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By GORDON MACDONALD, M.D.

The impact of a surgical assessment unit on numbers of general surgery outliers

Alexandra Jacobson, Garth Poole, Andrew G Hill, Magdalena Biggar

In July 2015 a surgical assessment unit was established at Middlemore Hospital. This is a 10 bed area adjacent to the emergency department, the aims of which include assessing and managing surgical patients who are likely to have short hospital stays with increased efficiency. Our study investigated the impact of the assessment unit's introduction on the numbers of general surgery patients admitted to non-general surgery wards, something which is necessary if there are no available beds on general surgery wards. We found that the establishment of the assessment unit was associated with a decreased number of such patients. Previous research suggests that this is likely to be associated with improved quality of care for patients and improved hospital efficiency.

The value of CT cardiac angiography and CT calcium score testing in a modern cardiology service in New Zealand: a report of a single centre eight-year experience from 5,237 outpatient procedures

Chris Ellis, Greg Gamble, Colin Edwards, Niels van Pelt, Ruvin Gabriel, Boris Lowe, Jonathan Christiansen, Andrew To, Helen Winch, Mark Osborne, John Ormiston, Malcolm Legget

CT cardiac angiography has become established in the modern management of cardiology patients. It has particular value as a tool to 'rule out' severe coronary stenoses, and as a tool to give a more accurate assessment of CVS risk. It adds significant value to the care of many patients within an established cardiology practice.

High rate of incidental glaucoma detection in New Zealand

Benjamin R LaHood, Joshua Erceg, Tui H Bevin, Gordon Sanderson

Glaucoma is a disease of the eye which can lead to permanent loss of vision starting with the peripheral vision, and if untreated, also affecting the central vision. It is the leading cause of preventable blindness in developed countries and usually has no symptoms until it is quite advanced. This study surveyed New Zealanders with glaucoma to assess how and why they were diagnosed with glaucoma. It confirmed that the majority of glaucoma was discovered through incidental findings when health professionals were not necessarily looking for glaucoma and the patient had no suspicion of the disease. The most common reason that people were suspicious was a family history of glaucoma. This means that there are a lot of New Zealanders who do not realise they have glaucoma, and if we are to prevent permanent loss of vision for these people, we need to raise awareness of this disease that has no symptoms and consider a screening program.

Efficacy and safety of TC-325 (Hemospray™) for non-variceal upper gastrointestinal bleeding at Middlemore Hospital: the early New Zealand experience

Hannah Giles, Dinesh Lal, Stephen Gerred, Paul Casey, Alasdair Patrick, Derek Luo, Ravinder Ogra

Hemospray is a new addition to the armamentarium against gastrointestinal bleeding. It is very easy to use and can be used safely and effectively in a wide variety of conditions that cause bleeding from the upper gastrointestinal tract. The technique is very easy to learn and the equipment easy to use.

Newborn vitamin K prophylaxis: an analysis of information resources for parents and professionals

Hayleigh Miller, Benjamin Wheeler, Nikki Kerruish

Many different information resources are available regarding vitamin K prophylaxis in New Zealand. Standardisation of such information would be more equitable and would facilitate easier review of content, and translation into multiple languages.

The scratch test for identifying the lower liver edge is at least as accurate as percussion and is significantly more effective for young trainees—a randomised comparative trial

Alexander Huelsen, Jesse Fischer, Justin Hegarty, Anna Ashcroft, Christopher MA Frampton, Murray L Barclay

Clinical examination of the liver is traditionally performed with a combination of percussion and palpation. This study compares the scratch test, a newer and less well-known technique, with the percussion method in a randomised comparative trial. The results demonstrate that both clinical test are overall similarly accurate and perform considerably better than previously reported. The scratch test however appears easier to learn and was significantly more accurate in the young trainee group.

The electronic tracking of referral and attendance at cardiac rehabilitation in Counties Manukau Health: a potential model for New Zealand

Andrew McLachlan, Fiona Doolan Noble, Mildred Lee, Katherine McLean, Andrew Kerr
Cardiac rehabilitation is an important part of the continuum of quality care following a heart attack. Currently, there is no way to track referral or attendance in New Zealand. In Counties Manukau Health we have developed and implemented an electronic tracking process to identify referral and attendance, which is linked to the national ANZAC QI system. This means we will be able to research cardiac rehabilitation benefits and outcomes across the country.

Rheumatologists fail to advise people with RA to get immunised, which matters if you are under 65: An audit in a New Zealand rheumatology service

Brendan Ng, Lynn McBain, Rebecca Grainger

Advice about vaccination against influenza and pneumococcal disease given to people with rheumatoid arthritis (RA) attending a regional rheumatology service was audited and showed advice was given very infrequently. Despite this, many people got influenza vaccination at times, especially if they were over 65 years. The vaccination rates for influenza were low for people with RA under 65 years of age and pneumococcal vaccination was very infrequent.

The effectiveness of hyperbaric oxygen therapy (HBOT) in radiation-induced haemorrhagic cystitis

Vincent Chong, Michael Rice

Haemorrhagic cystitis is one possible complication from radiotherapy. It is a difficult clinical problem to treat. Hyperbaric oxygen improves tissue oxygenation and healing of scarred tissue. This study showed a short term efficacy of 67% with hyperbaric oxygen on the improvement of haematuria.

‘Out of the frying pan, but not into the fire’: quantifying commercial cosmetic tanning services in New Zealand to inform endgame regulation

Bronwen M McNoe, Anthony I Reeder

This research was conducted in response to the Ministry of Health’s consultation document on reducing harm from commercial sunbeds. One of the main negative impacts of banning the provision of sunbed services was thought to be potential business closure resulting in loss of jobs. We conducted a nationwide audit of businesses potentially providing sunbed services to test whether this is likely to be the case. We found that a ban would have no more than minimal impact on only a very small number of businesses and so we believe, like in Australia, all commercial sunbeds should be banned.

Reducing harm from falls

Shelley Jones, Sandy Blake, Richard Hamblin, Carmela Petagna, Carl Shuker, Alan Merry

Patient falls in hospital, especially those leading to a fractured hip, have been far too common here and internationally. Such falls are a terrible event leading to terrific pain and discomfort, increased length of stay in hospital and, for many older people, permanent loss of mobility, admission to residential care and even death. The Health Quality & Safety Commission’s Reducing Harm from Falls programme has shown that national action and a robust targeted measurement framework has reduced such falls in hospital. The programme is “the first in the world to describe credible reductions on a national scale in...fractured hips from falls in hospitals”, in the words of UK patient safety expert Frances Healey.

Acute care general surgery— has Cinderella found her prince?

Garth Poole, Joshua Balhorn, Nicola Atkinson

Until 1990, general surgery was seen by some as the ‘Cinderella’ surgical specialty. Sub-speciality groups had moved rapidly ahead with techniques and often had less onerous acute commitments.

The arrival of the laparoscopic camera was the fairy godmother¹ and finally granted Cinderella transport to the ball. Unfortunately she still had two ugly, historical problems. One was the problem of diagnostic uncertainty in the abdomen, especially in the acute setting, and the other was the lack of systems to process the increasing load of acute patients.

Diagnostic uncertainty

Clinical assessment alone of the abdomen is demanding and often inaccurate. There has been a steady increase in availability and accuracy of diagnostic tests in the last 25 years. Laparoscopy, ultrasound, CT, MRI, ERCP, gastrograffin, CRP, nomographic scoring systems and interventional endoscopy have all contributed to improved diagnosis and treatment. For example, right iliac fossa pain is now treated with accuracy rates approaching 95%.² These tests reduce the rate of unnecessary interventions.

Increased diagnostic certainty has probably made general surgery more understandable to students and trainees and, possibly, more attractive as a career choice.

The diagnostic and laparoscopic revolutions were accompanied by advances in surgical techniques and increased the use of prosthetics, especially in hernia surgery. Pain management and ERAS have helped reduce the morbidity of open surgery.³

Acute care systems

The volume of acute admissions, unso- ciable hours and diagnostic pressure, however, remained a major burden on all public hospital general surgeons. The devel- opment this century of acute care surgery (ACS) units in New Zealand has increased teamwork and introduced a legitimate sub-speciality interest.⁴⁻⁶

These units have arisen rapidly in response to foresight and workload. They have allowed focused acute care, excellent training, and given confidence to the hospitals. The surgery is concentrated onto dedicated lists, and handover from admitting to acute team is essential. This handover is good for quality assurance and patients understand that operations are frequently performed by a different team to those that admitted them.

In a systematic review encompassing 27 studies and 744,238 patients, Darzi et al showed unequivocally that dedicated ACS models deliver improved patient care, often at a reduced cost.⁷

The New Zealand units are heterogeneous in size and design, but all serve the same function of concentrating acute surgery and focussing senior staff to supervise and provide quality care. Canterbury led the way 18 years ago with a dedicated surgeon on call. The smaller DHBs are still evolving individualised systems.

In Auckland these services are spread across three tertiary teaching institu- tions, each with significant volumes of ACS patients. Each unit has a different model but all are responding to the DHB popu- lation-based system. These units perform

a number of modular tasks that can be formally assigned to team members. These include collecting patients, staffing the operating theatre and performing ward rounds.

In 12 months to June 2016, CMDHB had 9,131 acute admissions (mean 25.0 patients per day), ADHB had 6,896 (18.9) and WDHB had 7,155 (19.6).⁸ These are significantly bigger volumes than those described in published work from Australia.⁹ These numbers are not stagnant but are steadily climbing, with CMDHB increasing in volume by approximately one extra patient per day, per year.¹⁰ Each Auckland hospital has a consultant-led system with daytime acute theatre access, and index admission acute cholecystectomy is the standard of care.¹¹

There is a paradox in that while each patient provides an individual diagnostic challenge and each day has significant variation in work, the overall annual workload increases predictably.

In a time of substantial fiscal constraints on healthcare and significant shortages in hospital beds, this only puts further tension onto a delicate system. The ACS model aims to alleviate these stresses. However, it is crucial that hospital administrators understand that rushing the “tempo” of the acute

admission or putting patients in multiple areas, or in the wrong area, is self-defeating.

One of the new tools available is a dedicated surgical assessment unit (SAU). A specific area of the emergency department is set aside for the management of surgical patients in order to take pressure off wards and increase access to investigations. These units have shown significant advantages in streamlining surgical care and bed management. In this issue of NZMJ, Jacobson et al showed that introduction of a 10 bed SAU could significantly reduce the volume of surgical outliers in non-surgical wards, despite a loss of 20 inpatient surgical beds.¹² This was achieved by discharges directly from the unit, streamlined access to theatre¹³ and by appropriate placement of patients due to the correct tempo of assessment.

So Cinderella now has her fairy godmother (the laparoscope) and improved diagnostic tests (her slippers). She has her handsome prince (ACS) for the ball, and she has a guaranteed guest list (acute admissions).

She now needs to make sure she has enough ballrooms in the right places (theatre, SAU, wards).

Competing interests:

Nil.

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CT coronary angiography in 2016

Christopher J Occleshaw

CT imaging of the heart is a relatively new diagnostic tool, used primarily for imaging of the coronary arteries. In this edition of the NZMJ, Ellis et al describe their use of this technique in a private practice setting over a period of eight years.¹

The first paper on cardiac CT was published by Sagel et al in 1977,² only four years after the development of the first 'EMP' scanner.³ The authors of this work notably included Godfrey Hounsfield, the electrical engineer who conceived of and developed the CT scanner, with funding from the royalties of the Beatles' music, thereby earning himself a Nobel prize, a knighthood and the enduring gratitude of radiologists everywhere (his name is given to the unit of radiographic density). They used the patient's ECG to synchronise the x-ray beam being turned on and off with the cardiac cycle, and claimed to have achieved an improvement in image quality. However, image acquisition still took a very considerable time, during which respiration continued, and the results were not adequate for diagnosis. There was an idea ahead of its time, but with 20 years of further advances in electrical and mechanical engineering, and in particular the development of multislice scanners and more sensitive radiation detectors, acquisition speeds have improved by several orders of magnitude. Achenbach described the first successful CT coronary angiography in 1998, using the same fundamental principle.⁴

The assessment of stenotic disease of the coronary arteries has primarily been performed by invasive catheter angiography (ICA), a technique which is remarkably safe, but has a small incidence of serious complications such as stroke, and which is inherently expensive. Subjective visual estimation of the degree of stenosis by the operator can be supplemented by measuring pressure gradients across lesions while using adenosine as a stressor agent.

CT coronary angiography (CTCA) allows for a visual assessment only, and CT images have fundamental differences to those from invasive angiograms. Firstly, there is reduced spatial resolution, and smaller coronary vessels are therefore beneath the resolving power of CTCA. Secondly, areas of high radiographic density, such as the calcium in atheromatous plaques, appear larger in volume on a CT image than they really are, due to an artifact inherent in the image reconstruction, a phenomenon known as 'blooming'. Thus the degree of stenosis on a CT image can be an over-estimate compared to that found at ICA. Finally, ICA is performed after the administration of intracoronary nitrate as a vasodilator, whereas CTCA necessitates less effective sublingual nitrate.

These differences in the images obtained have led to the main use of CTCA being to exclude coronary artery disease in those thought to have a relatively low risk of such, in an elective setting. There is a large body of literature demonstrating that CTCA is extremely reliable in excluding significant coronary disease. Ellis et al¹ describe exactly this usage, with the population under study reflecting the private practice setting. As the authors state, they do not have ICA correlation of their results in the patients without significant disease at CTCA. Advances in CT technology are so rapid that the 64-slice scanner used for their work, while state-of-the-art technology in 2006, would now be described as obsolete for cardiac imaging. In this context, their achievement of successful imaging of the entire coronary arterial tree in 95% of their patients is impressive, and a tribute to their attention to detail in scanning technique, and likely an appropriately conservative approach to patient selection. Continuing improvements in CT acquisition speeds have meant that patients previously regarded as unsuitable for CTCA on the grounds of irregular cardiac rhythms and

relative tachycardia can often be imaged successfully now. Improvements in spatial resolution are reducing the effect of the blooming artifact from calcified plaques.

