection. Overseas research and practice using CCS for routine monitoring show 0.7–4.5% of hospital admissions are associated with ADEs. Despite sharing the same ICD coding system as Australia, CCS is less established in New Zealand. Aside from some initial research by the Health Quality and Safety Commission (HQSC) and its primary use as a pharmacoepidemiological research tool, CCS has not been adopted in New Zealand for routine clinical use. It is not clear whether CCS is feasible or reliable in local settings for ADE monitoring. This study outlines the use of CCS for routine monitoring of ADEs and describes the characteristics of medication-related harm identified through this approach.

**Method**

An ADE was defined as any medication-related incident, regardless of the cause, documented by the medical team as having harmed the patient and/or where medical care was necessary to monitor or manage the event(s). This broad definition of ADE includes harm occurring from both adverse drug reactions (ADR) (ie, noxious and unintended responses occurring at normally used doses) and poisonings (ie, intentional or accidental overdoses) (Table 1). Selection of ADE-related ICD-10AM codes were based on those previously described in the literature and in consultation with the local clinical coding team (Table 1).

All admissions into Waitemata District Health Board (DHB), which provide secondary hospital services at North Shore (595 beds) and Waitakere (269 beds), from January 2015 to December 2016 with an ADE-related ICD-10AM (8th Edition) external cause code of Y40-Y59, X40-X49 or T36-T50 in any field were extracted using Microsoft Structured Query Language (SQL) Server Management Studio 2012 software (Figure 1). ADEs originating in or out of hospital were defined by the Condition Onset Flag (CoF) associated with diagnostic codes; providing insight into what conditions patients already have when admitted (CoF=2 (outside hospital)) and what arises during hospitalisation (CoF=1 (inside hospital)).

Patient demographic details along with ADE-related diagnosis information associated with these admissions were described. Statistical process control U and Pareto charts were used to identify special cause variation over time and highlight the most common ADE-related ICD codes used respectively. Analyses were undertaken using Excel 2013 and Minitab® 2015.

To determine whether the coded ADEs and its CoF matched what was clinically documented, two reviewers (doctor and pharmacist) were provided a random list of patients with the ADE-related ICD-10AM code (n=140) (eg, Y44) and its corresponding code description (eg, anticoagulant-related ADE). Clinicians would then review the electronic discharge summary (EDS) to look for the documented ADE. If they find documentation which supports the ICD code they tick ‘Correct’. If they do not then they tick ‘unclear/not in EDS’. If incorrect (eg, documentation is for opioid ADE) then they tick ‘Incorrect’. Neither preventability nor the accuracy of what was clinically documented was assessed. Any disagreements were resolved by consensus with assistance from a senior physician. Based on previous research it was estimated that the sample size was adequate to provide a positive predictive value (PPV) estimate with reasonable accuracy and narrow confidence intervals (±5%).

**Results**

In total, there were 244,992 admissions into Waitemata DHB hospitals during 2015–2016 (Table 2). 11,999 ADES were identified by ICD-10AM codes (4.9 ADEs per 100 admissions). Most (66%) ADES were adverse drug reactions (Y codes). ADES relating to poisoning (T codes) and accidental poisoning (X codes) were also relatively common, at 28% and 6% respectively. Most (82%) of the ADES were classified as originating from outside of the hospital. Of all hospitalisations, 9,040 admissions had one or more ADE which gives an overall proportion of admissions with ADEs of 3.7%.
### Table 1: ADE-related ICD-10AM codes.

<table>
<thead>
<tr>
<th>ADE identified:</th>
<th>ADE-related ICD-10AM code types and brief description</th>
<th>Examples of ADE-related codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>By disease manifestation</td>
<td>Disease manifestation codes (DMC): classified by the disease and/or documented clinical symptoms of the ADE. NB: while there are some disease manifestation diagnosis codes specific to ADEs, many are non-specific (eg, nausea) and have to be used in conjunction with other codes or data sources for higher specificity. For example, linkage of ICD-10 codes with community pharmacy dispensing data is required to more reliably ascertain simvastatin associated rhabdomyolysis.</td>
<td>Drug specific disease manifestation codes: N14.0: analgesic nephropathy (eg, non-steroidal anti-inflammatories (NSAIDs)) D52.1: Drug-induced (eg, methotrexate) folate deficiency anaemia Non-drug specific disease manifestation codes: R11: Nausea &amp; vomiting K59: Constipation F05: Delirium</td>
</tr>
</tbody>
</table>
| By disease manifestation AND drug cause | Clustering of both disease manifestation AND external injury cause codes (eg, CHADx). ADE is only counted when diagnosis code is immediately followed by one or more relevant external cause code. | Opioid-related nausea and vomiting (N&V) when:  
- R11: N&V AND immediately followed in sequence by Y45.0: opioids and related analgesic adverse effects |

**Chapter XX: External causes of morbidity and mortality**

- **Y40-Y59: Drugs, medicaments and biological substances causing adverse effects in therapeutic use.** Includes complications of care such as adverse drug reactions (ADR) which may occur despite appropriate care. NB: excludes accidents in the technique of administration of medicines
  - Y45 (group code): Analgesics, antipyretics and anti-inflammatory drugs comprising of Y45.0-Y45.9:  
    - **Y45.0:** Opioids and related analgesic ADEs  
    - **Y45.3:** Other NSAIDs  
    - **Y44.2:** Anticoagulants ADEs  
    - **Y42.3:** Insulin and oral hypoglycaemic ADEs

- **X40-49: Accidental poisoning by and exposure to noxious substances.** Includes accidents in the use of drugs such as accidental overdose, wrong drug given/taken in error, drug taken inadvertently
  - **X40:** Accidental poisoning relating to non-opioid analgesics (eg, NSAIDs, paracetamol)  
  - **X42:** Accidental poisoning relating to narcotics (eg, codeine)

**Chapter XIX: Injury, poisoning and certain other consequences of external causes**

- **T36-T50: Poisoning by drugs, medicaments and biological substances.** Includes overdose or wrong substance given or taken in error
  - **T42.4:** poisoning by benzodiazepines (eg, triazolam)  
  - **T43.0:** poisoning by tricyclic and tetracyclic antidepressants (eg, amitriptyline)  
  - **T40.7:** poisoning by cannabis (derivatives)

- Clustering of both disease manifestation AND external injury cause codes (eg, CHADx). ADE is only counted when diagnosis code is immediately followed by one or more relevant external cause code.
Figure 1: Outline of research process and outputs.
Some variation in the average number of ADEs per 100 admissions occurred over time and special cause variation was evident with higher (Jan 15, Dec 15 and Jan 16) and lower (Aug 15 and Sept 16) rates (Figure 2). ADEs originating outside hospital followed this pattern but no special cause variation was evident for inpatient ADE rates.

In total, 9,040 admissions had ≥1 ADE. In patients with ADEs, the ALOS, median age and the proportion of female, ≥65 year olds and New Zealand/other Europeans were higher than those of all Waitemata admissions (Table 3).

Adverse drug reactions (Y40-Y59 codes) predominated (n=7,931 ADEs (66%)) among ADEs originating both inside and outside of hospital (Table 4). Of all ADEs originating in hospitals, the majority (97.7%) were ADRs. ADRs were less frequent (59%) among ADEs originating from outside of hospital.

The most common drug classes associated with ADEs originating from both inside and outside of hospitals were analgesics (Y45), antibiotics (Y40), anticoagulants (Y44), diuretics (Y54) and cardiovascular (Y52) (Figure 3). Poisoning by psychotropics (T43), anti-epileptics and anti-parkinsonism agents (T42) and non-opioid analgesics were common causes of ADEs originating outside of hospital.

A total of 140 ADEs were randomly selected to assess the accuracy of coded ADEs and its CoF against what was clinically documented (Table 5). For eight admissions, the coded ADE was not documented within the electronic discharge summary (EDS). Of the remaining admissions (n=132), the accuracy of the coded ADEs was high (91%). Four errors occurred where incorrect ICD-10AM codes were assigned. In one example, postural hypotension related to the bendrofluazide was wrongly classified using the glucocorticoid-related ADE code (Y42.0) rather than the benzothiadiazine derivative one (Y54.3). The accuracy of the assigned CoF was also high at 91%. In a small number of admissions (3% of the sample) the wrong CoF had been assigned to the diagnosis code.

### Table 2: Overall ADE numbers and annual average rates.

<table>
<thead>
<tr>
<th>Overall</th>
<th>CY2015</th>
<th>CY2016</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total admissions</td>
<td>119,443</td>
<td>125,549</td>
<td>244,992</td>
</tr>
<tr>
<td>No. of ADEs identified via coding</td>
<td>6,033</td>
<td>5,966</td>
<td>11,999</td>
</tr>
<tr>
<td>Average no. of ADEs per 100 admissions</td>
<td>5.1</td>
<td>4.8</td>
<td>4.9</td>
</tr>
<tr>
<td>Proportion of ADEs by ICD-10AM code type:*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADR (ie, Y40-Y59) related</td>
<td>4,029 (67%)</td>
<td>3,902 (66%)</td>
<td>7,931 (66%)</td>
</tr>
<tr>
<td>Poisoning (ie, T36-T50) related</td>
<td>1,623 (27%)</td>
<td>1,749 (29%)</td>
<td>3,372 (28%)</td>
</tr>
<tr>
<td>Accidental poisoning (ie, X40-X49)</td>
<td>381 (6% )</td>
<td>315 (5%)</td>
<td>696 (6%)</td>
</tr>
<tr>
<td>Proportion of ADEs by point of origin using CoF:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1= originate in-hospital</td>
<td>1,079 (18%)</td>
<td>1,085 (18%)</td>
<td>2,164 (18%)</td>
</tr>
<tr>
<td>2= originate outside-hospital</td>
<td>4,954 (82%)</td>
<td>4,881 (82%)</td>
<td>9,835 (82%)</td>
</tr>
<tr>
<td>No. of admissions with ≥1 ADE (proportion of admissions (%))</td>
<td>4,537 (3.8)</td>
<td>4,503 (3.6)</td>
<td>9,040 (3.7)</td>
</tr>
<tr>
<td>Avg. no. of ADEs per admission with medication-related harm</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Range of ADEs per patient with medication-related harm</td>
<td>1-10</td>
<td>1-9</td>
<td>1-10</td>
</tr>
</tbody>
</table>

*NB: see Table 1 for descriptions of the ICD-10AM codes and illustrative examples.
Figure 2: Statistical process control charts of average number of ADEs per 100 admissions over time (overall, originating in- and outside-hospital).
Table 3: Patient characteristics of admissions with ADEs compared to overall inpatient demographics.

<table>
<thead>
<tr>
<th>Patient demographics</th>
<th>Patient characteristics of admissions with ≥1 ADEs</th>
<th>Patient characteristics of all Waitemata admissions*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=9,040 admissions</td>
<td>n=244,992 admissions</td>
</tr>
<tr>
<td>Median age (years)</td>
<td>64</td>
<td>60</td>
</tr>
<tr>
<td>Age groups (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–14 years</td>
<td>481 (5.3%)</td>
<td>29,541 (12.1%)</td>
</tr>
<tr>
<td>15–44 years</td>
<td>2,274 (25.2%)</td>
<td>76,923 (31.4%)</td>
</tr>
<tr>
<td>45–64 years</td>
<td>1,852 (20.5%)</td>
<td>55,911 (22.8%)</td>
</tr>
<tr>
<td>65–74 years</td>
<td>1,367 (15.1%)</td>
<td>33,966 (13.9%)</td>
</tr>
<tr>
<td>75–84 years</td>
<td>1,780 (19.7%)</td>
<td>27,445 (11.2%)</td>
</tr>
<tr>
<td>85+ years</td>
<td>1,286 (14.2%)</td>
<td>21,206 (8.7%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3,850 (42.6%)</td>
<td>105,957 (43.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>5,190 (57.4%)</td>
<td>139,034 (56.8%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ European</td>
<td>5,121 (56.6%)</td>
<td>126,643 (51.6%)</td>
</tr>
<tr>
<td>Other European</td>
<td>1,509 (16.7%)</td>
<td>33,070 (13.5%)</td>
</tr>
<tr>
<td>Māori</td>
<td>860 (9.5%)</td>
<td>24,373 (9.9%)</td>
</tr>
<tr>
<td>Asian (Chinese and Indian)</td>
<td>482 (5.4%)</td>
<td>21,718 (8.8%)</td>
</tr>
<tr>
<td>Samoan</td>
<td>253 (2.8%)</td>
<td>8,487 (3.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>815 (9%)</td>
<td>31,074 (12.7%)</td>
</tr>
<tr>
<td>Avg. Length of Stay (ALOS) (days)</td>
<td>6.2 days</td>
<td>2.7 days</td>
</tr>
</tbody>
</table>

*NB: obtained via business intelligence tools and provided for relative comparison.

Table 4: ADE characteristics by ICD-10AM group codes.

<table>
<thead>
<tr>
<th>ADE by cause</th>
<th>No. of ADEs originating in hospital (n=2,164 ADEs) (%)</th>
<th>No. of ADEs originating outside hospital (n=9,835 ADEs) (%)</th>
<th>Total no. of ADEs (n=11,999 ADEs) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADRs (ie, Y40-Y59)</td>
<td>2,115 (97.7%)</td>
<td>5,816 (59.1%)</td>
<td>7,931 (66.1%)</td>
</tr>
<tr>
<td>Poisonings (ie, T36-T50)</td>
<td>28 (1.3%)</td>
<td>3,344 (34%)</td>
<td>3,372 (28.1%)</td>
</tr>
<tr>
<td>Accidental poisoning (ie, X40-X49)</td>
<td>21 (1.0%)</td>
<td>675 (6.9%)</td>
<td>696 (5.8%)</td>
</tr>
</tbody>
</table>
Figure 3: Pareto chart of top 10 most frequently classified ADEs originating inside and outside of hospital (n=11,999 ADEs).

<table>
<thead>
<tr>
<th>ADE type</th>
<th>No. of ADEs classified as originating in-hospital</th>
<th>No. of ADEs classified as originating outside of hospital</th>
<th>Cumulative % in hospital</th>
<th>Cumulative % outside hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesics, antipyretics and anti-inflammatory drugs (Y45)</td>
<td>543</td>
<td>878</td>
<td>25.1</td>
<td>8.9</td>
</tr>
<tr>
<td>Systemic antibiotics (Y40)</td>
<td>301</td>
<td>497</td>
<td>39.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Agents affecting blood constituents (Y44)</td>
<td>231</td>
<td>951</td>
<td>49.7</td>
<td>23.7</td>
</tr>
<tr>
<td>Agents affecting water-balance and mineral and uric acid (Y54)</td>
<td>152</td>
<td>529</td>
<td>56.7</td>
<td>29.0</td>
</tr>
<tr>
<td>Agents primarily affecting cardiovascular system (Y52)</td>
<td>151</td>
<td>675</td>
<td>63.7</td>
<td>35.9</td>
</tr>
<tr>
<td>Hormones and synthetic substitutes and antagonists, not elsewhere classified (Y42) (eg, insulin)</td>
<td>133</td>
<td>445</td>
<td>69.8</td>
<td>40.4</td>
</tr>
<tr>
<td>Anaesthetics and therapeutic gases (Y48)</td>
<td>117</td>
<td>39</td>
<td>75.2</td>
<td>40.8</td>
</tr>
<tr>
<td>Other and unspecified drugs and medicaments (Y57)</td>
<td>100</td>
<td>458</td>
<td>79.9</td>
<td>45.5</td>
</tr>
<tr>
<td>Drugs primarily affecting autonomic nervous system (Y51) (eg, metaraminol)</td>
<td>92</td>
<td>353</td>
<td>84.1</td>
<td>49.1</td>
</tr>
<tr>
<td>Primarily systemic agents (Y43) (eg, antineoplastic, immunosuppressives)</td>
<td>64</td>
<td>299</td>
<td>87.1</td>
<td>52.1</td>
</tr>
<tr>
<td>Poisoning by anti-epileptic, sedative-hypnotic and anti-parkinsonism drugs (T42)</td>
<td>5</td>
<td>720</td>
<td>87.3</td>
<td>59.4</td>
</tr>
<tr>
<td>Poisoning by nonopioid analgesics, anti-pyretics and anti-rheumatics (T39)</td>
<td>2</td>
<td>712</td>
<td>87.4</td>
<td>66.7</td>
</tr>
<tr>
<td>Poisoning by psychotropic drugs (T43) (eg, antidepressants, antipsychotics)</td>
<td>1</td>
<td>828</td>
<td>87.4</td>
<td>75.1</td>
</tr>
</tbody>
</table>

NB: Arranged largest to smallest by top 10 occurring ADEs originating in-hospital then by those classified as outside hospital.
### Table 5: Accuracy of coded ADEs and its CoF with illustrative examples.