As CTCA has evolved since Achenbach, where will it fit in the diagnosis of coronary artery disease in the future? The SCOT-HEART trial⁵ offered CTCA in addition to standard cardiological assessment and investigation to a large number of patients with suspected angina in a high-risk population, and resulted in change of management in 27% of the subjects. Overall ICA usage increased because of patients previously considered not to need such who were found to have significant coronary disease at CTCA, and who outnumbered those patients whose ICA was cancelled after normal coronary arteries were found at CTCA. Thus ICA was used more appropriately. Stress studies were reduced in number, and diagnostic certainty and use of appropriate preventative therapies were increased in the CTCA group compared to the controls.

In New Zealand cardiological practice, CTCA is not used in this way as yet, and the number of invasive angiograms performed in patients with normal or near-normal coronary artery disease is now too high. Every week this author sits in the cardio-surgical case conference in our largest hospital and sees a number of patients referred for surgical treatment of cardiac valve disease. Those aged over 40 will have had their coronary arteries imaged, nearly all by ICA, and most have no significant coronary artery disease. If those patients alone had been referred for CTCA instead, the financial savings in the Auckland region public hospitals would be approx. \$0.4 million a year. Cardiology is now the only medical specialty in which elective angiographic imaging is still performed predominantly by invasive means.

However, if more patients are to gain access to CTCA in future, then other changes are required. In New Zealand hospitals, all CT scanners are 'owned' by radiology departments, who have been reluctant to allow cardiology patients access to their facilities, though they are happy to use such to justify the purchase of very advanced and costly scanner technology. This is slowly improving, but there is still little if any access to CTCA outside 'office hours'. Cardiac imaging is demanding on medical radiation technologists, and too few of the many CT-trained MRTs can perform cardiac imaging. Finally, medical educational authorities need to come to the party as well: there are relatively few medical practitioners skilled in CTCA interpretation. Training standards for Australasian cardiologists still require the performance of many catheter angiograms, but do not require the trainee to ever look at a cardiac CT or MRI scan, never mind actually perform or interpret one.

Technology will continue to evolve, and a fundamental redesign of the CT scanner to make it more suited for cardiac imaging in particular has recently been proposed.⁶ Prototype scanners capable of image acquisition in as little as 25–50ms are in design, and the advent of spectral imaging (the radiographic equivalent of splitting white light into its component colours) is likely to reduce contrast loads and radiation doses, which have already fallen significantly, even further. It may soon be possible to measure fractional flow reserve on CT images, thus allowing for assessment of the functional significance of an intermediate coronary lesion without the need for an invasive test.⁷ CT has revolutionised many medical specialties over the last four decades; cardiology may yet become one of them.

Competing interests:

Nil.

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Falls prevention as everyday heroism

Frances Healey

Anyone with an interest in falls prevention knows that, first and foremost, it's about multidisciplinary working. That ethos shines through the description in this issue of the New Zealand Medical Journal¹ of the Health Quality & Safety Commission's (the Commission's) successful three-year initiative working with patients, their families and healthcare staff to reduce the harm from falls.

But of course improving the quality of healthcare is also a multidisciplinary endeavour—not just in the sense of various disciplines of healthcare staff, but the insights we can gain from those who might describe themselves as improvement scientists, healthcare policy researchers, ergonomists, psychologists or ethnographers.

The Health Quality & Safety Commission's initiative is the first in the world to describe credible reductions on a national scale in the most serious type of harm—the fractured hips from falls in hospitals that lead to long-term loss of independence for most patients who experience them, and are followed by death within weeks or months for too many.²

Healthcare organisations in other countries will have a keen interest in replicating their success, and considering if lessons can be drawn from their description of *how* they went about this.

But if we also want to succeed, we need to explore *why* they met with success.

Firstly, in embarking on their improvement journey, the Commission had a theory of change. 'Theory' is not a word that strikes joy in the hearts of most clinicians aiming to improve healthcare quality, and I've had my own struggles to embrace this aspect of planning quality improvement.³ Davidoff and colleagues⁴ make a wonderfully articulate case as to why a theory of change matters, but I fear those they were trying hardest to convince

will never have read their article—because it had theory in the title.

So to summarise their case at its most basic level: they urge us to articulate why we think an intervention will work, before we attempt to introduce it. These can be 'small theories' specific to an area such as a falls prevention initiative or formal, academically framed theories with wider applicability. Without either a 'small theory' or a formal theory, our solutions are likely to be a poor match for the barrier or challenge we are trying to overcome.

As I explored in my *BMJ* editorial,⁵ following the publication of the admirably conducted but ultimately unsuccessful 6-PACK falls prevention randomised trial,⁶ we are in a happy place where our 'small theories' specific to falls prevention are chiming with wider formal theories of how to make healthcare safer.⁷

In its efforts to emulate industries with admirable safety records, healthcare had come close to believing careful compliance with a rigidly defined procedure was right in all circumstances. Past falls prevention efforts that were focused on risk scores and a set menu of interventions were part of that ethos. Vincent and Amalberti⁸ have helped us understand that although this ultra-reliable model is indeed what we need for many healthcare processes, it will be counterproductive if we try to apply the model to all healthcare processes. The Commission's theory of change was that it needed to support a shift to an adaptive model of falls prevention, where patients, families, whānau and healthcare staff work together to understand what helps each individual older person reduce their falls risk.

Mary Dixon-Woods and her colleagues⁹ outline the 10 key challenges that any healthcare improvement initiative needs to overcome to succeed at scale. Reflection on New Zealand's improvement journey shows

how many of these were tackled within their three-year programme. Those challenges tackled include the clinical leadership needed for change, as shown by the inexhaustible Sandy Blake, Director of Nursing, Patient Safety and Quality, at Whanganui District Health Board, and the national leadership demonstrated by the Commission's selection of falls prevention—an infamously “wicked” healthcare problem—as a major and long-term strand of the national safety programme.¹⁰ This priority setting is not reflected in all developed countries, despite the sheer scale of falls injuries in the community and in hospitals, and the life-changing consequences of those falls.

Also notable is their ability to *measure* their success on a national scale, not solely through reliance on reported incidents (which will inevitably be affected by changes in the culture of reporting¹¹) but through analysis of routine hospital data. The range and quality of resources provided to support improvement—from a national falls atlas of healthcare variation to falls risk assessment tools and care plans—were also clearly a key factor. The Commission's approach also encompassed promotion and awareness-raising via falls focuses, international visitors and social engagement during the New Zealand national patient safety campaign *Open for better care*, and yet remained rigorously scientific, as one can see in the cutting edge primers on the evidence base (the ‘10 Topics in reducing harm from falls’).¹² Their ethos of ‘aggregation of marginal gains’¹³ helped avoid overwhelming organisational capacity while the multidisciplinary emphasis avoided

tribalism. The Commission's programme also took an evolutionary approach to the focus of improvement efforts, with an initial priority area of hospitals and care homes later encompassing integration of falls prevention efforts along the patient's pathway, and then onwards to community falls prevention, which is likely to help secure sustainability.

Vincent and Amalberti's strategies for safer healthcare in the real world include one more level of response to exceptional circumstances: the ultra-adaptive model, where skilled, respected and charismatic individuals exercise a high degree of personal initiative to lead their teams through challenging and life-threatening emergencies. Chesley ‘Sully’ Sullenberger's successful landing of US Airways Flight 1549 on the Hudson River is an example from aviation of this heroic approach. For healthcare, the immediate aftermath of the Christchurch earthquake is a powerful example of where this heroic approach was needed and where the healthcare community mobilised rapidly and independently to enable far more lives to be saved than would otherwise have been the case. We've seen this again after the Kaikoura earthquake.

Falls prevention is a different, everyday sort of heroism, rather less likely to reach the front pages of the newspapers; the patients saved from harm and the teams who helped them forever nameless. The publication of the Commission's ‘Reducing harm from falls’ results is a reminder that such quiet heroism is equally to be celebrated.

Competing interests:

Nil.

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The impact of a surgical assessment unit on numbers of general surgery outliers

Alexandra Jacobson, Garth Poole, Andrew G Hill, Magdalena Biggar

ABSTRACT

AIMS: Patient care and efficiency outcomes are improved if acute patients admitted to non-specialty (outlier) wards are minimised.¹ Assessment units may help to reduce numbers of outlier patients.² A surgical assessment unit (SAU) was recently established at Middlemore Hospital. We aimed to determine the impact of its introduction on numbers of general surgery outliers on post-acute ward rounds.

METHODS: A 10-bed SAU was introduced in July 2015, coinciding with the closure of 20 beds on the general surgical wards. The numbers and locations of patients on post-acute ward rounds before and after the establishment of the SAU were compared. A student two-tailed t-test was used for statistical comparisons, with $p < 0.05$ considered significant.

RESULTS: A total of 1,462 patient locations were analysed from 71 post-acute ward rounds. There were similar overall numbers of post-acute patients before and after the introduction of the SAU (mean 21 vs 20, $p = 0.33$). There were fewer post-acute patients in outlier wards after the introduction of the SAU (mean 1.7 before vs 0.8 after, $p = 0.04$).

CONCLUSION: Despite a net reduction in general surgery beds and no change in the overall number of post-acute patients, the establishment of a SAU was associated with a reduction in outliers.

Best practice guidelines for ward rounds recommend that patients be nursed on appropriate specialty wards.³ However, with rising numbers of acute admissions and high levels of hospital occupancy, it is often necessary to admit patients to alternative, non-specialty wards as “outlying patients” (outliers).

Outliers are widely considered to be undesirable. They are associated with observed increases in emergency calls, complications,¹ in-hospital mortality^{1,4} and poorer efficiency outcomes (as evidenced by longer hospital stay).⁵ Outliers may disrupt team-based models of care and make communication between medical, nursing and allied staff more challenging.³ Particularly if geographically distant, outliers may also place a greater time-burden on the surgical ward round than patients in home wards.⁶

The use of an assessment or short-stay unit is an increasingly common initiative to streamline the management of acute admissions. The vast majority of published research evaluates medical assessment units. These units have been associated with a reduction in length of stay,^{2,7-12}

reduced emergency department waiting times,¹¹ no increase in readmissions,^{2,7-10} no increase in mortality^{2,7-10} and reduced numbers of outliers.^{2,7}

On 1 July 2015 a 10 bed surgical assessment unit (SAU) was established at Middlemore Hospital. This is a tertiary teaching institution in Auckland, New Zealand, with an average of 9,143 patients admitted as general surgical acute patients annually. The opening of the SAU coincided with the reassignment of part of a general surgery ward (20 beds) to medicine to aid with winter medical demand, resulting in a net loss of 10 general surgery beds. This represented a 17% reduction (the usual number of general surgical ward beds, before the partial closure was 120). Prior to its establishment, general surgery patients awaiting an inpatient bed either stayed in the emergency department's short stay unit overnight or were placed on outlying wards.

The main aims of the SAU were to manage patients with hospital stays less than 28 hours, to increase the number of surgical patients discharged from the front of the hospital and to facilitate timely discharge

before 11am. Based on previous published experience there was a possibility that outlier numbers would decrease.^{2,7} However, there was also concern that the net bed reduction coincident with the introduction of the SAU at Middlemore Hospital could increase the number of outliers for the busy post-acute general surgery team and in turn impact negatively on patient outcomes.

The aim of the study was to determine the impact of the introduction of a surgical assessment unit (SAU) on numbers of general surgery outliers on the post-acute surgical ward round at Middlemore Hospital.

Methods

Approval for the study with the Counties Manukau research office was sought and granted (registration no. 2270); no formal ethics review was required. Post-acute team inpatient lists were prospectively collected over a six-week period immediately prior to the introduction of the SAU (April–May 2015) and in a similar period beginning one month after the introduction of SAU (August–October 2015). These lists represent the total number of patients under the care of general surgery (both in assessment phase and with admission status), resulting from a referral to general surgery in the preceding 24 hours and who were subsequently visited by the admitting/acute team on a post-acute ward round. These lists included patient locations and were generated immediately prior to the daily morning handover meeting and commencement of the post-acute ward round. The number and location of post-acute patients was recorded. Pre-existing team patients (ie those that had not entered the hospital within the preceding 24 hours, including elective patients) were excluded.

A two tailed t-test was used to compare the mean numbers of post-acute team patients in each location, before and after the introduction of the SAU.

Definitions of terms

'Home wards' were defined as in-patient general surgery wards, of which there were four prior to the establishment of the SAU and three and a half after its establishment.

'Non-surgical areas' included all areas other than the 'home wards'—ie outlier wards, as well as the intensive care and high dependency units, the emergency department, the

emergency department's short stay unit and, after its introduction, the SAU.

'Corrected non-surgical areas' included all areas other than the 'home wards', the emergency department's short stay unit before the introduction of the SAU and, after its introduction, the SAU. This term essentially considered the SAU to be a surgical ward and therefore excluded patients in this location as outliers. Because the ED's short stay unit had previously been used in a somewhat similar way—in that, if capacity allowed, general surgery patients were often kept there overnight while awaiting a ward bed—it was felt to be appropriate to also exclude patients in the short stay unit prior to the establishment of the SAU as outliers for part of the analysis.

'Outlier wards' represented in-patient wards other than the 'home wards' and did not include the intensive care or high dependency units or any areas within the emergency department. These locations were of greatest interest as they represented the true surgical outlier patients.

Results

Thirty-five post-acute lists were analysed over a six-week period between April–May 2015, immediately before the introduction of the SAU and 36 lists were analysed from a similar period in August–October 2015, after the introduction of the SAU. Some lists (seven prior to introduction of SAU and six after) were inaccessible to the researchers and so were excluded. Overall, the locations of 1,462 patients (743-before, 719-after the introduction of the SAU) during 71 post-acute ward rounds were evaluated.

There was no significant difference in the number of post-acute patients seen on the post-acute ward round before and after the introduction of the SAU (mean of 21 vs 20, $p=0.33$).

After the introduction of the SAU, there were a higher number of post-acute patients in 'non-surgical areas', ie in all areas outside the 'home wards', (mean of 5.1 before vs 6.6 after, $p=0.05$). However, when 'corrected outlier areas' were considered, there were fewer post-acute patients in these outlier areas after the introduction of the SAU (mean 2.7 before vs. 1.6 after, $p=0.04$).

Importantly, overall, there were fewer post-acute general surgery outliers (ie general surgery patients in 'outlier wards') after the introduction of the SAU (mean of 1.7 patients [range 0–9] before vs 0.8 after [range 0–6], $p=0.04$). Prior to the introduction of the SAU, six (17%) of the post-acute ward rounds contained >3 outlier patients; after the introduction of the SAU only one (3%) ward round contained >3 outliers.

Discussion

This study demonstrates that the introduction of a surgical assessment unit was associated with a decrease in the number of post-acute general surgical patients admitted to non-surgical wards, despite a net decrease in general surgical bed numbers. This implies that the establishment of the SAU has been associated with improved patient flow with potential benefits to patient care.

Outliers are widely considered to be undesirable and published reports suggest that outliers may have poorer quality of care and efficiency outcomes. An Australian observational cohort study of 58,158 all-specialty admissions demonstrated that outlier status was associated with a 53% increase in emergency calls. Outlier patients had more complications and higher in-hospital mortality.¹ In medical patients a retrospective study of heart failure patients found that those initially admitted as outliers had a longer stay in hospital with a mean difference of 2.6 days⁵ while another analysis of nearly 20,000 general medical patients found that being an outlier was associated with an increased risk of in-hospital mortality by over 40%.⁴

Outliers may also disrupt team-based models of care and make communication between medical, nursing and allied staff more challenging. A single-centre study at Auckland Hospital found that outlying patients placed a greater time-burden on the surgical ward round than patients in home wards; the mean time per patient at the bedside was similar, but the mean total time per patient (including transit, gathering notes, bedside consult and discussion) almost doubled (2 min 57 for patients on home wards vs 5 min 40 for outliers).⁶ While transit time will depend on geographical distances between home and outlier wards, certainly in Middlemore Hospital such

distances can be considerable, as the main admission blocks span a distance of approximately 300m over three multi-story and only partially interconnected buildings.

The use of an assessment or short-stay unit is an increasingly common initiative to streamline the management of acute admissions. Advantages include improved access to timely assessment and diagnostics although these factors were outside the focus of the current study. Published experience has demonstrated that the introduction of such units is also associated with a decrease in outliers. A UK study found the mean number of medical patient outliers was lower after the introduction of a 21-bed medical short stay unit despite there being no net change in medical bed numbers and no change in percentage bed occupancy.² Following the introduction of a 12-bed acute surgical admission ward in the Netherlands, outlying patients decreased from 9.5 to 0 percent, however, it is unclear whether there was an associated change in bed numbers.⁷

As expected, there was no difference in the total number of post-acute patients in the two study periods. A higher number of post-acute patients in 'outlier areas' after the introduction of the SAU was observed and was consistent with the fact that this term included the SAU, where some new admissions were now being directed, and that part of one general surgery ward had closed, reducing the number of inpatient ward beds.

However, this study indicates that despite a net reduction in general surgical beds, the establishment of the SAU was associated with a reduction in post-acute general surgery patients being admitted to outlier wards. The inclusion of an analysis of "corrected outlier areas" ensured that the observed effect was not accounted for by a mere change in name of part of the ED (as might be hypothesised when considering the ED short stay unit vs the SAU). There was no change in admission policy thresholds during the study period and no change in access to diagnostic services.

These findings suggest that the SAU has had a positive impact on bed management for acute patients, in that a higher proportion of patients are admitted to surgery-specific areas. The reasons for this positive association are currently unclear

but may be due to improved patient flow—for example, greater numbers of patients seen and discharged directly from the assessment area, and greater numbers of patients directed to the theatre admission area rather than ward admission for minor surgical procedures which results in same day discharge, therefore decreasing burden on inpatient surgical ward beds. Any reduction in length of inpatient stay would likely contribute to reduced numbers of outliers, but was not measured. These factors could be the subject of future study.

Although the locations of pre-existing team patients were excluded from the study, it is unlikely that the observed decrease in post-acute outliers is a consequence of a re-location of pre-existing team patients or elective patients to outlier wards, as this is prevented by hospital policy. Elective patients are allocated to pre-arranged general surgery ward beds and are given priority over acute patients in this regard. Acute patients requiring more than 28 hours in hospital are admitted to a general surgery ward if capacity allows; if not, they are admitted to an outlying ward until a general surgery ward bed becomes available. Once a patient, either elective or acute, is admitted to a general surgery ward, it is hospital practice for the patient to remain on that same ward until discharge; thus while it is possible for an inpatient to move from an outlier ward to a “home” ward, the opposite does not occur.

There are some limitations of this study. The data was non-consecutive because access to some of the post-acute lists was lost (these lists are a real-time reflection of patients in surgical care and so could not be reproduced). Given that the number of missing lists was almost identical in the two study populations, this is felt unlikely to have influenced the observed outcome. The study

did not include patients who may have been seen and discharged from hospital prior to the morning handover meeting, or who may have been well enough to be discharged and asked to return the following day to the theatre admissions area for surgery. These factors do not affect the validity of the findings, however may play a part in accounting for them. The study also did not evaluate numbers of elective admissions during the two periods, which may have impacted on the availability of surgical beds.

Finally, the data reflects the location of patients at a single point in time. This is relevant to the locations of patients at the time of the post-acute ward round, however may overestimate the numbers of all outliers over time, as patients could be moved to a general surgery home ward in the days subsequent to the post-acute ward round. Given that the current data is a true representation of the post-acute teams' movements and that other published studies have also generally not addressed patient movement, the results and conclusions are felt to be valid.

Conclusion

In summary this study investigated the impact of the establishment of a surgical assessment unit at a large teaching hospital on outlier patient numbers. The number of general surgery patients admitted remained similar after the establishment of the unit but the number of outlier patients visited on a post-acute ward round decreased. Previous reports suggest that this is likely to be associated with improved quality of care and efficiency gains.

Further research could be considered to evaluate the reasons for this effect and also to evaluate resultant quality of care and efficiency outcomes in a surgical population.

Competing interests:

Nil.

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The value of CT cardiac angiography and CT calcium score testing in a modern cardiology service in New Zealand: a report of a single centre eight-year experience from 5,237 outpatient procedures

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ABSTRACT

BACKGROUND: Computed tomographic (CT) cardiac angiography is of increasing value in several areas of patient management in cardiology. We assessed the ability of CT cardiac angiography to effectively 'rule out' severe coronary stenoses in patients presenting with 'atypical' symptoms and/or an equivocal stress test, which offers a new approach to the management of coronary artery disease. We also examined the use of the CT calcium score test in cardiovascular (CVS) risk assessment.

METHODS: From a large single centre (Mercy Hospital) in Auckland, using a prospectively acquired, comprehensive database, we audited the entire eight-year experience of 5,169 patients (7/8/06 to 31/1/14) who underwent 5,237 64-slice computed tomographic (CT) cardiac angiogram or CT calcium score tests (GE Lightspeed scanner).

RESULTS: From 5,169 patients there were 5,237 CT procedures. The mean patient age was 57 (SD 10) years; 42% patients were female. Of the 3,603 (69%) full CT cardiac angiogram scans, 3,509 (67%) included a calcium score test. One thousand four hundred and eighty-three (28%) of scans were a calcium score test only. Of the 3,603 (69%) full CT cardiac angiogram scans, it was possible to 'rule out' significant coronary atheroma (stenosis $\geq 50\%$) in 2,947 (82%) of these procedures. Of the 4,903 (94%) patients who had a CT calcium score test, in whom we could calculate the NZ Framingham-based CVS risk, it was possible to reassign 532 (22%) of these patients who were previously thought to be at 'low risk' to be at a higher CVS risk.

CONCLUSION: CT cardiac angiography has become established in the modern management of cardiology patients. It has particular value as a tool to 'rule out' severe coronary stenoses, and as a tool to give a more accurate assessment of CVS risk. It adds significant value to the care of many patients within an established cardiology practice.

Computed tomographic (CT) cardiac angiography has emerged as a reliable, non-invasive method to image the heart.¹ From the early 'four-slice' systems through to the '64-slice' machines, the technique has gathered a scientific and clinical momentum for use in several areas of cardiological management.² The currently available dual source, high definition and broad detector scanners (256- and 320-'slice'), are increasingly being used in clinical practice and will further advance the role of the technique.³

The principle benefit of CT cardiac angiography is to accurately image coronary arteries, using a venous injection of an iodine-based contrast agent. This is especially useful in patients at low or intermediate risk of ischaemia, who have atypical chest pain symptoms or equivocal results from functional assessments such as an exercise treadmill test or stress echocardiogram, and in whom it is suspected that the coronary arteries will be normal or 'near-normal'. The 'negative predictive value' of a standard 64-slice CT cardiac angiogram is between 97 to 99%,⁴⁻⁵ and has become the management of choice for many of these patients who may have recurrent hospital admissions, or have a significant morbidity from their symptoms, and in whom a conventional (invasive) angiogram is felt to be too invasive.

Another extremely valuable role for CT cardiac angiography is for the assessment of cardiovascular (CVS) risk using the CT coronary calcium score test. This is performed using a non-contrast, ECG-gated scan of the heart,⁶ with a very low radiation dose of approximately 1mSv, roughly equivalent to a bilateral mammogram.^{7,8} CT coronary calcium scoring allows the detection and quantification of subclinical calcified coronary atherosclerosis, and has repeatedly been shown to be more accurate than conventional epidemiological-based risk factor assessment, including the entire Framingham-based equation.⁹⁻¹¹ Further, the impact of this knowledge improves patient compliance with lifestyle modification and preventative medication.¹²

There are also an increasing number of other applications for CT cardiac angiography.¹³ These include the assessment of cardiac structures, especially the left atrium, before electrophysiology studies and in

particular atrial fibrillation ablation. In addition, the assessment of the aortic valve and aortic root is widely performed prior to transcatheter aortic valve replacement (TAVR) procedures. Further, the accurate measurement of the aorta with aneurysmal dilatation, and the assessment of structures around the heart including the pericardium, cysts and masses are increasingly the role of CT cardiac angiography.

We aimed to assess our use of this technique over the life-span of our initial 64-slice CT machine to allow an understanding of its role and to refine our use of CT cardiac angiography in a busy practice.

Methods

Data collection

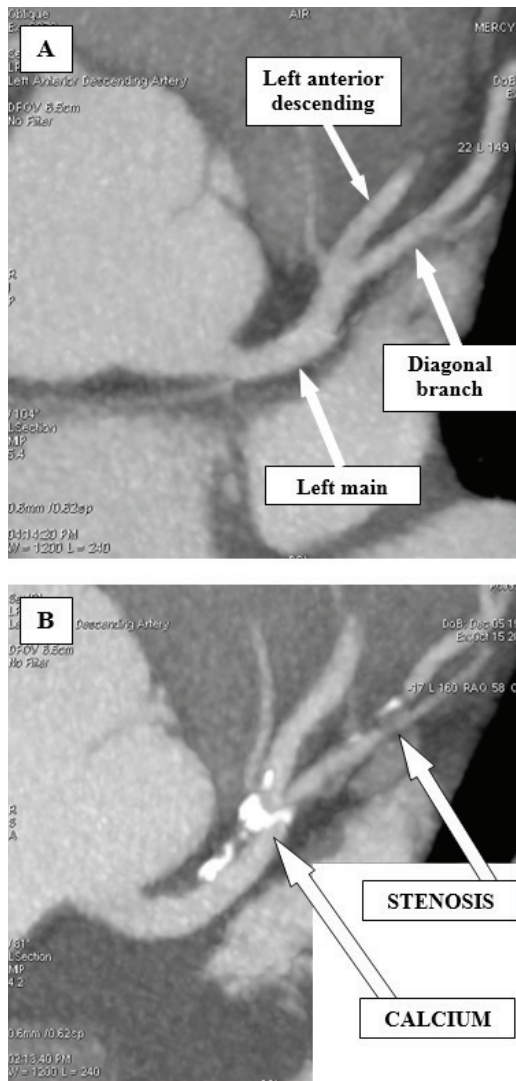
Data were prospectively collected from all patients presenting for a CT cardiac angiogram and/or a CT calcium score test. Consistent with National Guidelines for a new clinical service¹⁴ care was taken to record relevant, but limited data, which was prospectively obtained by a practice nurse using a standardised data collection sheet from 7 August 2006 until 31 January 2014. The data collection form recorded patient demographics, relevant personal and family history, medication use and the results from the CT cardiac angiogram and the calcium score. Data were securely held at the practice.

Referrals for a full CT cardiac angiogram were from cardiologists and specialist physicians in Auckland and other North Island centres, for patients principally with equivocal exercise test changes and/or equivocal symptoms. Referrals for the screening CT calcium score test only, were from cardiologists, specialist physicians and also general practitioners, using an 'open access referral' for this non-contrast, low radiation dose risk-assessment tool.

All CT cardiac angiograms, including the calcium score, were performed by one of six radiographers using a standardised protocol for the 64-slice CT machine (GE Lightspeed). CT cardiac angiography gives clear images of coronary arteries without (Figure 1a) and with (Figure 1b) a severe stenosis.

The calcium score was derived according to the method of Agatston,⁶ with these details incorporated into the CT machine.

Figure 1: Typical CT angiogram images (a) without stenosis or atheroma (b) with calcified atheroma and stenosis.