<table>
<thead>
<tr>
<th>Overall summary</th>
<th>Total (%)</th>
<th>Illustrative examples (ICD-code, description and verbatim case notes relating to ADEs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy of coded ADE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>128 (91.4%)</td>
<td></td>
</tr>
</tbody>
</table>
| Incorrect | 4 (2.9%) | Y55.6: Antiasthmatics, not elsewhere classified: Hypokalaemia secondary to salbutamol nebs
Y40.9: Systemic antibiotic, unspecified: Started on trimethoprim 02/09, taken intermittently over five days having been on cefuroxime for two days before. Became unwell 10/09 with hypotension, rash, fevers, AKI (acute kidney injury) (Creatinine 220) and hyponatraemia (Na 125) with a CRP of 94. Seen by dermatology… - impression of drug reaction to antibiotics

| Incorrect | 4 (2.9%) | Y42.0: Glucocorticoids and synthetic analogues: bendrofluazide potentially causing postural hypotension with risk of falling [wrong drug class]
T40.4: Other synthetic narcotics: Last night had a headache and difficulties with her family, so took some paracetamol, and then withdrew from the family in her room and continued to take paracetamol two tabs at a time, until she had taken 17 total tablets over the evening…She vomited once. This morning she felt unwell and did not go to school [paracetamol not a synthetic narcotic]

| Not clear or noted within EDS | 8 (5.7%) | Y45.3: Other non-steroidal anti-inflammatory drugs [NSAID]: nothing noted within EDS
Y45.0: Opioids and related analgesics causing adverse effects in therapeutic use: nothing noted |

| **Accuracy of CoF** | | |
| Correct | 127 (90.7%) | Y40.1: Cephalosporins and other beta-lactam antibiotics (CoF=1, in hospital): Had episodes of diarrhoea postoperatively, as a result antibiotics were stopped
X44: Accidental poisoning by and exposure to other and unspecified drugs (CoF=2, outside hospital): accidentally given himself 44 unit of Apidra Solostar® [insulin formulation] at 11pm instead of his usual 44 units of Lantus®. He drank some sugary drinks and ate some bread in an attempt to keep his blood sugars high but BSL [blood sugar level] dropped to ~4 and he called for help

| Incorrect | 4 (2.9%) | Y43.0 (CoF=2, outside hospital): Antiallergic and antiemetic drugs causing adverse effects in therapeutic use: Given domperidone [while in hospital] for nausea - developed itch + rash on arms
Y45.3 (CoF=1, inside hospital): Other non-steroidal anti-inflammatory drugs [NSAID]: Reviewed by renal registrar - AKI thought to be secondary to NSAID use for the last 3–4 months [prior to admission]- acute element to acute ATN [acute tubular necrosis] and cardiorenal failure

| Not clear or noted within EDS | 9 (6.4%) | T50.9 (CoF=2, outside hospital): Other and unspecified drugs, medications and biological substances: nothing noted within EDS
Y45.0 (CoF=1, inside hospital): Opioids and related analgesics causing adverse effects: nothing noted |
Discussion

The aim of this study was to outline the use of CCS for routine monitoring of ADEs and describe the characteristics of medication-related harm identified through this approach. ADEs are relatively prevalent in patients admitted into Waitemata DHB hospitals with an average of 4.9 ADEs per 100 admissions. The average ADE rate observed in this study is consistent with other studies that have used clinical coding surveillance in New Zealand (0.9–7.9), Australia (0.7–4.5), UK (3.2%), Germany (4.8%) and the US (5.7%).

Likewise the finding that ADEs are more prevalent in older adults, are mostly ADRs (66%) and associated with longer ALOS and medicines such as analgesics, antibiotics, anticoagulants and diuretics are consistent with previous research. By contrast the observation that most ADEs (82%) originated outside hospital was not consistent with other research findings where both the New Zealand Quality in Healthcare Study (NZQHS) and ADE Collaborative (ADEC) studies reported that only 40% or 16–29% of ADEs respectively originated in the community.

Reviews undertaken by two clinicians of a random sample of ADEs showed the majority (90%) were accurately classified as per clinical documentation. For eight admissions, the coded ADE was not documented within the electronic discharge summary (EDS) but may have been identified had the paper medical record been obtained. While some ADEs were assigned the wrong ICD-10AM code and CoF, overall they did not affect the total number found; which provides a level of assurance to the quality and reliability of coded data at Waitemata DHB.

Based on research findings, coding data can be relied upon to reflect clinically diagnosed and documented ADEs. Research findings are generally consistent with those reported in key studies on ADEs, such as NZQHS, where iatrogenic harm has been robustly identified by interdisciplinary teams. The fact that the data obtained using CCS can be relied upon yet can be generated relatively quickly without the need for additional manual data collection in a large and busy DHB indicates CCS is a tool which can feasibly be used for routine ADE detection and measurement.

Limitations

Current national coding standards mean that if a patient is transferred between general and rehabilitation wards, despite being part of the same hospital journey, this is counted as two admissions. In these scenarios, ADEs may be counted twice. Overall, however, the methodological limitation should not affect the average ADE rate because even though harm is counted more than once there is a corresponding increase in denominator size. The emergence of the above limitation prompted further investigation, which reassuringly identified that only a relatively small proportion (n=272 of 9,040 ADE positive admissions (3%)) were of the same hospital journey, so the effect of this is relatively minor. Nonetheless, further research to better understand the size and significance of this problem and adjusting where necessary will further improve data reliability.

Study findings suggest that if ADEs are coded, it is likely they are clinically documented, but it is unclear whether this is conversely true. That is, whether all clinically documented ADEs in medical records are coded. It is also unclear whether all ADEs that occur are correctly diagnosed and documented by the medical team. Research suggests that these processes are not always carried out as well as they could be, which has implications for coding and thus ADE rates. Future research involving in-depth medical record reviews of the same set of data as those obtained from coding and with a clinical coder will help to reveal the false negatives, false positives and true negatives rates.

The statistical process control charts (SPC) (Figure 2) showed the occurrence of results outside the control limits. Their occurrence seem to be quite variable with (largely ADEs originating outside of hospital) results fluctuating above and below the limits over relatively short periods of observation (six months). It is not clear whether the difference relates to changes in the patient casemix. For example, over the December to January period, one might expect to see a lower number of elective/waiting list admissions and a higher proportion of acutely admitted patients. Coupled with the fact that most ADEs identified through CCS originated...
from outside of the hospital, there is the potential for ADE proportions to be skewed during the Christmas period and this is a potential confounder. Future research into the reasons for variations through separating SPC charts by admission type (ie, acute or elective/waiting list) may be useful to better understand reasons for variation.

This study did not include outpatients, patient admissions where duration was ≤3 hours or use ADE-related Disease Manifestation Codes (DMC) either alone or in combination with drug-related external cause codes (Table 1) so ADEs may be undercounted. Future research using these codes may provide a more comprehensive insight into the magnitude of harm. Current coding classification systems also do not provide granular detail about ADEs such as its seriousness or preventability. Future and more sophisticated coding schemas such as SNOMED CT (System of Nomenclature of Medicine-Clinical Terms) and ICD-11 when implemented may provide additional information.\textsuperscript{31}

Implications for policy

The limitations of using ADEs as the sole primary metric has previously been outlined but it remains an important component of a multi-dimensional approach to measuring medication safety.\textsuperscript{3,32,33} A major barrier to the routine collection and analysis of ADE data (eg, audits) for most New Zealand hospitals has been the capacity and resource required.

Because it is mandatory for all DHBs to submit coded data to the MoH as part of NMDS collection, all hospitals in New Zealand will already have the administrative data readily available and most, if not all, should be familiar with how to extract the data. Aggregation of ADE data from across DHBs can be used to identify areas of high risk to better prioritise national improvement initiatives and used to determine their effectiveness. Because standardised ICD-10AM codes are used across DHBs, CCS can be applied to NMDS data, which means that, for the first time, national ADE rates can be routinely and sustainably generated for monitoring over time. Furthermore, the coding of data using internationally agreed standards means that data across hospitals can be compared for the purpose of understanding whether

unwarranted variation exists and if so, why; so lessons can be learnt from higher performing organisations.

Implications for system-wide improvement planning and monitoring

Even though hospitals have not focused on the use of the clinical coding dataset for the purpose of monitoring ADEs, it should be relatively straightforward to obtain and in the first instance, use descriptive statistics to identify high-risk areas in hospitals to inform and prioritise improvement. The fact that no additional data collection is required means that a minimal amount of resource, beyond that of an information analyst and someone with medication safety expertise, is required. Because health information is coded in a largely consistent and standardised manner over time within an organisation, significant variations in ADE rates is more likely to reflect system changes rather than variations due to inconsistent data collection. SPC charts can be used to identify special cause variation that signal the need for further investigation or the effects of system changes on ADEs over time.

Research suggests that certain ADE detection tools are more sensitive at detecting particular types of medication-related harm than others.\textsuperscript{6,34} The prevalence of 4.9 ADEs per 100 admissions identified in this study suggests that CCS detects more medication-related harm than incident reporting but not as many as those using other techniques such as ADE trigger tools. Ideally, CCS should be used in conjunction with other ADE identification tools to obtain a more complete and balanced overview of medication-related harm. In busy, resource-constrained DHB environments, the use of multiple detection tools for ongoing ADE monitoring is often not feasible. Despite lower rates of ADEs detected in this study, their characteristics are generally similar to previous research and because CCS does not require additional data collection, it is a practical solution for quickly identifying areas with highest rates of harm and for continuous ADE monitoring.

This study identified that a large proportion of ADEs (82%) were classified as originating outside of the hospital (n=9,853 ADEs), which is in contrast to rates reported elsewhere. One interpretation of this
finding is that CCS is particularly sensitive at detecting ADEs originating from outside of the hospital. The majority of medicines use occurs in primary care and so another interpretation is that results indeed reflect the high numbers and proportions of ADEs originating from outside of the hospital. Their sheer number warrants further investigation and serves as a reminder of the importance of improving medicines use in community settings.

It is concerning that 41% of ADEs originating from outside of hospitals were classified as due to poisoning, both accidental and intentional. Such figures highlight the need for better preventative strategies and CCS may be a useful tool (especially using ICD-10AM X and T codes) for organisations such as Accidental Compensation Corporation (ACC) to inform improvement efforts and monitor the effectiveness of their initiatives. Significant proportions of ADEs identified using CCS were poisoning from psychotropics, anti-epileptics, anti-parkinsonism drugs and non-opioid analgesics; which indicates the need for improving medicines use beyond those typically focused on for improvement such as opioids, anticoagulants and insulin.

Implications for future research
This study has provided an overview of the numbers and characteristics of ADEs identified using CCS. More in-depth analyses of ADEs by drug class, location and point of origin and by patient population sub-groups can provide information by which to more precisely pinpoint improvement. Similarly, because coded data contains details of the discharge service and ward, ADE data can be analysed based on these variables for more specific intra-organisational improvement and monitoring.

Conclusion
This study has detailed, for the first time in New Zealand, the characteristics of hospital-wide ADEs identified using CCS and ICD-10AM data. By comparing and contrasting the findings from this study against existing knowledge on ADEs occurring in New Zealand, it is apparent that ADEs can be routinely measured in a reliable and sustainable manner on a local scale. By describing in detail the research process, this work serves to guide other hospitals who may be struggling to routinely measure and monitor ADEs.
Competing interests:
Nil.

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REFERENCES:


Preventing cardiovascular disease in New Zealand: making better use of statins but also tobacco control, changing the food supply and other strategies

Nick Wilson, Amanda C Jones, Nhung Nghiem, Tony Blakely

ABSTRACT

There is new evidence from a very large systematic review and meta-analysis (Navarese et al 2018), that using statins for reducing levels of low-density lipoprotein cholesterol reduces the risk of premature death. In this viewpoint article we consider the implications of this new evidence for New Zealand but also examine how the use of statins may be improved for primary prevention of cardiovascular disease (CVD) in this country. We suggest the need to explore such options as fixed-dose combination pills containing statins, three-drug polypills, behind-the-counter dispensing and six-month prescriptions. But in addition to pharmacological prevention of CVD, there is a need for improved population-wide changes to the environment. These include adopting policies to improve tobacco control, the nutrition environment (eg, particularly around sodium), alcohol control and making walking and cycling easier options.

Recent systematic review evidence on statins

A systematic review and meta-analysis has recently been published in the Journal of the American Medical Association (JAMA) by Navarese et al. The authors found that intensive therapy with lipid-lowering medicines such as statins reduced the overall risk of death from all causes and also from cardiovascular disease (CVD), relative to those on less intensive therapy. But surprisingly, this benefit of a lower death rate was only statistically detectable for people with levels of LDL-Cholesterol (LDL-C) above 100mg/dL (which is equivalent to 2.6mmol/L—the units used in New Zealand’s CVD management consensus statement). Conversely, heart attacks and strokes were statistically significantly lower for those receiving intensive treatment (compared to less intensive therapy) both at above or below the 100mg/dL level. For this reason we think there is probably no immediate need to adjust the current New Zealand consensus statement away from the emphasis on CVD risk to any focus on just treating LDL levels. Indeed, New Zealand is a world leader in using absolute CVD risk levels for guiding prevention and management (albeit with this approach not always dominating in clinical practice). Furthermore, the country now has newly developed New Zealand-specific risk equations which are used in the latest consensus statement. Even so there is a need for a pooled analysis of the individual participant data from studies considered by Navarese et al (rather than just the meta-analysis using aggregated data as they used). Specifically, the international health sector needs to see the interaction of baseline LDL and LDL reduction from this individual participant level data, so as to better understand possible management implications at relatively low levels of LDL.
The current New Zealand context
In New Zealand, ischaemic heart disease is the leading cause of death and cerebrovascular disease is the third ranked cause of death. Furthermore, CVD is currently the leading pharmacologically undertreated chronic condition. Recent data reaffirm CVD’s contribution to health inequalities, with Māori, Pacific and Indian populations at higher risk. In addition to the disease burden, inequalities are also present in disease treatment. Māori populations are less likely than non-Māori populations to be prescribed CVD medicines, a situation that has not improved substantially over the past decade. The ethnicity-based gap in CVD medication treatment adherence has fortunately decreased in recent years, but a gap still remains.

The need for improved CVD preventive management is further reflected in recent cohort study data. This study used a sub-sample of the PREDICT cohort involving 55–74-year-old patients without prior CVD (ie, a population of 127,000 New Zealanders with a mean age of 62 years, of whom 43% are men and 7% are on a statin). The average LDL-C level in this population was 3.2mmol/L (SD=0.8), suggesting that for most of these New Zealanders, lifestyle change with or without statins to lower LDL-C levels, are appropriate. Furthermore, by absolute levels of CVD risk, there are also large gaps in the provision of treatment among New Zealanders (Figure 1). For example, all those in the highest risk group of >15% risk in this figure should ideally be on statins unless they have experienced notable adverse effects from them. Similarly, a reasonable proportion of those in the next highest risk group (10–15%) should be on statins if they can’t reduce their risk via dietary change. New Zealand seems to be prescribe statins at a higher level than Australia for those in the highest risk category, but at lower levels than Australia for the lower risk categories (Figure 1). Other evidence based on a wider sub-sample of the PREDICT cohort (all 35–74-year-old patients) reports that even for people with a prior CVD hospitalisation and where this is known by their primary care clinician, there is suboptimal use of medications for lipid-lowering (ie, at 85% coverage, based on dispensing data).

**Figure 1:** Proportion of the population-dispensed statins by level of CVD risk in New Zealanders in a sub-sample of 55–74-year-old patients without prior CVD from the larger PREDICT cohort and a similar Australian population (with average ages of 62 and 64 years, respectively; data abstracted from Schilling et al.).
How might statin use in New Zealand be improved?

Here we outline some areas for creating a more supportive environment for sustained use of statins, which may be worthy of immediate consideration by New Zealand policy-makers.

Two CVD medicines in one pill

There seems little doubt that fixed-dose combinations (FDCs) of medicines are effective in improving adherence to multiple medicines as per this recent systematic review.10 FDCs are already on the New Zealand market for combinations of anti-hypertensives but there is no statin and anti-hypertensive option such as the combination of atorvastatin and amlodipine in Australia.11 Pharmac could therefore consider encouraging the pharmaceutical industry to register such products in New Zealand. This would potentially benefit the large proportion of New Zealanders who are prescribed a statin and who are already prescribed anti-hypertensives. It would also potentially save them prescription charges (at least under current funding arrangements).