Quantification of the extent of calcium deposition is achieved with the reporting clinician following each artery or major branch of the coronary circulation and identifying calcium deposits within the coronary arteries. It is important that a clinician with an in-depth knowledge of the heart reports a calcium score test, to avoid non-coronary calcium, such as pericardial or mitral valve annulus calcification, being inadvertently added to the 'coronary score'. Agatston scores of zero indicate no calcification is present, whereas a calcium score of >100 units indicates 'significant' calcification; a calcium score of >400 units has been used as the threshold for 'severe' calcification.¹¹

Patients gave informed consent to undergo the clinical investigation as a part of their clinical management. As an audit of current practice, individual patient consent was not required for this study, collection of relevant data being actively encouraged for a clinical service.¹⁴

Statistics

Continuous data are summarised as median and interquartile range or mean and standard deviation as appropriate. Differences in frequencies were tested using chi-squared procedures or Fisher's exact test as appropriate and differences between groups in continuous variables using the Wilcoxon independent groups test. SAS (SAS Institute Inc, v9.4, Cary NC, USA) was used to perform the analyses. All tests were two-tailed and a 5% significance level was used.

Results

We examined all 5,237 CT cardiac angiography procedures performed at Mercy Hospital, Auckland. The patient's mean age was 57 (SD 9.5) years, 42% were female, 80% were of European ethnicity (Table 1).

From 5,169 patients there were 5,237 CT procedures. The majority of scans, 3,509 (67%) were both a CT calcium score test for CVS risk assessment *and* a CT cardiac angiogram to image the coronary arteries, with 1,483 (28%) scans being a calcium score alone, and 94 (1.8%) a CT cardiac angiogram alone. A few procedures, 151 (2.9%) were for patients imaged for other reasons (Table 2).

Full CT cardiac angiogram

Of 3,603 full CT cardiac angiograms, 3,410 (95%) had clear images, with 193 (5%) having unclear images of some or all of the six main arteries or major branches of the coronary circulation (left main stem, left anterior descending, diagonal branches, left circumflex, intermediate/obtuse marginal branches, right coronary artery) (Table 3).

Of the 3,410 full CT cardiac angiograms with clear images in all six arteries or major branches, we calculated that 463 (14%) of scans had at least one artery coronary disease (as conventionally understood: ie one artery disease is LAD and/or diagonal, or circumflex and/or intermediate branches

Table 1: Baseline patient demographic data: all patient scans (n=5,237), full CT cardiac angiogram (n=3,603) and calcium score (n=4,992).

	Full CT angiogram (n=3,603)	Ca score (n=4,992)	All patient scans (n=5,237)
Mean age [years] (SD)	57 (9.4)	57 (9.3)	57 (9.5)
Sex (female)	1,592 (44%)	2,102 (42%)	2,194 (42%)
Ethnicity			
Caucasian	2,824 (80%)	4,046 (81%)	4,212 (80%)
Māori	91 (2.6%)	116 (2.3%)	129 (2.5%)
Pacifica	85 (2.4%)	93 (1.9%)	105 (2.0%)
Indian	223 (6.4%)	257 (5.2%)	270 (5.2%)
Asian	161 (4.6%)	183 (3.7%)	194 (3.7%)
Others	129 (3.7%)	154 (3.1%)	162 (3.1%)
Not reported	90 (2.5%)	143 (2.9%)	165 (3.2%)
Smoking			
Current	159 (4.4%)	194 (3.9%)	209 (4.0%)
Previous	1,237 (34%)	1,639 (33%)	1,718 (33%)
Never	2,191 (61%)	3,117 (62%)	3,258 (62%)
Not reported	16 (0.4%)	42 (0.8%)	52 (1.0%)
Hyperlipidaemia [†]	1,654 (46%)	2,091 (42%)	2,229 (43%)
Hypertension [†]	1,368 (38%)	1,640 (33%)	1,757 (34%)
Diabetes mellitus [†]	258 (7.1%)	277 (5.6%)	306 (5.9%)
FH of 1st degree relative with CVS Disease	1,568 (44%)	2,200 (44%)	2,269 (43%)

[†]Data missing from five patients.

Table 2: Initial and follow-up studies performed on 5,169 patients undergoing 5,237 CT scans.

	First scan	Second scan	Third scan	TOTAL scans
1. Full CTCA* AND Ca** score	3,482 (67%)	26 (41%)	1 (25%)	3,509 (67%)
2. Full CTCA NO Ca score	90 (1.7%)	3 (4.7%)	1 (25%)	94 (1.8%)
3. Calcium score only	1,461 (28%)	22 (34%)	0	1,483+ (28%)
4. Electrophysiological workup	79 (1.5%)	12 (19%)	2 (50%)	93 (1.8%)
5. Thoracic aorta imaging + TAVR***	52 (1.0%)	1 (1.6%)	0	53 (1.0%)
6. Other	5 (0.10%)	0	0	5 (0.10%)
Total	5,169 (99%)	64 (1.2%)	4 (0.08%)	5,237 (100%)

*CTCA: Computed tomographic cardiac angiogram.

**Ca: Calcium.

***TAVR: Transcatheter aortic valve replacement.

+ In three patients, calcium score not calculated.

Table 3: Clarity of images for full CT cardiac angiograms by the six arteries and major branches (n=3,603).

Images clear for ALL six arteries/branches	3,410 (94.6%)
Images unclear for SOME of the six arteries/branches	169 (4.7%)
Images unclear for ALL six arteries/branches	24 (0.7%)
Total	3,603 (100%)

Table 4: Significant stenoses and overall atheroma in the coronary arteries of full CT cardiac angiograms with clear images (n=3,410).

All arteries normal (no non-calcified atheroma and calcium score=0)	1,099 (32%)
Mild atheroma (<50% stenosis or calcium score ≥1) in at least one artery	1,848 (54%)
No significant stenosis (<50%)	2,947 (86%)
Left main	23 (0.7%)
1 artery disease**	303 (8.9%)
2 artery disease	98 (2.9%)
3 artery disease	39 (1.1%)
Significant stenosis (≥50%) in left main or at least one artery	463 (14%)

** 1 artery: LAD/Diagonals or Circumflex/Intermediate/Obtuse Marginals or RCA

or RCA) of ≥50% diameter stenosis (Table 4, Figure 2). Mild atheroma was seen in 1,848 (54%) of procedures and normal coronary arteries in 1,099 (32%) of procedures.

CT calcium score test

There were 4,992 scans with a CT calcium score, however, in three of these patients the calcium scan was performed as part of a ‘calcium score only’ investigation, but the score not calculated, as very marked calcification was present, and the clinical decision was made to not calculate the very high

calcium score. In one third of scans: 1,812 (36%) patients had a calcium score of nil Agatston units, 1,407 (28%) of patients had a score of >100 units and 533 (11%) of patients a score of >400 units (Figure 3).

In 4,903 patients we compared the calcium score result with the current calculated Framingham CVS five-year risk score and risk levels (incorporating the advised New Zealand Guidelines group (NZGG) adjustments).^{15,16} At least one data component of the Framingham risk score was missing

Figure 2: Overall atheroma in coronary arteries of patients having a full CT cardiac angiogram with clear images (n=3,410).

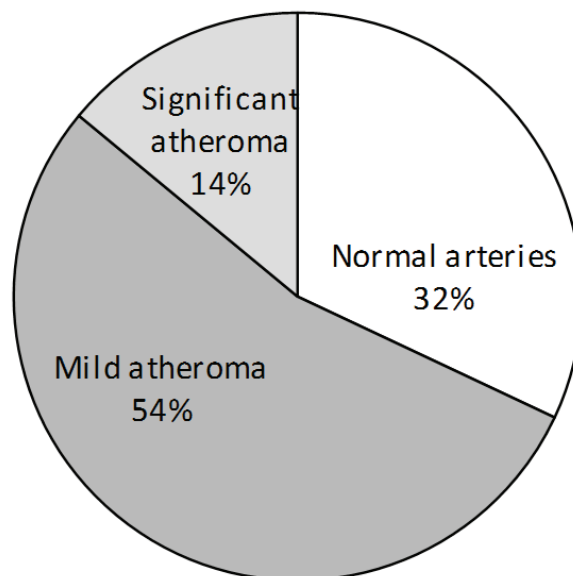
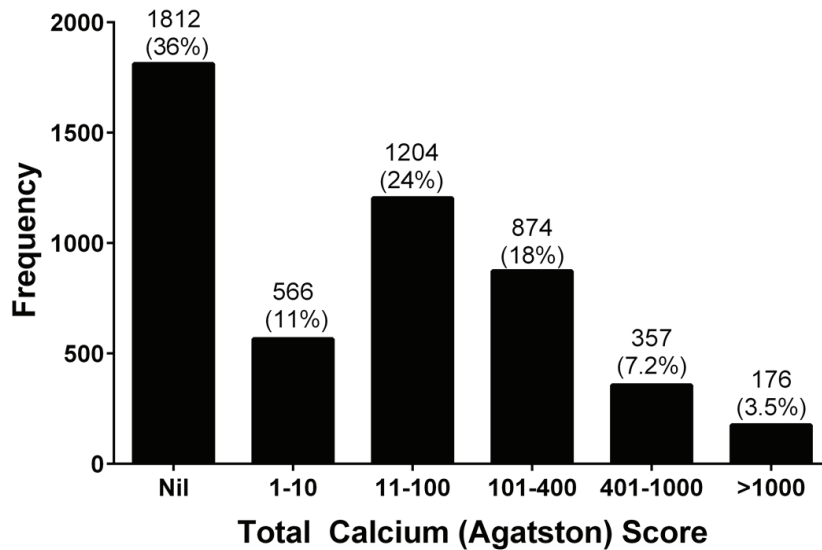


Figure 3: Frequency distribution of total calcium scores (n=4,989).*



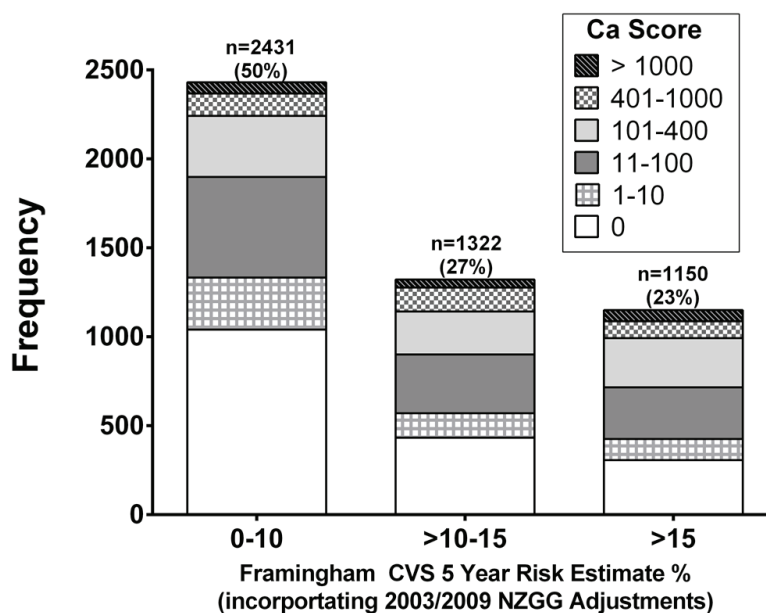
*Excludes three scans which did not have full calcium score calculated (patients with markedly calcified arteries, not further calculated).

from 86 patients, so they were excluded. Two patients were excluded because of missing calcium score and one patient was excluded with missing both the Framingham risk score data and the total calcium score. Half of the patients: 2,431 (50%) were calculated to be at *low CVS risk* as defined by the NZGG (0–10%, 5-year risk), of whom 1,040 (43%) patients had a calcium score of nil units, 532 (22%) a score of >100 units and

189 (7.8%) patients a score of >400 units (Figure 4, Table 5).

One quarter of the patients: 1,150 (23%) were calculated to be at *high CVS risk* as defined by the NZGG (>15%, 5-year risk), of whom 434 (38%) had significant calcium deposits with an Agatston calcium score >100 (Table 5). However, 307 (27%) patients of those calculated to be at high CVS risk (>15% 5-year risk) had no calcium within the

Figure 4: Frequency of patients with calcium scores with increasing Framingham CVS risk (n=4,903).



*Excludes two patients whose calcium score was not calculated, 86 patients missing at least one component of the Framingham risk score and one patient missing both total calcium score and at least one component of the Framingham risk score.

Table 5: Patients with calcium scores and calculated Framingham CVS risk (n=4,903).*

Five-year Framingham CVS risk				
Calcium score	0–10%	10–15%	15+	P
>400	189 (7.8%)	180 (14%)	157 (14%)	P<0.0001
>100	532 (22%)	421 (32%)	434 (38%)	P<0.0001
1–100	859 (35%)	468 (35%)	409 (36%)	P=0.99
Nil	1,040 (43%)	433 (33%)	307 (27%)	P<0.0001
Total	2,431	1,322	1,150	

*Excludes two patients whose calcium score was not calculated, 86 patients missing at least one component of the Framingham risk score and one patient missing both total calcium score and at least one component of the Framingham risk score.

coronary arteries, with an Agatston score of 0 (Table 5).

Radiation dose

The radiation dose was recorded in 2,666 (74%) of the 3,603 CT cardiac angiograms with a median dose length product (DLP) of 657 (Q1, Q3 551, 956), an effective median dose of 9.2 (Q1, Q3 7.7, 13.4) mSv. The radiation dose was recorded in 4,054 (81%) of the 4,992 CT calcium score tests, with a medium DLP of 81 (Q1, Q3 57, 103), an effective dose of 1.13 (Q1, Q3 0.79, 1.44) mSv.

Discussion

The assessment of patients with chest pain and suspected coronary artery disease is a common clinical situation for clinicians.

A careful history and examination by an experienced doctor is the key component to making an accurate diagnosis. Subsequent investigations traditionally use functional methods of assessment: using treadmill electrocardiographic testing, stress echocardiography or stress scintigraphy, with the aim to demonstrate or exclude areas of ischaemia, which are suggestive of a flow limiting stenosis within a coronary artery. However, these functional tests can only *suggest* a likelihood of severe coronary disease and not *confirm* the diagnosis of coronary artery atheroma. Confirmation of the diagnosis requires the imaging of coronary arteries, which has previously been limited to the invasive technique of coronary angiography.