Three CVD medicines in one pill—a polypill

Where multiple CVD medicines have been prescribed, improving adherence is also an argument for further evaluating a CVD polypill for this country. Polypill use may potentially reduce Māori versus non-Māori gaps in treatment adherence.12 Similar to the two-medicine FDCs described above, this product would potentially save prescription charges for patients, dependent on current funding arrangements. Those polypills that combine a statin, anti-hypertensive and aspirin, are now marketed in some other OECD countries (eg, Trinomia13). Recent reviews of such polypills are favourable14 and there is evidence from New Zealand and other countries that use of polypills does not lead to neglect of lifestyle risk factors (eg, dietary change).15 Overall we suspect that these advantages of such polypills for people with appropriate indications, are likely to outweigh the potential downsides of clinicians having to occasionally revert to monotherapies in order to determine if a specific polypill component is suspected of causing adverse effects etc.

Of note is a recent report16 that Pharmac's Cardiovascular Subcommittee has recommended that Trinomia be funded in New Zealand. This is a polypill that combines atorvastatin, ramipril (an anti-hypertensive) and aspirin. The use of such a polypill might be justified even further if CVD guidelines were broadened to consider the prevention on colorectal cancer via low-dose aspirin use (as argued previously for New Zealand).17

Behind-the-counter (BTC) statins at pharmacies

Regulations could be changed to allow pharmacists to provide controlled access to statins and anti-hypertensives for people with a past doctor's prescription in the last year or two using a BTC arrangement. This would be analogous to how New Zealand pharmacists can now dispense oral contraceptives, ie, a doctor's prescription is not needed for every dispensing. Statins are BTC at pharmacies in the UK with some evidence of this approach being beneficial.18

Six-month prescriptions for CVD pharmacotherapy

This approach is currently used for oral contraceptives in New Zealand, but could be reasonably explored for statins, anti-hypertensives, low-dose aspirin or FDC/polypill equivalents. Longer duration statin prescriptions have been associated with greater adherence and enhanced treatment effectiveness.19 This would probably reduce costs to patients in terms of doctor visit costs and prescription charges.20 Consideration could also be given to the Australian 'continued dispensing' model.21 This approach enables pharmacists to dispense a one-month supply of statins to a patient without a valid prescription, thereby ensuring a non-interrupted supply (eg, when the user runs out of supply when travelling away from home).

Improved health literacy and information for decision-making

More research into why New Zealanders who are recommended to take statins by their doctors and who are not taking them (their knowledge, attitudes and behaviours) could build on the findings of a systematic review.22 This is particularly so in terms of how such research might help reduce ethnic inequalities in the use of this preventive medication (eg, health literacy around statins among Māori,23 along
with clinician attitudes around offering preventive medication).

More specifically there is a likely need for patients to have answers to such questions as, “If I take this statin for the rest of my life, how many extra years of life might I expect from it?” Similarly, for policy-makers, “What is the likely cost-effectiveness and cost-savings to the health system with use of statins in different age/sex/ethnic-groups?” The Burden of Disease Epidemiology, Equity and Cost-Effectiveness Programme (BODE3) at the University of Otago Wellington are exploring such issues using multi-state life-table modelling. When completed, this work may allow for more informative guidelines and facilitate more meaningful patient-clinician discussions around what is the best personalised path to preventing CVD.

Tackling other key drivers of the CVD epidemic in New Zealand: smoking, processed food, alcohol and physical inactivity

Although the more targeted strategy of increasing the use of medicines such as statins is important in those at the appropriate levels of elevated CVD risk, another priority is to improve population health strategies. In particular, smoking is a major contributor to CVD in New Zealand and so it seems necessary to progress the Government's Smokefree 2025 goal more vigorously as per this proposed plan and various endgame strategies (eg, a sinking lid on supply, the ‘tobacco-free generation’ strategy, retail outlet restrictions and tobacco tax increases). Many New Zealand modelling studies show that tobacco control interventions are cost-saving to the health sector (including higher tobacco taxes, specific endgame interventions and more traditional quitting support interventions). There is also a need to make improvements to New Zealand's hazardous food environment since processed foods contribute to CVD by being high in salt (sodium) and saturated fat. To progress things further there is a need for additional action on 19 widely recommended good practice food environment policies to improve population nutrition. In particular, there is a need to consider taxes on unhealthy food and soft drinks. Indeed, Mexico has a ‘junk food’ tax which appears to be working and some European countries tax salty products. Favourable results have also come from a potential salt tax modelled for New Zealand, a modelled salt tax in the US, and a range of food taxes modelled for Australia (on saturated fat, salt, sugar and sugar-sweetened beverages).

The level of sodium in processed food could be reduced by regulation (especially now that there is clearer evidence that the relationship with the risk of death linearly increases from low to high sodium intakes). Indeed, there is now published New Zealand modelling work on dietary salt reduction, which suggests cost savings to the health system, with these and other sodium reduction interventions detailed in an online interactive league table.

The largest study to date indicates that alcohol consumption monotonically increases overall risk of health loss at all levels of intake. Even though this study found a J-shaped curve for ischaemic heart disease risk (eg, with a minimum risk for men at 0.83 standard drinks daily), this benefit was eliminated by other health risks (eg, cancer risk). Furthermore, a high level of alcohol intake is a net contributor to increased CVD risk (ie, via stroke, arrhythmias, heart failure, fatal hypertensive disease and fatal aortic aneurysm; all outweighing any reduced risk of myocardial infarction). This evidence, combined with that of another recent large study and New Zealand-specific evidence for harm from alcohol, could be used to justify further advances in alcohol control in this country. These interventions could include such evidence-based ones as higher alcohol excise taxes, and warning notices on health risks.

Finally, since physical inactivity contributes to CVD risk, New Zealand could benefit from improved infrastructure so that walking and cycling to work are more viable options. This could be done by building more cycleways, upgrading walkways and reducing urban sprawl. For example, in some American cities there has been good adoption of cycling infrastructure along with favourable evaluations eg, as per a study of investing in bicycle lanes in New York City. The latter study suggested a cost of only $1,300 per quality-adjusted life-year.
(QALY) gained, which is very good value-for-money. Similarly, in Portland Oregon, a study of bicycling infrastructure reported that: “The benefit-cost ratios for healthcare and fuel savings are between 3.8 and 1.2 to 1, and an order of magnitude larger when value of statistical lives is used”. Municipal investment in off-road trails has also been found to benefit bicycle commuting in the city of Minneapolis.

Conclusions

The new systematic review published in JAMA highlights again the value of statins for preventing death from all-causes and from CVD. Ideally more work will better clarify the size of the benefits for treating those with low LDL-C levels (<2.6 mmol/L). In the meantime, New Zealand probably needs to do more work to increase statin use among those at increased CVD risk. There seems to be a need to explore various options such as fixed-dose combination pills, poly pills, BTC dispensing and six-month prescriptions. But there is also a strong case for the New Zealand Government to do more population-level CVD prevention via adopting policies to advance tobacco control, improve the nutrition environment (eg, particularly around sodium and saturated fat), improve alcohol control and making walking and cycling easier options.

Competing interests:
Nil.

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A New Zealand case of nasal myiasis involving *Lucilia cuprina* (Diptera: Calliphoridae)

Dallas Bishop, Depak Patel, Allen Heath

ABSTRACT

A case of nasal myiasis that occurred in February 2017 in the Northland region was the first involving *L. cuprina* naturally-acquired in New Zealand.

The order Diptera (two-winged flies) contains many species that afflict humans and their endeavours, but arguably the larvae (maggots) of those that cause myiasis1 (invasion of living animals by larvae) excite the most disgust.

A review of instances of human myiasis in New Zealand2 divided them into imported and indigenously-acquired cases. Eyes, nasal passages and wounds were the predominant sites from which the larvae were isolated.

In two cases blowflies (Calliphoridae) were involved. The European green blowfly (*Lucilia sericata*) was found in a mastoid cavity (Waikato Hospital (2009)). In the second, the Australian sheep blowfly (*L. cuprina*) was found in an infested wound. This patient had arrived from Fiji.2

Case report

A 67-year-old New Zealand-born European male from the rural Kaiwaka area, (approximately 60km south of Whangarei) diagnosed with squamous cell carcinoma of his nose presented at the Whangarei Base Hospital Ear, Nose and Throat services in February 2017 with nasal irritation and foreign body sensation in his nasal wound and eye for one week.

The patient was described as fit and well and had lived at Kaiwaka since 2011 where living conditions were described as basic but clean.

The patient’s history indicated a keratinised lesion on the right nasal alar evident in photos taken 14 years previously. This gradually increased in size eroding local tissues. Clinical and histological diagnosis of squamous cell carcinoma was confirmed in approximately 2005. Gold standard therapy for squamous cell carcinoma is surgical excision which was declined by the patient and alternative therapies pursued. The lesion gradually encompassed and eroded his entire nose and after 10 years involved the majority of his face with exposed nasal cavity and multiple sinuses. Once the wound reached the stage where it was an open lesion the patient chose to leave it undressed. Information provided by family indicated that the patient had been forewarned of the possibility of flies depositing eggs or larvae in the open wound while sleeping. The patient preferred not to use a mosquito net which could have provided some protection.

On examination, a 12x10cm necrotic, erosive, fungating wound involved the entire nose, left cheek, medial eye and forehead. Multiple larvae were seen in the wound. The patient was apyrexial and had normal vision. There was no evidence of active cellulitis in surrounding tissue. Computed topographic scanning confirmed a breach of the bony orbit, medial and anterior aspects of the maxillary sinus and posterior aspect of the frontal sinus,
suggesting near dural involvement. Infectious disease services advised intravenous amoxicillin/clavulanic acid and manual extraction was recommended. Ketamine sedation was administered and approximately 60 larvae were removed. Paraffin ointment was applied to the wound bed to encourage a hypoxic growth medium for the larvae, thus encouraging removal from crevices. One serial debridement and extraction was performed 48 hours later and the patient discharged the following week after adequate nursing care was established at home along with palliative care involvement. The patient declined any consideration of curative surgery or radiotherapy.

Two larvae, removed from the wound and preserved, were identified independently by DB and AH, and agreed on consultation, as third instar larvae of *L. cuprina* using external morphological characters, specifically the form and arrangement of the spines on the spine band between the head and first thoracic segment. This readily differentiates *L. cuprina* from *L. sericata*. Specimens of the latter were available for comparison. *Lucilia cuprina* (Figure 1) is a recent addition to the New Zealand fauna, not known prior to 1985 but confirmed from flystruck goats in Northland in 1988. A subsequent survey showed the species had in fact been in New Zealand from around 1984. It now occurs throughout the country and is the predominant species identified in flystrike cases in sheep.

**Discussion**

This is the first New Zealand report of a naturally-occurring human myiasis infestation involving *L. cuprina*. Cases of human myiasis involving *L. cuprina* were reported from Brisbane, Australia (10/14 hospital cases) and it was also present in 1/42 cases in the US. An Oklahoman case of human nasal myiasis involving *L. cuprina* was acquired following admission to hospital but more commonly wounds have become infested prior to presentation for treatment.

Sterile blowfly larvae used as a maggot debridement therapy (MDT) are typically *L. sericata* a species that feeds readily on dead tissue whereas *L. cuprina* larvae generally (but not exclusively) prefer live tissue.

**Figure 1**: *Lucilia cuprina* adult.
Unintentional MDT use of a colony of *L. cuprina* in Egypt, resulted in two applications of these larvae to patients with diabetic foot ulcers. The wounds healed successfully. This colony was assumed to be *L. sericata*, but had been established from a contaminated source. This latter case supports the view that with careful management *L. cuprina* may have a role in MDT.

In the cases reviewed here the resident populations of larvae were removed and the wounds variously treated or further debrided. In the present case, it was noted that some opportunistic larvae were feeding on the necrotic tissue, but their removal was indicated given that they had access to open interior cavities which was not in the patient's best interests.

**Competing interests:** Nil.

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Lower-limb amputation in New Zealand: temporal changes and the role of diabetes mellitus

Jason K Gurney, James Stanley, Steve York, Diana Sarfati

Lower-limb amputation is traumatic and life-altering for individual patients, and resource-intensive for the health system serving them. While some lower-limb amputations occur in healthy populations following accidents or other acute trauma, most arise from chronic conditions, including peripheral vascular disease and diabetes mellitus.1,2 The rate of lower-limb amputation (and temporal changes in the rate) has not been well-documented in New Zealand, nor has the contribution of diabetes to this rate been quantified at a national level.

We examined inpatient hospitalisation data for the period 2005–2016, and found that a total of 13,562 lower-limb amputations were conducted over this time period (crude rate: 26.6/100,000 New Zealanders in 2013 Census). This rate is comparable to other international contexts, such as Canada (22.9/100,000).1 By linking these amputation data to New Zealand’s Virtual Diabetes Register (VDR),3 we were able to determine that 58% (n=7,802) of these amputations were performed on patients with diabetes. Very few amputations were flagged as occurring due to lower-limb cancer (n=42) or trauma (n=156), leaving approximately 40% of all lower-limb amputations occurring among patients without documented diabetes, cancer or trauma. Vascular disease is likely to be a major contributor to this group of amputations, and also to the burden of amputation among the diabetic population. In a recent investigation, we found that the presence of peripheral vascular disease among patients with diabetes increased the risk of minor (below-ankle) amputation by more than seven times (adjusted hazard ratio [HR] 7.22, 95% CI 6.09–8.56) and the risk of major (through-or above-ankle) amputation by more than 12 times (HR 12.72, 95% CI 10.65–15.24) compared with those without peripheral vascular disease.4

When examining temporal changes in the rate of major and minor amputation across the total population, we found that the rate of major amputation appeared to reduce between 2005 and 2016—from 12/100,000 in 2005 to 8/100,000 in 2016 (Figure 1). Using Poisson regression, we determined that the rate of major amputation has dropped by 3.0% per year over this period (95% CI 2.2%–3.3%), but has remained relatively stable for minor amputation (0.7% increase/year, 95% CI 0.1%–1.4%). In combination, these observations may (or may not) suggest a gradual improvement in the prevention of major amputation via increased timely access to vascular and high-quality diabetic foot care services; however, this is speculative and further investigation is required to substantiate this theory.

While the rate of major amputation may appear to be reducing over time for the total population, this observation masks some substantial disparities between population sub-groups. In a recent analysis based on population-level patients with diabetes (using the VDR) we found that male patients with diabetes are nearly 40% more likely to undergo a major amputation than female patients (adjusted HR: 1.39, 95% CI 1.20–1.61), and nearly 80% more likely to undergo a minor amputation (1.77, 95% CI 1.56–2.00).4 This gender disparity is in keeping with other international contexts.5–9 The literature remains unclear regarding the
definitive driver(s) of this gender disparity, but plausible reasons include a reduced likelihood among males to seek timely diabetic foot care compared with females, and a higher risk of smoking and vascular disease among men.

Perhaps most troubling is the substantial disparity between Māori patients with diabetes and European/Other (non-Māori/Pacific/Asian) patients, where Māori are 65% more likely to undergo a major amputation (adjusted HR: 1.65, 95% CI 1.37–1.97). Similar findings were observed by Robinson et al in 2016. However, somewhat paradoxically, the risk of minor amputation is no greater among Māori patients than European/Other patients (1.06, 95% CI 0.90–1.25). Both Pacific and Asian patients with diabetes appear to have the lowest relative risk of amputation: for example, Pacific patients are 27% less likely than European/Other patients to undergo major amputation (0.73, 95% CI 0.55–0.95), while Asian patients are 57% less likely (0.43, 95% CI 0.29–0.65). The drivers of these disparities—particularly the contrast between Māori and Pacific populations, both of which make up a disproportionate share of the New Zealand population with diabetes—require further deliberation and suitably sophisticated data analysis to account for how this trend is changing.

While it is pleasing to observe a marginal decline in the rate of major amputation over time, greater collective effort across the health sector is needed to further reduce this rate. In the vast majority of cases, lower-limb amputation is an entirely preventable event—a last-resort intervention that is the result of a chronic, systemic decline in peripheral function. The chronic nature of this decline provides ample opportunity for the prevention of limb loss: for instance, given that 80% of all diabetic amputations are preceded by a foot ulcer, primary care and outpatient foot care services must continue to be resourced to provide primordial prevention against the development of foot ulcers—as well as the efficacious treatment of current ulcers and the prevention of re-ulceration. Evidence suggests that an integrated approach across primary and secondary services that targets high-risk patients will yield the greatest outcome in this respect.

In summary, more than half (58%) of lower-limb amputations occurring in New Zealand between 2005–2016 occurred among patients with diabetes. While rates of major amputation appear to be marginally reducing over time, rates of minor amputation are holding steady around 15/100,000 New Zealanders. To further reduce these rates amidst increasing rates of diabetes, and to address troubling disparities within our population, the prevention (and treatment) of diabetic foot ulcers deserves continued and increasing resource allocation.
Competing interests: Nil.

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Endovascular clot retrieval (ECR) is now considered the standard of care for selected patients with acute ischaemic stroke due to a large vessel occlusion (LVO). There is a strong correlation between outcome and time to treatment with ECR. Patients need ECR initiated within six hours of symptom onset; however, recent evidence suggests that this time window, in highly selected patients and utilising advanced imaging, can be extended to 24 hours.