Over the last 10 years, CT cardiac angiography has significantly changed the landscape for the assessment of chest pain and suspected coronary artery disease. With

the ability to accurately image coronary arteries with a non-invasive technique, there is now an “intermediate step” for assessment, which bridges the gap between the clinical review with functional tests, and the invasive cardiac angiogram.

Although temporal and spatial resolution of CT cardiac angiography remain inferior to conventional invasive coronary angiography, nonetheless high diagnostic accuracies have been demonstrated for the detection of significant coronary artery disease. The most appropriate use of a CT cardiac angiogram is in patients in whom the clinician is looking to “rule out” significant coronary stenoses in a low- or intermediate-risk patient.¹³ If a clinician believes a flow limiting stenosis is present, or probably is present, in a high cardiovascular risk patient, then a conventional, invasive coronary angiogram is usually indicated.

The advent of the 64-slice CT cardiac angiogram has allowed for consistent and reliable coronary imaging. We have shown that from a careful programme of 3,612 patients receiving a full CT cardiac angiogram, in 95% of patients, clear images were seen of all six main arteries or major branches. With this, the ability to “rule out” significant coronary wall stenoses was successful in 86% of patients, while 14% of patients were reported to have possible severe stenoses. These may not have otherwise been detected, following the patient’s presentation with either atypical chest symptoms or an equivocal functional test. Patients were then managed with a subsequent invasive angiogram, and revascularisation as required, or were managed medically, but with the knowledge

that significant coronary wall atheroma was present with appropriate subsequent preventative strategies. The potential benefit of this non-invasive coronary assessment is major, and CT cardiac angiography has developed into an important adjunct to a cardiological programme.

With the development of CT cardiac angiography supplementing conventional invasive angiography for making a more accurate diagnosis of anatomical coronary disease, the value of functional testing may become more one of predicting prognosis. There is a wealth of data which has demonstrated the ability of functional stress testing to separate low risk from higher risk patients, with electrocardiography, echocardiography, nuclear scintigraphy and magnetic resonance imaging.^{17–20}

Acquisition

Coronary CT angiography involves a venous injection of an iodine-based contrast agent, with the CT scan being “gated” to the ECG; images being obtained during diastole, when the coronary arteries are relatively still.²

The key for patients undergoing a cardiac angiogram is for the heart rate to be lowered to <60 beats per minute. Even with the most advanced CT cardiac angiography machines, if the coronary artery is moving at the time that the imaging is undertaken, clear images are not seen.²¹ The use of oral as well as intravenous beta-adrenergic blocking medication (usually metoprolol tartrate) is necessary to lower the heart rate. Hence patients with a significant contraindication to ‘beta-blockers’ are unsuitable for this technique.

Overweight patients give less clear images, as do older patients, who are more likely to have extensive calcification, which obscures full luminal assessment. Patients in atrial fibrillation or with frequent ectopic beats are also less able to give clear images of the coronary arteries, and hence are also often unsuitable for this technique.

Haemodynamically stable patients are suitable whereas those who are unstable and in whom it is dangerous to slow the heart rate to < 60 beats per minute should have their coronaries imaged with a conventional invasive cardiac angiogram.²²

Radiation dose

The radiation dose for the acquisition of CT cardiac angiography with a 64-slice machine is similar to that of an invasive cardiac angiogram at between 5–10mSv.^{7,8,23} However, the current range of 128 or 256 slice detector CT cardiac angiogram machines can now obtain good images with a radiation dose generally between 1–4mSv, which is less than is delivered with a conventional cardiac angiogram.³ This radiation dose can be compared with the annual background radiation dose in New Zealand of 3mSv. The radiation dose for a CT calcium score test is even lower, at about 1mSv, approximately the same dose as a bilateral mammogram.^{7,8}

Analysis

Complex computer software allows the x-ray images to be recreated in axial, double oblique, maximum intensity projection, curved multiplanar formats and three-dimensional volume rendered reconstructions. Reporting clinicians require extensive training and experience with the technique to optimally integrate a new CT cardiac angiogram programme into a cardiological service.²²

Acute chest pain

Randomised controlled trials have established the useful role of coronary CT coronary angiography in patients presenting to emergency departments with undifferentiated acute chest pain and negative serum troponin and normal ECG recordings.²⁴ However, our outpatient programme did not include the assessment of patients with acute chest pain.

Coronary artery calcium scoring

The conventional *epidemiological* methods of the assessment of CVS risk is currently being challenged by the advent of *imaging* methods.²⁵ The intuitively attractive method of visualising the actual calcified coronary atheromatous burden in an individual patient has also been shown to be a more accurate method of risk assessment.^{9,10}

A calcium score of >100 Agatston units conferred a 10-fold increase in risk, in the St Francis heart study of 4,613 asymptomatic people followed for 4.3 years compared with a calcium score of zero.⁹ Further, the

coronary calcium score alone was superior to the Framingham risk score at predicting CVS events (area under the receiver-operating characteristic (ROC) curve of 0.79 \pm 0.003, $p=0.0006$), and enhanced the risk stratification of those falling into the Framingham categories of low, intermediate and high risk ($p<0.0001$).⁹

A calcium score of >400 Agatston units conferred a risk of up to 30 times the risk of a population with a calcium score of zero units in the Multi-ethnic study of atherosclerosis (MESA), in 6,814 asymptomatic participants at a median follow-up of 3.75 years.²⁶ It was recommended that cut points be used on the absolute calcium score level of 100 and 400 Agatston units.²⁶

In addition, patients without calcification, with a calcium score of nil Agatston units, have an excellent 15-year survival.²⁷ Of 9,715 individuals (mean age 53.4 \pm 10.5 years, 59% male) undergoing calcium score screening, at a mean follow up of 15 years, 95% of individuals with a calcium score of zero were alive compared to 85% of individuals with a calcium score of $>zero$.²⁷ Interest has been given to patients who are calculated by epidemiological methods to be at high CVS risk, but are found to have a low calcium score, with the potential to reassign these patients to a lower risk group.²⁸

The ability to more accurately assess CVS risk with imaging methods, compared to the traditional epidemiological methods, has led to groups looking to 'refine' CVS risk inaccuracies. The current American CVS risk guidelines have combined four very large epidemiological studies into one equation to assess risk, and have recommended that for patients with a CVS risk of 7.5% and above over 10 years should be recommended for statin treatment.²⁹ Using this guideline, approximately 33 million Americans would be eligible for statin management using the epidemiological equation on its own. To try

to refine this number of patients eligible for statin use, a major paper from the USA Government-funded MESA study has reviewed patients who would fit these guidelines, and have looked at the calcium score of those recommended to consider statin therapy. Forty-one percent of these patients were shown to actually have a calcium score of zero, and would therefore really be at very low risk.³⁰ Hence the combination of an epidemiological CVS risk tool with a more accurate calcium score test may be a model to better refine CVS risk assessment in populations. The relative cost implications of these strategies are yet to be carefully explored, but are needed.

Study limitations

We have described the clinical use of CT cardiac angiography, including the actual reports of the scans. We do not have a correlation with invasive cardiac angiography in the 14% of patients with atheroma reported to be $>50\%$ luminal stenosis. Neither do we have follow-up data on patient management. However, this study is of the actual use of CT cardiac angiography to demonstrate the strength of the procedure, namely to exclude severe stenoses from a group of patients with atypical symptoms or equivocal results from stress testing.

The study cohort for coronary artery calcium scoring is a selected population, which may not be representative of the New Zealand population, and may under-represent or over-represent the degree of coronary calcification across New Zealand.

Conclusions

CT cardiac angiography has become established in the modern management of cardiology patients. It can be readily integrated into established practice, and adds significant value to the care of many patients.

Competing interests:

All authors excepting Greg Gamble received payment for reporting of Cardiac CT scans from the 'Auckland Heart Group' private cardiology practice or from working at the Mercy Radiology Cardiac CT scanner. As a part of their private cardiology practice Chris Ellis, Colin Edwards, Niels van Pelt, Ruvin Gabriel, Boris Lowe, John Ormiston and Malcolm Legget have a share-holding in the 'Auckland Heart Group', which itself has a minority share in the ownership of the Mercy Radiology Cardiac CT scanner. Greg Gamble received payment from the Auckland Heart Group for data management and statistical analysis of this work.

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High rate of incidental glaucoma detection in New Zealand

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ABSTRACT

AIM: To investigate how glaucoma is initially detected in New Zealanders and what factors aroused disease suspicion.

METHODS: A postal survey of 500 randomly selected members of the Glaucoma New Zealand database was undertaken in 2012 to analyse factors relating to their initial presentation and diagnosis of glaucoma. Online surveys and telephone interviews were used to increase the response rate.

RESULTS: The overall response rate was 80% (376/468) of eligible participants. The sample had an average age of 76 years. Prior to diagnosis, 80% (290/361) of participants who responded to this question reported no suspicion of glaucoma. A positive family history for glaucoma was the most common reason (71%) for presenting to a health care professional with a suspicion of glaucoma (13% of total sample). After diagnosis, 95% (357/376) of respondents reported that they had informed family members of their diagnosis.

CONCLUSIONS: This study confirmed that the majority of glaucoma was discovered through incidental findings. A positive family history was the most common risk factor prompting examination, knowledge about which appeared to increase dramatically post-diagnosis. These findings indicated that there was potential to educate the public about glaucoma in order to raise awareness and diagnose the disease earlier.

Glaucoma is the leading cause of preventable blindness in developed countries, including New Zealand.¹ Population-based studies find high rates of undiagnosed glaucoma^{2,3} with over 50% of people with glaucoma living in developed countries remaining undiagnosed and unaware of their disease.⁴ Early detection is vital to reduce the burden of unnecessary blindness due to glaucoma. The Royal Australian and New Zealand College of Ophthalmologists recommends that the public should have their eyes checked every two years⁵ and the New Zealand Association of Optometrists recommends a regular eye examination every two to five years for healthy adults.⁶ However, like other developed countries, New Zealand does not have a formal screening program for glaucoma.

A preliminary, unpublished study by the same investigative team reviewed the medical records of 400 patients seen in a nurse-led glaucoma clinic in the Dunedin

Hospital Ophthalmology Department, Dunedin, New Zealand in 2011, and found that 72% of new cases of glaucoma were detected incidentally during referral for another reason unrelated to glaucoma. This high rate of incidental detection of glaucoma in a subset of glaucoma patients prompted this survey of a more representative national sample.

The aim of this study was to determine how people came to be assessed and diagnosed with glaucoma, given that it is largely a “silent disease” without symptoms, and what prompted those whom were not found incidentally to seek examination.

Methods

Five hundred members of Glaucoma New Zealand were randomly selected from the 3,595 members who had indicated they had a diagnosis of glaucoma. They were sent a postal questionnaire in January 2012 along with a unique code allowing them to answer an identical online questionnaire

Table 1: Demographic characteristics of study participants.

Gender		Place of residence	
Male	137 (36%)	Urban	351 (93%)
Female	239 (64%)	Rural	25 (7%)
Ethnicity		Mean age in years (SD)	76.4 (7.7)
NZ European	314 (84%)	Employment status	
NZ European + Other	16 (4%)	Retired	307 (83%)
British	30 (8%)	Employed	62 (17%)
Māori	2 (1%)	Unemployed	3 (1%)
Other	14 (4%)		

using SurveyMonkey.⁷ A reminder letter, containing an additional copy of the questionnaire was sent to all non-responders two weeks later. This letter highlighted the availability of a toll-free phone number for participants to call with any queries, comments or to request assistance over the phone to complete the questionnaire. Participants who did not respond to either the letter or online survey within two months were contacted by phone and requested to complete the questionnaire by direct questioning. All phone interviews were conducted by the same investigator (JE).

Data from posted questionnaires, online surveys and phone interviews were collated in Microsoft Excel. The only inclusion criterion was having a diagnosis of glaucoma. Individuals were excluded if they indicated that they did not have glaucoma but had been misclassified by Glaucoma New Zealand, had an incorrect address or were deceased. The presence of actively treated glaucoma was confirmed through the questionnaire to ensure that all participants were either receiving glaucoma treatment or had undergone surgical and/or laser glaucoma treatment. Blank answer fields in the location section of the written questionnaire were completed using details from the Glaucoma New Zealand database. When other answer fields were left blank, answers

were interpreted as answers of “zero”, “not applicable” or “none” as appropriate to the question. If one or more of the answer fields immediately before or after the blank field was also left blank, the question was classified as having been missed.

Classification Coding System (CCS) software by *Statistics New Zealand* was used to convert street addresses into 2006 mesh-block codes which were used to link each individual participant to a New Zealand Deprivation (NZDep) Score.⁸

Ethnicity data was retrieved from Dunedin Hospital records. In New Zealand, ethnicity is a measure of self-perceived cultural affiliation.⁹

Results

Of the 3,595 members of the Glaucoma New Zealand database, 500 were randomly selected to participate in this study. Members who had not been treated for glaucoma, had incorrect addresses or were deceased were excluded, leaving 468 eligible participants. The initial postal survey provided 27 responses and the second postal survey provided an additional 301 responses. A further 48 participants were contacted by phone or completed the survey online to give an overall response rate of 80% (376/468). The demographic characteristics of participants are described in Table 1.

Table 2: Initial suspicion of glaucoma and reason for suspicion.

Respondent suspicion of glaucoma		Reason for suspicion of glaucoma	
Not suspicious	290 (80%)	Family history only	46 (65%)
Suspicious	71 (20%)	Family history and symptoms	4 (6%)
		Symptoms only	19 (27%)
		Unspecified	6 (9%)

Table 3: Initial consultation and suspicion of glaucoma.

	Initial consultation regarding glaucoma			
	Optometrist	Ophthalmologist	General practitioner	Other
Suspicion	35 (51%)	28 (41%)	3 (4%)	2 (3%)
No suspicion	230 (82%)	30 (11%)	14 (5%)	7 (3%)
Total	265 (76%)	58 (17%)	17 (5%)	9 (3%)

Prior to being diagnosed with glaucoma, 80% (290/361) of participants who answered this question had no suspicion of glaucoma. Of those who were suspicious about glaucoma, 65% (46/71) sought examination due to having a positive family history for glaucoma (Table 2).

When glaucoma was suspected, respondents were more likely to have chosen to have their initial consultation with an ophthalmologist. Most (82%, 230/265) respondents who had no initial suspicion of glaucoma were most likely to be seen and had an initial suspicion of glaucoma raised by their optometrist (Table 3).

Only 4% (17/374) of respondents who answered this question did not use spectacles of any type. The majority of spectacle wearers (322/357) had their glasses prescribed by their optometrist. Nearly half, 47% (178/376) of all respondents were aware of having at least one “blood-relative” with glaucoma and 95% (357/376) reported informing relatives that they had glaucoma. Of those who had discussed their diagnosis with family members, 93% (332/357) had also reported advising their relatives to have regular examinations.

Discussion

The most striking finding of this New Zealand wide survey of a randomly selected group of people with glaucoma was that 80% did not have any suspicion of glaucoma prior to being diagnosed. Of the 20% who did present with a suspicion of glaucoma, the most common cause for concern was a positive family history. Participants were well aware of the importance of a positive family history after their diagnosis, with 95% reporting that they informed their own family members and 93% of these advising family members to have their eyes examined.

This study supported the often quoted statistic from large population-based studies that in the developed world, more than 50% of glaucoma cases remain undiagnosed.¹⁰ The presence of a first-degree relative with glaucoma is a risk factor for glaucoma.¹¹ The percentage of respondents with a positive family history (47%) was higher in this study than that found in population-based studies such as the Baltimore Eye Survey (16%)³ or the Barbados Eye Study (17%)² as would be expected with a targeted glaucoma population. Gender and age trends were in keeping with larger studies of glaucoma detection.¹⁰ Wong et al¹² found that all previously undiagnosed people in their study with glaucoma who had been seen by an eye health professional in the previous year were aged 50 years or older. The mean age of our study population was in keeping with increased age being a risk factor for glaucoma.¹³

This study highlighted the silent nature of glaucoma and showed the importance of opportunistic screening by healthcare providers in order to detect the disease early. Most participants had worn or currently wear spectacles, representing an excellent potential point of contact where patient education and examination can be optimised to catch as many cases of undiagnosed glaucoma as possible.

An encouraging finding was that when glaucoma was diagnosed, people were informing family about the disease and recommending examination. While this appears reassuring that the general public are aware of the increased risk of glaucoma associated with having a positive family history, the group who suspected glaucoma due to family history only comprised 13% of the study population. More importantly still, 47% of participants stated that they

were aware of having at least one relative with glaucoma. This disparity between those who knew they had a relative with the disease and those who are also suspicious that it may affect them suggests that many do not comprehend the significance of the increased risk they face. Education of healthcare workers who come in contact with an at-risk population could potentially prompt patients with a family history of glaucoma to be assessed earlier and to discuss it with their family.

Respondents were selected from the Glaucoma New Zealand database for our study. Membership is voluntary and members do not have to have a diagnosis of glaucoma. While efforts were made to

exclude members who did not have a diagnosis of glaucoma, it is often difficult for people to know whether they have glaucoma or are merely a “glaucoma suspect” given the nature of glaucoma and its variable diagnostic criteria over time and between studies.¹⁴ One strength of this study was achieving a high response rate through the use of multi-mode survey methods.

This survey provided further evidence that many people with glaucoma have no suspicion of their disease prior to being diagnosed, and raises the question of whether a glaucoma screening programme should be implemented rather than relying on the recommendations of professional bodies.^{5,6}

Competing interests:

Nil.

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Efficacy and safety of TC-325 (Hemospray™) for non-variceal upper gastrointestinal bleeding at Middlemore Hospital: the early New Zealand experience

Hannah Giles, Dinesh Lal, Stephen Gerred, Paul Casey, Alasdair Patrick, Derek Luo, Ravinder Ogra

ABSTRACT

AIMS: A case series to review early experiences with Hemospray™ for a variety of non-variceal upper gastrointestinal bleeding (UGIB) at Middlemore Hospital.

METHODS: Hemospray™ was administered therapeutically as first line or rescue at the discretion of the endoscopist. All cases of UGIB requiring Hemospray™ at Middlemore Hospital were identified to the investigator who undertook analysis of electronic and hard copy notes.

RESULTS: Between October 2013 and July 2016, 36 patients were treated endoscopically with Hemospray™. Source of bleeding was predominantly gastric in 17, 15 were duodenal and four oesophageal. The majority of lesions were peptic ulcer or post-intervention (78%), with others being Mallory Weiss tear (MWT), gastric mass, Dieulafoy lesion, portal hypertensive gastropathy and post-biopsy. Thirty-one were actively bleeding with mostly oozing haemorrhage (75%). Twenty-three patients were on antithrombotic therapy (ATT), two each on warfarin and low molecular weight heparin (LMWH) and 19 on antiplatelet agents. Hemospray™ was administered therapeutically in all cases, as first line or rescue. Acute haemostasis was achieved in all patients; four (11%) episodes of re-bleeding occurred within seven days, with average follow-up of 16 months. There were no instances of equipment malfunction or adverse events specific to use of Hemospray™.

CONCLUSIONS: Our early experience with Hemospray™ is very promising and there is clear role for Hemospray™ as a rescue therapy when standard methods have failed to achieve haemostasis and possibly as first line in cases of diffuse bleeding not amenable to standard interventions. However, Hemospray™ is not recommended as a standalone therapy for spurting haemorrhage due to the increased frequency of re-bleeding.

TC-325 (Hemospray™, Cook Medical Inc, Winston-Salem, NC, US) is a synthetic haemostatic powder recently licensed for use in non-variceal upper gastrointestinal bleeding (UGIB) in New Zealand. Middlemore Hospital was the first centre in Australasia to use Hemospray™. Proposed mechanism is via formation of a mechanical barrier and concentration of clotting factors, which enhances activation of the clotting

cascade.¹ The in vitro effects of TC-325 on standardised coagulation and platelet function have been studied, showing that both prothrombin time and activated partial thromboplastin time are reduced in a dose-dependent manner in the presence of the powder.² These results suggest that Hemospray™ may facilitate local hemostasis.

There is a growing body of evidence supporting its safety and efficacy for peptic

Figure 1: Hemospray™ device.



ulcer-related haemorrhage,³⁻⁵ and to a lesser extent in malignancy related^{6,7} and other causes of UGIB such as portal hypertensive gastropathy⁸ and post-interventional bleeding.^{6,9} Results indicate high rates of success for oozing haemorrhage; 73–100% for initial haemostasis and 11–33% for re-bleeding.^{3,4} However, concern remains around spurting haemorrhage with variable success for initial haemostasis (0–100%)^{3,4,6} and higher rates of re-bleeding (35–50%),^{3,10} particularly when combined with the use of antithrombotic therapy.

Methods

The Hemospray™ package includes a delivering device with a powder syringe (20g each), two catheters (7 and 10 F, suitable for a working channel of 2.8 and 3.7 respectively) and a CO₂ cartridge (Figure 1). The latter is activated by turning a red knob placed at the base of the handle until it stops. Before inserting the catheter in the working channel of the endoscope, blood must be removed as much as possible and the bleeding site must be identified. Air is then flushed through the accessory channel and the catheter is slowly advanced until the catheter tip is visualised. Care must be taken to avoid direct contact between the catheter tip and blood or mucosa to avoid occlusion.

It is advisable to maintain a 1–2cm distance from the bleeding site during the procedure. Then, after turning the red valve, placed at the top of the delivery device to the open position, TC-325 is ready to be delivered by depressing the red trigger button in 1–2 second pulses. Following the manufacturer's instructions, no more than three devices (60g) should be applied per patient. However, in one case up to seven syringes were used with no adverse effects seen.⁴

Hemospray™ was used therapeutically as first line or rescue, at the discretion of the endoscopist. Between October 2013 and July 2016 all cases of UGIB requiring Hemospray™ at Middlemore Hospital were identified to the investigator who undertook analysis of electronic and hard copy notes. No more than one canister was used for any single application. All endoscopists had undertaken a training session with Hemospray™. This case series was approved by the institutional review board (#1848).

Results

A total of 36 patients (mean age of 68.6 years), 25 male (69%) were treated endoscopically with Hemospray™. Clinical presentation was haematemesis in 12, 20 with melaena, five with syncope, seven

Table 1: Endoscopic findings, management and outcomes.

Location	Lesions	Number	Stigmata	Hemospray™	Outcome
Gastric	Ulcer	9	4 Spurting	4 Rescue	1 Re-bleed
			3 Oozing	1 First line, 2 rescue	-
			1 Adherent clot	Rescue	-
			1 Clean base	First line	-
	Gastric polypectomy	3	3 Oozing	2 First line, 1 rescue	-
	Gastric mass	1	Oozing	First line	-
	Post ESD gastric lesion	1	Oozing	Rescue	-
	Gastric polyp	1	Oozing	Rescue	-
	Dieulafoy lesion	1	Visible vessel	Rescue	-
	Portal hypertensive gastropathy	1	Oozing	First line	-
Duodenal	Ulcer	15	1 Spurting	Rescue	-
			11 Oozing	1 First line, 10 rescue	2 Re-bleed
			1 Adherent clot	Rescue	1 Re-bleed
			1 Visible vessel	Rescue	-
			1 Clean base	First line	-
Oesophageal	Post biopsy	2	2 Oozing	2 Rescue	-
			Mallory Weiss tear	1	Oozing
	Ulcer	1	Oozing	Rescue	-

Hemospray was administered therapeutically as first line (n=9) (Figure 2), or rescue (n=27) (Figure 3). Other modalities used were adrenaline injection (n=21), thermal therapy (n=4) and mechanical (n=18).

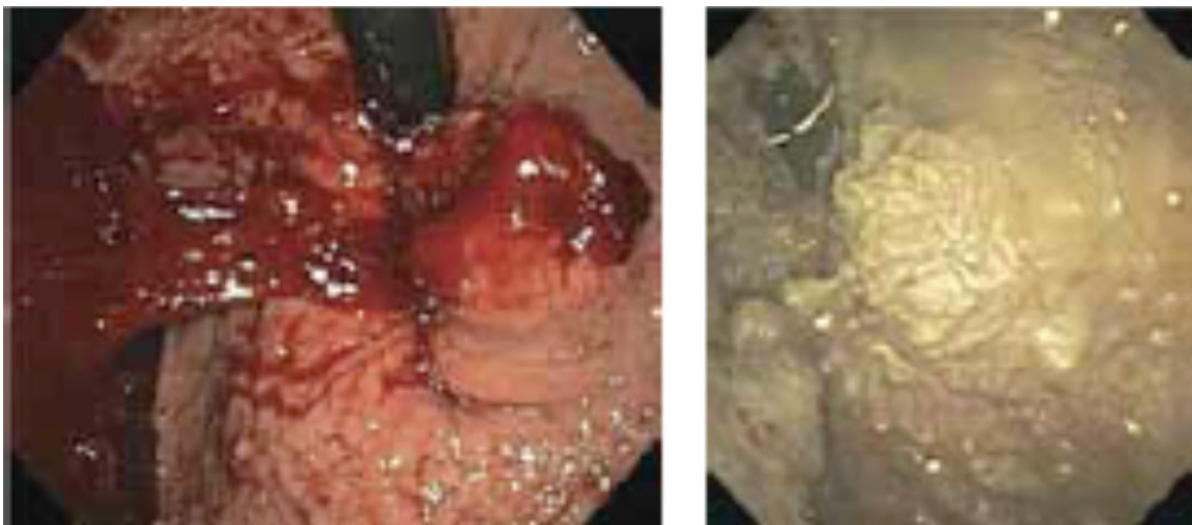
Figure 2: Bleeding gastric cardia mass, before (left) and after (right) Hemospray application.⁵

Figure 3: Gastric ulcer (arterial bleed), post clipping with ongoing ooze (left) and after Hemospray™ administration (right), hemostasis achieved.



with presyncope and one each with symptomatic anaemia and elective procedure. Rockall score ranged from 3–10, mean 5.9 with evidence of haemodynamic instability (heart rate >100 beats/min, systolic blood pressure <100 mmHg) in 13. Laboratory results showed a mean haemoglobin (Hb) nadir of 79.8 g/L (normal 135–170 g/L), thrombocytopenia (platelets <150x10⁹/L) in nine and eight with coagulopathy (international normalised ratio (INR) >1.2). Review of medications showed 19 patients on antiplatelet agents (64%) and four on anti-coagulation, two each with warfarin and LMWH. Nine (27%) patients were on proton pump inhibitors (PPI) at admission and 27 (75%) were on PPI at discharge.

Source of bleeding (Table 1) was most commonly gastric (n=17) or duodenal (n=15) with a small number of oesophageal (n=4). Bleeding was secondary to peptic ulcer (n=24), post polypectomy (n=3), gastric polyp (n=1), gastric mass (n=1), post endoscopic submucosal dissection (ESD) (n=1), portal hypertensive gastropathy (n=1), Dieulafoy lesion (n=1), Mallory Weiss tear (n=1), post oesophageal biopsy (n=2) and an oesophageal ulcer (n=1). Thirty-one lesions were actively bleeding; the majority demonstrated oozing haemorrhage (n=27) with five cases of spurting haemorrhage.

Acute haemostasis was achieved in 100% of patients, with four episodes of re-bleeding within seven days. Two of the patients who re-bleed were anti-coagulated, one with LMWH and one with dual anti-platelets, the latter of which was an arterial bleed. The remaining two were in a technically difficult position where clips were not able to be placed.