1.66 million New Zealanders live in regional centres (outside Auckland, Wellington and Christchurch) where access to ECR involves emergency inter-hospital transport to a metropolitan centre. However, there are diagnostic, resource, logistical and time constraints that make accessing ECR a challenge.

The Taranaki District Health Board (TDHB) formed a working group in late 2017 to revamp the hyper-acute stroke pathway with an emphasis on giving our residents access to the ECR service offered by Auckland City Hospital (ACH).

The distance from Taranaki to Auckland is 318.5km with a helicopter flight time of 72 minutes. The Taranaki Rescue Helicopter is based at Taranaki Base Hospital and St John, flight-credentialed intensive care paramedics (ICPs) are responsible for patient care during transport.

TDHB utilises a ‘Code Stroke’ model which ensures timely access to resources to assess, treat and transfer acute stroke patients.

Key elements of the implementation process/pathway:
1. Pre-hospital notification by St John (ambulance)
2. Code Stroke Team with adequate human resource and expertise
3. Standard imaging including both non-contrast CT and CT angiography with automated and rapid transfer of images to the ECR centre
4. Activation of the helicopter transfer team once LVO confirmed, prior to acceptance by the ECR neurologist
5. Documentation with appropriate communication channels
6. ICP training
7. Regular ‘Code Stroke’ training scenarios

The new pathway was rolled out on 22 July 2018. The following describes a patient representative of those who have utilised the pathway. Table 1 shows the key time points.

A fully independent 87-year-old New Plymouth resident started to feel unwell at 0800 and took herself to bed. One hour later she realised that she was unable to move the left side of her body, coincidently her daughter rang and recognised her speech was slurred so called for an ambulance. Paramedics had to break in to enter while avoiding the patient’s dog, identified that the patient had likely had a stroke and pre-alerted the hospital.

On arrival to hospital she was assessed by the emergency department (ED) personnel and Stroke Team. Her National Institutes Health Stroke Scale (NIHSS) score was 11 with dense left hemiplegia and sensory loss. She was transferred to the CT scanner on the ambulance stretcher.

Her non-contrast CT head excluded intracranial haemorrhage and her CT angiography showed a thrombosis in the right M1 segment of the right middle cerebral artery. Following consent she was treated on the CT table with a fibrinolytic bolus.
Simultaneously, the helicopter transfer team was activated and a phone call was made to the neurologist at ACH. She was returned to ED, a fibrinolytic infusion was commenced and the ICP arrived to prepare her for transport. It took three hours and seven minutes from arrival at TDHB to having her clot successfully extracted, including a 64-minute helicopter flight and 24-minute ACH door-to-groin-puncture time. Her last seen well-to-clot extraction time was five hours and five minutes.

Twenty-four hours after ECR, her NIHSS score was six with mild limb and facial weakness and a small basal ganglia infarct on her CT. She was repatriated to TDHB on day two, and discharged home on day eight with subtle weakness on her left side, a NIHSS score of zero and a Modified Rankin Scale (mRS) score of two.

The working group agreed that patients would be prepared for flight, transported to and loaded into the helicopter prior to ECR centre acceptance. We believe this can save up to 45 minutes. Thrombolysis and ECR pathways occur in parallel, with the remaining fibrinolytic infusion administered in flight, which minimises delay to ECR.

In this issue of NZMJ, Burnell et al report on patients treated with ECR by ACH.\textsuperscript{6} Not surprisingly, symptom onset to groin puncture time for patients presenting at regional hospitals averaged 141 minutes longer than those presenting to metropolitan hospitals. It is unknown how outcomes differ between these two groups. To date, TDHB have transferred six patients to ACH for ECR, all six patients have returned home, four are functionally independent with a mRS score less than three, the other two have a mRS score of three. The above case highlights that rapid transfers are feasible with good clinical outcomes but significant cultural, technological and structural changes are required. We hope that our pathway sets the standard for acute stroke care in regional New Zealand.

<table>
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<th>Time from last well (mins)</th>
<th>Length of last step (mins)</th>
<th>Milestone</th>
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<td></td>
<td>Patient last felt well</td>
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<tr>
<td>~0900</td>
<td>60</td>
<td>60</td>
<td>Patient noticed left-sided weakness</td>
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<tr>
<td>0914</td>
<td>74</td>
<td>14</td>
<td>111 call received</td>
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<tr>
<td>0920</td>
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<td>6</td>
<td>Ambulance arrived on site</td>
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<td>0952</td>
<td>112</td>
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<td>Ambulance departed to ED</td>
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<td>118</td>
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<td>130</td>
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<td>CT Head started</td>
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<td>Activation of helicopter transfer team</td>
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<td>150</td>
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<td>Alteplase bolus given and call made to ACH neurologist</td>
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<td>159</td>
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<td>Helicopter team arrived in ED and acceptance for transfer to ACH</td>
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How common is off-label prescription of quetiapine?

Andrew McKean, Erik Monasterio, Tom Elliott

Given increasing reports about the frequency in off-label prescribing of quetiapine, particularly for populations at risk of disproportionate side-effects (young and elderly), the authors examined community pharmacy dispensing records for Canterbury District Health Board (Population 543,820) in the month of January 2018. These data were analysed on Tableaux™.

Four thousand three hundred and thirty-two (4,332) patients were dispensed a prescription of quetiapine; 1,478 received risperidone; 1,311 olanzapine; 508 haloperidol; 411 clozapine; 342 aripiprazole; 161 paliperidone; 120 chlorpromazine and 26 ziprasidone. The proportion of patients’ dispensed quetiapine (4,332) was essentially the same as all the other antipsychotics studied (4,357).

The data are particularly compelling when compared to a recent survey the authors completed looking at 200 consecutive patients with a diagnosis of schizophrenia discharged from inpatient psychiatric care in Canterbury between April 2017 and March 2018. In this survey only 1% of patients (2/200) were discharged on quetiapine monotherapy and a further 2.5% (5/200) patients were on a combination of regular antipsychotics that included quetiapine.

Quetiapine is only licensed for schizophrenia and bipolar affective disorder in New Zealand. Quetiapine does not have a license for children and adolescents under the age of 18 nor does it have a license for dementia-related psychoses in the elderly.

Given the very common prescription of quetiapine and limited potential for licensed indications, we infer that most of the prescriptions are for off-label use. Commonly cited examples in the literature for this include augmentation in the treatment of depression, night sedation and as an anxiolytic. Quetiapine is associated with metabolic syndrome, constipation, QTc interval prolongation, has misuse and abuse potential and also overdose potential.

Given these risks, patients should be fully informed of the expected risks and benefits of treatment, and the limited evidence base for off-label prescribing. Informed consent should be sought.

Of note, night sedation medications are frequently dispensed in community pharmacy. In January 2018, 7,274 patients were dispensed a prescription for zopiclone, 1,235 received triazolam, 1,112 received temazepam and 102 received nitrazepam. Insomnia is a common problem and quetiapine is sometime viewed as a “safer” alternative than zopiclone or benzodiazepines as a hypnotic. There is insufficient evidence for this and should wherever possible be avoided. Working to counter patients’ increased expectations of a prescription, highlighting the benefits of sleep hygiene, the risks of substance impaired driving and only prescribing short “one off” courses of hypnotics maybe some of the ways to reduce the numbers of patients requesting hypnotics or quetiapine for insomnia.

One of the limitations of this letter is that we used a dispensing database to obtain the numbers of patients that were dispensed antipsychotics by community pharmacies in Canterbury. The data only related to numbers of patients that were dispensed medications. Doses and indications were not available. Specific information on doses and indications would be valuable in clarifying the extent and types of off-label prescribing of quetiapine.

In summary, this survey adds evidence that everyday prescription of quetiapine does not appear to be in keeping with its use as an antipsychotic, and widespread off-label prescribing is common and not without short- and long-term risks.
Competing interests:
Andrew McKean has received speaker fees from Novartis.

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George John Alexander Wilson

7 June 1925 – 27 May 2017

Otolaryngology Head & Neck Surgeon

George Wilson was a pioneer of ENT surgery to the people of Northland, providing a marvellous regional service for over 30 years. He was the sole ENT surgeon in the region for 26 years and during that time made a major contribution to improved hearing.

George was born in Auckland to David Wilson (a plumber) and Edna Flannery (a registered nurse). He had two younger siblings—David (Buster) and Mary. George attended Whau Valley Primary School and subsequently Whangarei Boys High School. He commenced medical intermediate at Otago University in 1943 entering Medical School the following year.