Nine patients died. Four deaths were unrelated to bleeding, two from advanced haematological disease, one invasive pancreatic adenocarcinoma and one with sepsis on a background of end stage liver disease. Four were palliated on recurrence of bleeding due to comorbidities, mostly advanced malignancy and one elderly patient with advanced dementia. One patient died of progressive multi-organ failure despite cessation of bleeding. Three of the lesions were unable to have mechanical therapy due to the location. One, as previously mentioned was an arterial bleed on dual anti-platelets that re-bleed despite clips, adrenaline and Hemospray™.

Average follow-up was 16 months. There were no instances of equipment malfunction or adverse events attributable to Hemospray.

Discussion

Hemospray was used as first line in cases where other modalities would not have been suitable, such as a broad based MWT, oozing gastric mass, post polypectomy, portal hypertensive gastropathy and gastric erosions with multiple areas of ooze and one case with an unclear source of bleeding in a patient with significant thrombocytopenia (platelets 72x10⁹/L). Hemospray™ was also used successfully on a malignant gastric mass as a bridge to radiation; the patient subsequently received radiation and has been stable with no further bleeding for 10 months. Where Hemospray™ was used as the mode of choice due to appropriate lesions as described above, there were no episodes of re-bleeding.

Hemospray rescue was used after failure of standard modalities, predominantly when clips had been deployed onto a visible vessel and ongoing ooze was present. There were five cases of spurting haemorrhage, all required multimodal management with adrenaline, clips, Hemospray™ +/- heater probe. Four of these patients had successful primary therapy with no re-bleeding, none of whom were on ATT, however, the one patient who was on dual anti-platelets re-bled and did not survive.

Our experiences with Hemospray have thus far been very promising with no Hemospray failures or adverse events seen. The high rates of acute hemostasis and low rates of re-bleeding, despite significant comorbidities and severity of bleeding (associated with high rates of haemodynamic instability, thrombocytopenia and coagulopathy) and high use of ATT in our group, make it an appealing modality. The majority of deaths were due to advanced underlying malignancy or other life limiting comorbidities in patients who were nearing end of life and do not necessarily represent true failures of therapy.

From the literature and our own experiences, there is a role for Hemospray in cases of diffuse bleeding such large ulcers, post endoscopic mucosal resection, portal hypertensive gastropathy, gastric antral vascular ectasia, unclear source of bleeding, malignancy or technically difficult location where standard therapies would be ineffective or impossible.^{1,6-8,11} In addition, at smaller centres where expert endoscopists may not be available, this is a simple alternative.⁷ It is important however, to consider if this is definitive and should be used as bridging therapy if the underlying pathology is likely to cause recurrent bleeding.

There has been some concern around the risks of perforation, obstruction and systemic embolisation. Two studies have sited perforation as a complication.^{3,5} The largest study, with 82 patients, reported a large number of technical issues including blockage of application catheter (4),

blockage of endoscope working channel (1) and endoscope adherent to the mucosa (2).⁵ This suggests endoscopists were working in close proximity to the mucosa. The recommendation is no closer than 1–2cm. At which distance the pressure is very low and unlikely to cause adverse effects such as perforation.

There is concern around the theoretical risk of systemic embolisation in variceal bleeding due to lower pressure of varices. However, recent studies have also shown safety and efficacy of Hemospray for acute variceal haemorrhage.^{12,13}

Of genuine concern is the risk of biliary orifice obstruction. There are reported cases in the literature after use for post-sphincterotomy bleeding.¹⁴ Hence it should be used with caution for this indication.

Hemospray has more recently been trialled in small numbers of lower GI bleeding (LGIB) for a variety of causes and again has been shown to be safe and effective. However, as with UGIB Hemospray, failures were seen with re-bleeding in two cases on ATT with spurting haemorrhage.^{9,15,16}

Conclusions

Although further studies are required to compare Hemospray to standard modalities and assess its use for LGIB and variceal haemorrhage, there is already a role for Hemospray. We would suggest its use as first line for oozing haemorrhage in cases of diffuse bleeding, unclear source of bleeding or technically difficult location and as rescue therapy for any bleeding where other modalities have failed.

Its safety and efficacy in oozing haemorrhage has been demonstrated in numerous studies, however, several studies have shown that spurting haemorrhage especially in the context of ATT use has lower rates of hemostasis with higher rates of re-bleeding. In cases of spurting bleeding, Hemospray is not advisable to be used as monotherapy but could be used in combination with mechanical therapy.

Competing interests:

Nil.

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Newborn vitamin K prophylaxis: an analysis of information resources for parents and professionals

Hayleigh Miller, Benjamin Wheeler, Nikki Kerruish

ABSTRACT

AIMS: Vitamin K prophylaxis represents one of the first healthcare decisions families make for their newborn. Information resources are an important component of this process. This study aimed to identify and analyse written information about vitamin K.

METHODS: Resources concerning vitamin K prophylaxis for both parents and health professionals were accessed through tertiary hospitals in New Zealand and Australia, midwives associated with Queen Mary Maternity Centre (Dunedin, New Zealand), antenatal class providers in the Dunedin, New Zealand area, and an online search of Australian and New Zealand government and hospital websites, as well as the Centre for Disease Control (CDC) in the US. These materials were assessed with regard to coverage of information relevant to vitamin K prophylaxis, whether a statement of the recommended option was included, and information concerning parental choice.

RESULTS: In Australia, the majority of centres use the Australian Government National Health and Medical Research Council (NHMRC) resource. In New Zealand, eight different resources are in use. There was variation between resources in all aspects, including use of different incidence rates for vitamin K deficiency bleeding (VKDB). No New Zealand resources were available in languages other than English. The resources for health professionals also varied, and the two available New Zealand consensus statements (Ministry of Health and College of Midwives) differed in terms of their main recommendation.

CONCLUSIONS: Many different information resources are available regarding vitamin K prophylaxis in New Zealand. Standardisation of such information would be more equitable and would facilitate easier review of content and translation into multiple languages.

Vitamin K deficiency bleeding (VKDB) can present as relatively insignificant gastrointestinal or muco-cutaneous bleeding in the first hours to months of life.^{1,2} However, in approximately 50% of late-onset cases, it presents as serious haemorrhage that can result in death or permanent neuro-disability.³ As a result, many countries have introduced public health programs that offer vitamin K prophylaxis to all babies at birth, with an intramuscular (IM) route generally preferred, partly because of concerns of reliability of administration and partly due to concerns about the efficacy of oral administration.⁴ In the presence of IM vitamin K prophylaxis, VKDB is rarely seen with an incidence of approximately 1/100,000 live births, or less, compared to rates of

1/1,500 or more in the absence of prophylaxis.^{3,5} When VKDB does occur, it is almost invariably in children for whom vitamin K has been omitted through error or because their parents withheld consent.³

Limited data is available on newborn vitamin K prophylaxis uptake, however, recently published data suggests that New Zealand has considerably lower uptake of IM vitamin K than Canada^{6,7} and Australia.⁸ Concern about reducing uptake rates has also been expressed in the US following four recent cases of serious late haemorrhage in previously healthy newborns.⁹ Little is known about factors that may influence uptake, but several may be important, including the issue of potential harms. In the early 1990s IM vitamin K prophylaxis

was linked to an increased risk of childhood leukaemia.^{10,11} Although subsequent work has been unable to replicate these findings,^{12,13} these safety concerns appear to remain for some health professionals, as well as for parents. This is highlighted in New Zealand data that compared the attitudes of medical and midwifery staff towards vitamin K prophylaxis. In this study, 16% of midwives were concerned about harms caused by vitamin K prophylaxis, and only 55% stated that they thought all babies should receive it.¹⁴

In light of these apparent ongoing concerns about harm caused by vitamin K, some suggestion of declining uptake³ and emerging evidence about attitudinal differences between professional groups, we sought to further explore influences on parental and health professional decision-making. To this end information resources available to both parents and health professionals in Australia and New Zealand were analysed and compared with regard to coverage of information relevant to vitamin K prophylaxis (including stated incidence rates and the terminology used to describe VKDB), statement of recommended option/s and information about parental choice.

Methods

Sourcing materials

Printed and electronic resources concerning vitamin K prophylaxis were requested from multiple sources including all 28 Level 3 Neonatal Intensive Care Units (NICUs) in Australia and New Zealand (while NICUs were the access point for this information, the resources provided were not confined to NICU practice but were also those utilised by the relevant antenatal services), all 65 independent midwives undertaking deliveries at Queen Mary Maternity Centre (QMMC) via an anonymous online questionnaire (QMMC being the only hospital birthing unit in the city of Dunedin, New Zealand) and the two antenatal class providers for Dunedin. This collection strategy was supplemented by online searches for vitamin K resources from Australian and New Zealand government and hospital websites, as well as the Centre for Disease Control (CDC) in the US.

Evaluation process

In order to analyse and compare these information resources, we developed an analysis tool based on a literature review pertaining to public health interventions in childhood. The criteria within the tool were fully determined prior to analysis of information resources, which was undertaken independently by two authors (HM and NK). Where variation in scoring between the two researchers existed, differences were discussed until consensus was reached. The tool is reproduced in Appendix 1 and the three key elements are described below:

1. Information coverage

The New Zealand Ministry of Health (Medsafe) guideline was used to determine the range of headings reasonably discussed in an information resource.¹⁵ Areas covered were: What is vitamin K?; What is VKDB?; Prophylaxis options (IM/Oral/None); timing of prophylaxis; benefits of prophylaxis; and potential harms of prophylaxis.

Each component was assessed on a scale from zero to three, meaning not covered at all (0), minimally covered (1), moderately covered (2) or extensively covered (3).

In addition to the above areas covered in the analysis tool we also recorded some specific aspects of content, such as quoted incidence rates of VKDB, and terminology used that clearly differed between resources.

2. Recommendation

Resources were assessed with regard to whether or not they reflected the following Medsafe recommendation: "All babies should receive vitamin K prophylaxis. The recommended route of administration is intramuscular."

3. Parental choice was scored from one to three, where no mention of parental choice (implication or statement that this is routine, expected) scored 1, mention of parental choice alongside a recommendation for IM vitamin K scored 2 and a statement that prophylaxis is entirely parental choice scored 3.

Results

A summary of all the information resources collected and their analysis is included as Table 1 (full results in Appendix 2).

Table 1: Summary of scoring given to material.

Material assessed			
Organisation	Information coverage (/18)	Medsafe Recommendation stated	Parental choice
Parent information			
Vitamin K for Newborn Babies - Auckland DHB 2015 ²⁸	11	Y	2
Vitamin K and Your Baby - Canterbury DHB 2011 ²⁹	14	Y	2
Vitamin K prophylaxis and your baby - Capital and Coast DHB 2011 ³⁰	10	Y	2
Vitamin K for newborn babies - Counties Manukau DHB 2009 ³¹	15	Y	2
Vitamin K for newborn babies - Southern DHB ³²	9	Y	1
Information for parents about Neonatal Vitamin K - Waikato DHB 1999 ³³	15	Y	2
Vitamin K - Waitemata DHB ³⁴	17	Y	2
Vitamin K: Does my baby need it? - Women's Health Action Trust 2010 ¹⁶	17	N*	3
Vitamin K for newborn babies - Australian Government NHMRC 2013 ³⁵	12	Y	2
Protect your Baby from Bleeds – CDC ³⁶	8	Y	1
Professional information			
Vitamin K Prophylaxis in the Newborn - Ministry of Health 2001 ¹⁵	15	Y	2
Vitamin K Consensus Statement – NZ College of Midwives 2000 ²⁷	4	N	3
Joint statement and recommendations on vitamin K administration to newborn infants to prevent vitamin K deficiency bleeding in infancy - Australian Government NHMRC 2010 ²⁶	17	Y	2
Protect Babies from Life-threatening Bleeding – CDC ³⁷	9	Y	1

* This resource stated that New Zealand health professionals recommend vitamin K but not that intramuscular is the preferred route.

Response rate

One hundred percent (6/6) of New Zealand NICUs provided parental information, all of which were different and created by the individual hospital or district health board (DHB). Sixty-four percent (14/22) of Australian NICUs responded and all of these units used the Australian NHMRC brochure. In addition, a resource created by the Waitemata DHB was found online, and North American education material created by the CDC was included for international comparison. The information resources accessed through NICUs were also used by their relevant antenatal service.

The response rate for the midwifery survey was 45% (29/65). Fifteen (52%) used the QMMC vitamin K pamphlet and 13 (45%) "Vitamin K: Does my Baby Need it?" published by the Women's Health Action Trust,¹⁶ which was also used by one of the antenatal classes contacted. Of note, this resource was the only one found in our

study with an associated cost to the health provider (~\$1/pamphlet). A number of midwives stated that they often provide more than one type of brochure and a number also recommended other information sources. These included various articles and pamphlets available from the Maternity Services Consumer Council website,¹⁷⁻¹⁹ and an article from the magazine 'Kiwiparent'.²⁰

Resources/protocols for health professionals were provided by 36% (10/28) of NICUs. Additionally, New Zealand Ministry of Health, New Zealand College of Midwives, Australian Government National Health and Medical Research Council (NHMRC) and North American Centre for Disease Control (CDC) material was found online. These resources varied widely with some hospitals providing drug protocols, and others drug monographs. As a result, assessment of vitamin K information for health professionals focused on the New Zealand

consensus statements (Ministry of Health and College of Midwives), Australian NHMRC guidelines and the CDC information sheet.

Analysis

In 91% of cases, both reviewers (HM and NK) assigned the same score. In the 9% of cases where variation existed, differences were discussed until consensus was reached.

Parent resources

Table 1 demonstrates that the level of information covered in different brochures varied significantly (for parent information resources scores ranged from 9 to 17 out of a possible 18). This was true for all aspects of the information, including discussion of potential harms and benefits (for full results refer to Appendix 1).