George worked as a House Surgeon at Auckland Hospital 1949–1950. His personal hearing loss was noted at that time and he was seen by ENT surgeon Bill Bridgman, who recommended George should study ENT rather than other areas of medicine. As an ENT Registrar at Greenlane Hospital 1951 (he was the first trainee at Greenlane), George met Trish Mannion (a nurse), and they married December 1952. Just a few weeks later they sailed to the UK where George received further training at Edinburgh, Guilford and then during five years as Registrar at the Royal National Throat Nose and Ear Hospital at Grays Inn Road. George started to use hearing aids while working in England and as they had an obvious component worn on the body this sometimes proved a helpful talking point, particularly during his final fellowship oral exams. He gained his FRCS(Ed) in 1956.

George and Trish sailed back to New Zealand at the end of 1956, George working his passage as a ship's surgeon on a refrigeration ship which berthed at Port Chalmers. Northland Hospital Board was seeking an ENT surgeon to start a service for Northlanders and George commenced work at Whangarei Hospital in January 1957. As there had been no resident ENT surgeon previously, the work initially involved dealing with gross pathology. There was an
epidemic of juvenile tracheo-bronchitis in the winter of 1957. Airway restoration at that time was by tracheostomy, as endotracheal intubation was not in vogue. Tonsillectomy was performed with guillotine under ether. Some years later the Doughty ET tube was used with inhalation anaesthetics.

About 1958–59 Whangarei Hospital procured a Zeiss microscope, which revolutionised ear surgery. Chronic suppurative otitis media (CSOM) with its high incidence in Māori became a large part of George’s practice. During the mid 1960s George went to Boston to study stapedectomy, returning to operate on many cases, as there was a large residual population with otosclerosis. He also returned with the first grommet produced by Sheehy.

George travelled regularly to the small peripheral hospitals at Kaitaia, Rawene and Dargaville. In the early years he spent two to three weeks away each time as the journey was long and slow on metal roads. The concept of the Ear Caravan for managing CSOM was conceived by Sir Patrick Eisdell-Moore, but there were issues in Auckland so the first one came to Northland in about 1975. The van visited each school for a week providing daily aural toilet and drops, which usually resulted in a dry ear which either healed spontaneously or was made suitable for surgical repair. The caravan was so successful that the incidence of CSOM was significantly reduced, but as a result the incidence of otitis media with effusion (glue ear) increased and this provided continuing work for the caravan. George obtained his FRACS in 1979. With the increasing workload a second ENT surgeon was appointed to Northland in 1983 (Jeremy Gathercole).

Audiologists did not come to Northland till the 1970s and prior to that George held weekly clinics at the NZ League for the Hard of Hearing. George continued to be involved with the Northland branch of the Hearing Association until after he retired. He was President for many years and was later made Patron. In the 1970s and early 1980s George worked with aid programmes to the Pacific Islands spending time in the Solomon Islands, Niue and the Cook islands. On these visits he was accompanied by Trish, who provided audiometry and other support.

Alongside his professional commitments George was an energetic Rotarian. He and Trish ran a farm with Charolais cattle for many years. As retirement neared they moved to Headland Farm Park. George became heavily involved in conservation projects, specifically weed eradication from native bush, and pest control, and he received several civic awards for this work. Following George’s retirement from clinical practice in 1990 he and Trish enjoyed some great camper-vans trips in the US and Australia, travelling for over two years in total.

George is survived by his wife Trish and 3 children, Craig (landscaper and garden centre owner), Andrew (lawyer) and Oriole (audiologist) and five grandchildren.

This obituary is based upon one prepared for The New Zealand Society for Otolaryngology by Jerry Gathercole FRACS, with the further assistance of Trish, Oriole and other members of the Wilson family.

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URL:
Oral steroids for resolution of otitis media with effusion in children

Children with persistent hearing loss due to otitis media with effusion are commonly managed by surgical intervention. A safe, cheap and effective medical treatment would enhance treatment options. Antibiotics, topical intranasal steroids, decongestants, antihistamines and mucolytics are ineffective treatments for this condition.

In this randomised placebo-controlled trial, the benefits of a short course of oral steroids are evaluated. Children aged 2–8 years suffering from persistent otitis media with effusion and hearing loss were recruited from 20 outpatient departments in the UK. Two hundred were randomised to receive oral steroid (prednisolone) and 189 received placebo.

The conclusions reached were that a short course of oral prednisolone is not an effective treatment for most children aged 2–8 years with persistent otitis media with effusion, but is well-tolerated. One in 14 children might achieve improved hearing but not quality of life.

*Lancet* 2018; 392:557–68

Subacromial decompression versus diagnostic arthroscopy for shoulder impingement

The pathognomic clinical sign of shoulder impingement syndrome, subacromial shoulder pain while lifting the arm, is commonly attributed to “impingement” of the rotator cuff tendons between the humeral head and the overlying acromion.

The surgical treatment used to alleviate this is to smoothen the undersurface of the acromion. Doubts have been raised about the efficacy of this procedure. To elucidate, orthopaedic surgeons in Finland have conducted a trial comparing subacromial decompression versus diagnostic arthroscopy, a placebo surgical intervention.

The results demonstrated that arthroscopic subacromial decompression provided no benefit over diagnostic arthroscopy at 24 months.

*BMJ* 2018; 362:k2860

Smoking cessation, weight change, type 2 diabetes and mortality

Smoking cessation reduces the risk of major chronic diseases and extends life expectancy, but considerable weight gain may occur in quitters after cessation. In this report the researchers discuss the results of their cohort studies in which they compare the subsequent health of smoking quitters with non-quitters.

The risk of type 2 diabetes was higher among recent quitters (2–6 years since smoking cessation) than among current smokers (hazard ratio, 1.22). The increase in the risk of type 2 diabetes was directly proportional to weight gain and the risk was not increased among quitters without weight gain. In contrast, quitters did not have an increase in cardiovascular or all-cause mortality, regardless of weight change after quitting.

The researchers concluded that smoking cessation that was accompanied by substantial weight gain was associated with an increased short-term risk of type 2 diabetes but did not mitigate the benefits of quitting smoking on reducing cardiovascular and all-cause mortality.


URL:
An Apparatus for Administering Warm Ether

By E. H. Williams, M.R.C.S.

I am enclosing photograph of a warm-ether apparatus designed by me some six months ago and used with very satisfactory results in thirty or more major operations. The apparatus consists of two compartments, A and B. A contains a hot-water chamber separated from the outer casing by felt. Into this chamber filled with boiling water dips a copper coil of which the two ends are at D; one of these communicates with the mask C, while the other end is continuous with a tube leading from the anaesthetic chamber in B, on the right of the figure. This chamber, also insulated by felt from its outer casing, is divided into two compartments, either of which can be connected with the incoming stream of air by a two-way cock, E. One of these divisions is for ether and the other for any mixture of ether and chloroform that may be thought desirable. My reason for making provision for a chloroform mixture was that in strong male subjects there is some difficulty in obtaining complete muscular relaxation in the first
few minutes of the operation, after which pure ether is quite satisfactory.

The air is forced by a foot-pump into the base of A by a tube which takes a few turns round the hot-water chamber, between it and the outer casing, passing then to take a few further turns in the insulated space round the anaesthetic chambers, finally appearing at the upper right-hand corner of the apparatus at G. A piece of rubber tubing connects G with the two-way cock E.

The anaesthetic chambers have windows let into their roofs, through which the level of the contained anaesthetic can be seen. My object in making the incoming air take this course was that a warm air should produce quicker evaporation of the anaesthetic.

This apparatus provides a pleasantly-warmed vapour; and, as the mask is covered with several layers of gauze, it combines the advantages of open ether, and lastly, no mean consideration in these times, it is very economical in anaesthetic required.

This apparatus was made for me by a Dunedin firm of brass-founders, and the workmanship and finish are quite equal to that of similar articles made in England.
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WMA Assembly in Reykjavik

Tackling suicide
Bank of Mum and Dad: what are you on about?

From the frontline: A Certain Kind of Doctor
NZMA on Gender in Medicine: A Wellington Report
Review: Crazy Rich Asians

NZMJDigest
http://www.nzma.org.nz/publications/nzmjdigest

The NZMA publishes the e-magazine NZMJDigest 10 times a year. It contains news and views from the profession and the NZMA, including the NZMA Chair's editorial, along with highlights from and links to the New Zealand Medical Journal.

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