Other key differences in content included stating different incidence rates of VKDB from “approximately one in 10,000 babies” (Canterbury DHB) to “less than one in 1,000 babies” (Southern DHB). Some brochures broke this information into the three categories of VKDB with the Women’s Health Action Trust pamphlet stating that “classic VKDB...occurs in the first week of life in 0–0.44% of healthy infants”—equivalent of up to one out of 227 infants. In addition, the terminology used to describe VKDB varied, with a minority of resources still using the outdated term “Haemorrhagic Disease of the Newborn” (HDN).

All resources, except that from the Women’s Health Action Trust, stated that IM vitamin K was recommended for all babies. seven of the nine Australasian parent resources scored 2 in the parental choice category (meaning that while it was acknowledged that parents could make their own decision concerning vitamin K, they also recommended IM vitamin K prophylaxis) while one brochure made no mention of parental choice, and one portrayed the choice as entirely the parents responsibility without relaying the standard recommendation (refer to Table 1 and Appendix 1 for scoring).

No New Zealand parent brochures were available in languages other than English, in contrast to the Australian NHMRC brochure, which is available in seven different languages.

Health professional resources

Information coverage varied significantly between the consensus statement from the New Zealand College of Midwives and the other consensus statements, although it is acknowledged that the midwifery statement does not purport to be a resource concerning clinical aspects of vitamin K and includes a list of references. The midwifery statement was alone in not making the recommendation of IM vitamin K being the preferred option, instead emphasising parental choice (Table 1). In contrast, the CDC resource made no mention of parental choice.

In addition, the CDC health professional resource stated that “in the majority of cases of VKDB, there are no warning signs before a life-threatening bleed occurs”. This is in contrast to the New Zealand Medsafe data sheet, which states “most cases of severe VKDB are preceded by ‘warning bleeds’”.

Discussion

This is the first study to identify and analyse key information resources available to parents and professionals about newborn vitamin K prophylaxis. The key findings are that in Australasia, there are a large number of such resources available to parents and health professionals, particularly in New Zealand. Some of these vary significantly with regard to all aspects studied, including content, message and tone. This may have important implications for the parental decision-making process. While only resources related to vitamin K were analysed in this study, the problems discussed are likely to be relevant to many other health interventions.

In relation to information coverage, it is widely acknowledged and incorporated in the New Zealand code of patient rights, that patients (or their parents) have a right to be provided with good quality information regarding their healthcare options.²¹ It has also been shown that providing patients with good quality information, especially if written, increases recall.²² In this study we have not attempted to articulate the ‘right’ amount of information to provide to patients, rather we aim to highlight the significant variation that exists in this regard. We do however, agree with the New

Zealand Medsafe guideline that acknowledges that where there has been significant debate and uncertainty (as there was in the last two decades over the safety of vitamin K), it is particularly salient to provide adequate information, and further information should be available should a patient feel they need it.¹⁵

A lack of information, or a perception of this, has also been associated with patient anxiety in a number of healthcare areas. With immunisation, this perception has led to negative attitudes by families towards immunisation and even towards healthcare providers.²³ There does however, exist a tension between providing patients with enough information to facilitate informed decision-making without overwhelming them with excessive or irrelevant information.²⁴ Aspects of information provided to parents, such as incidence of an illness or serious outcomes, are important and should ideally be reproducible between all sources of information. However, these often varied considerably. While we acknowledge there are difficulties in determining an exact figure for the incidence of VKDB, it is potentially confusing for both parents and professionals to be exposed to such widely differing statistics, particularly when data sources are not referenced. This confusion comes in part from the literature, which is also not clear on this subject, and differs between papers depending on the country of origin, the definition of VKDB used and whether the data comes pre- or post-introduction of vitamin K prophylaxis. The most recent figures available for New Zealand come from surveillance of neonatal VKDB between 1998–2008 when the overall incidence of classic VKDB (in the presence of an established public health prophylactic programme) was found to be 1.24/100,000 live births. These authors also postulate a figure of or approximately one in 1,439 for the incidence of VKDB in infants not receiving prophylaxis.³

Our study has also shown that there is consensus across all documents, except the New Zealand College of midwives, that vitamin K is recommended for all babies and that IM prophylaxis is the recommended route. This deviation is important to note, as evidence suggests that when health professionals recommend such interventions, this is likely to influence parents.

For example, a recent report concerning parental attitudes to vaccination found that most parents (87%) stated that they usually follow their health care provider's advice.²⁵

However, recommending vitamin K to parents does not imply that parents' choices should ultimately be constrained. While our study found a high degree of consistency with regard to the recommendation, there was some variation in how parental choice was approached. In particular there were subtle but potentially important differences between the various consensus statements. The Medsafe statement states that "it is the responsibility of the lead maternity carer (LMC) to discuss vitamin K prophylaxis and ensure that parents are aware of the recommendation that all babies should receive vitamin K prophylaxis",¹⁵ the NHMRC statement says "Parents should receive written information during the antenatal period about the importance of vitamin K prophylaxis"²⁶ and the midwifery consensus statement states that "Midwives should ensure the woman is informed and supported to reach her own decision on whether vitamin K is to be given intramuscularly, orally or not at all".²⁷ These differing wordings may affect how the decision is portrayed to parents. They may also reflect a deeper divide—in recent New Zealand data, only 55% of midwives thought that all babies should receive vitamin K, compared to 100% of medical staff.¹⁴

Again, in this paper we are not attempting to articulate the most ethically acceptable approach to parental choice in this context but rather to raise concerns about the lack of clarity that currently exists. Highlighting this variability may provide an opportunity for practitioners and professional groups to further reflect, decide upon a preferred approach and articulate this clearly in policy, as has occurred with immunisation and the "Immunisation Handbook".

A particular strength of this study is the involvement of midwives in sourcing documents used in a real world setting. This is important as in New Zealand, midwives provide the primary maternity care for the majority of pregnant women. The high response rate from NICUs (100% in New Zealand) is an additional strength, ensuring an appropriate snapshot of what information is being provided to parents through

major centres in the antenatal and postnatal periods in both countries. However, we did not contact smaller maternity units in New Zealand or Australia, or specifically target homebirth midwives, and only approached the two community antenatal education providers in Dunedin rather than conducting a nationwide survey. It is therefore possible that the number and variety of resources included in this study is an underestimate of the true total. If this was the case, it would add further weight to our argument that it would be beneficial to further standardise the information available. Similarly, although our study has determined that no New Zealand parent brochures were available in languages other than English, we did not assess how health professionals respond to this difficulty with families of different ethnicities.

In conclusion, many different information resources on newborn vitamin K prophylaxis are available. In New Zealand, this is a particular problem, where multiple resources are in use with often subtle but important differences in content and overall message. Ideally, especially for New Zealand, and to bring vitamin K prophylaxis more into line with comparable interventions such as immunisation and newborn screening, more standardised information regarding newborn vitamin K prophylaxis should be available. A standardised brochure would facilitate easier review of content, ensuring information remains up to date, accessible and aligned with best practice. More importantly, this would ensure all parents receive the same information, regardless of language, location or place of birthing.

Competing interests:

Hayleigh Miller reports grants from HRC Summer Studentship Scholarship during the conduct of the study.

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Appendix 1: Assessment instrument.

Organisation producing pamphlet	
Title of pamphlet	
<i>Completeness of information</i>	
What is vitamin K?	0-3
What is VKDB?	0-3
Prophylaxis options (IM/oral/none)	0-3
Timing of prophylaxis	0-3
Benefits of prophylaxis	0-3
Potential harms of prophylaxis	0-3
Medsafe recommendation stated	Y/N
Parental choice	1-3

Appendix 2: Complete data.

Organisation	Completeness of information						Medsafe recommendation stated	Parental choice
	What is vitamin K?	What is VKDB?	Options	Timing	Benefits	Side effects		
Parent information*								
Auckland DHB	1	3	3	2	2	0	Y	2
Canterbury DHB	3	2	2	2	3	2	Y	2
Capital and Coast DHB	1	1	3	2	1	2	Y	2
Counties Manukau DHB	2	2	3	3	2	3	Y	2
Southern DHB	2	3	1	1	1	1	Y	1
Waikato DHB	2	3	3	2	2	3	Y	2
Waitemata DHB	3	3	3	3	2	3	Y	2
Women's Health Action Trust	3	3	3	3	2	3	N**	3
Australian Government NHMRC	1	1	3	3	2	2	Y	2
CDC	1	2	0	0	3	2	Y	1
Professional information*								
Ministry of Health	1	3	3	3	3	2	Y	2
College of Midwives	0	0	3	0	1	0	N	3
Australian Government NHMRC	3	3	3	3	3	2	Y	3
CDC	2	2	0	1	3	1	Y	1

Abbreviations: * DHB—District Health Board; NHMRC—National Health and Medical Research Council; CDC—Center for Disease Control.

** This resources stated that New Zealand Health Professionals recommend vitamin K but not that intramuscular is the preferred route.

The scratch test for identifying the lower liver edge is at least as accurate as percussion and is significantly more effective for young trainees—a randomised comparative trial

Alexander Huelsen, Jesse Fischer, Justin Hegarty, Anna Ashcroft, Christopher MA Frampton, Murray L Barclay

ABSTRACT

BACKGROUND: Clinical examination of the liver requires experience to achieve accuracy. The scratch test is a simple technique to identify the lower liver edge and enhance liver palpation, and may be easier for trainees.

AIM: We aimed to evaluate the accuracy of the scratch test compared to percussion at different levels of medical training.

METHOD: Eight examiners, from trainee intern to consultant level, were randomised to scratch or percussion testing, followed by liver palpation, on 50 subjects. Later, each examiner performed the alternative test on each subject. Confidence with each test was rated 0–3 (unsuccessful–very confident). Ultrasound scan (US) was performed as a reference for liver location.

RESULTS: Ultrasound revealed 33/50 (66%) of livers extended below the right costal margin in the midclavicular line during quiet respiration (range 0.5–16cm). Of these, 33, 87% and 76% were identified within 2cm of the US location using scratch and percussion tests, respectively ($p>0.05$) for all examiners, but with significantly greater accuracy for the scratch test in young trainees (91% v 75%; $p=0.016$). Ability to palpate the liver was not different following either test. The training effect was assessed by comparing the accuracy results of the first 25 with the last 25 examined subjects, revealing a significant increase in accuracy with percussion from 71% to 85% ($p=0.038$) compared to no change with the scratch test (88% and 86%).

Examiner confidence in the test result was significantly higher using the scratch test versus percussion, average confidence scores being 2.2 versus 1.8 ($p<0.001$), with a greater difference in the young trainee group at 2.4 versus 1.7 ($p<0.001$).

CONCLUSION: The scratch test was at least as accurate as percussion overall in identifying the lower liver edge and significantly more accurate for the young trainees. The scratch test requires less training and in addition, all examiners and especially the young trainees were significantly more confident in their findings using the scratch test.

The liver examination performed with percussion and palpation requires experience and remains challenging for young trainees. Clinical liver span estimations with percussion are problematic due to significant underestimation of size and poor inter-examiner agreement that largely relates to variation in estimation of the upper liver border.¹⁻³ Furthermore, clinical liver span correlates poorly with liver volume in the absence of liver disease.⁴ The ability to identify and palpate the lower liver edge (LLE) however, remains of clinical relevance as it allows the examiner to gain information regarding liver size and consistency.

Our local experience suggested that a different method for identifying the lower liver edge, known as the scratch test, would be easier for trainees and enhance success with liver palpation. The scratch test is a simple technique that was first described in principle in the early 20th century.⁵ However, until now there has been insufficient evidence to define its role in the clinical examination of the liver.

We therefore aimed to evaluate the accuracy of the scratch test in a randomised controlled trial and compare with the current clinical standard of liver examination by percussion, both followed by palpation.

Method

Study design

This was a single centre randomised controlled study conducted in a tertiary hospital in New Zealand. The regional Ethics Committee approved the study protocol and written informed consent was obtained from each participant before enrolment in March and April 2012.

All authors had substantial roles in the design and/or execution of the study. The data was analysed by the first author with the assistance of a statistician.

Participants

The 50 study subjects were inpatients and outpatients of the General Medicine and Gastroenterology Departments at Christchurch Hospital, New Zealand, as well as staff members from Christchurch Hospital, and all were over the age of 16 years. Exclusion criteria were pregnancy, recent abdominal surgery, abdominal pain, inability to lie supine for 30 minutes and

inability to fast for three hours prior to, and during the two hours of the study.

Demographic data collected included subject age, gender, weight and height.

Study protocol

The 50 subjects were examined in groups of 10 on five study days. There were eight examiners at different levels in their medical career, including two trainee interns (final year medical students), two house surgeons, two registrars, one consultant gastroenterologist and one consultant physician. All examined on each study day, examining all subjects twice.

All examiners had formal training in liver percussion and palpation during their medical career.⁶ The scratch test technique was introduced as follows: the young trainees underwent three 30-minute bedside teaching sessions, the registrars were familiar with the technique due to previous exposure and a pilot study, and both consultants underwent one 20-minute training session.

For the scratch test, the stethoscope was placed directly below the xiphoid. Then light strokes were performed with the tip of the index finger passed across the right midclavicular line (MCL) starting above the right costal margin (RCM) and moving inferiorly to identify a significant reduction of the auscultated 'scratch' noise. This location was assumed to correlate with the LLE position. The percussion method was performed along the MCL only to identify the LLE. All participants were positioned supine and marked as demonstrated (Figure 1).

An independent person performed subject randomisation. On each study occasion, subjects and examiners were allocated randomly to one of 10 examination cubicles and examinations started simultaneously. All examiners switched cubicles every two and a half minutes for five examinations, with the randomly allocated scratch or percussion test followed by palpation, and then the alternative test followed by palpation was performed for the remaining five subjects. After a 30-minute break, the system was repeated with percussion and scratch tests reversed so that all subjects were examined by both methods by each examiner.

Measurements with scratch and percussion tests were documented on examination during quiet respiration and

Figure 1: Preparation and marking of participants prior to examination.



on maximum inspiration. Confidence with the test result was graded on a scale from 0–3 (0=unsuccessful, 1=unsure, 2=confident, 3=very confident). Liver palpation was graded on a scale from 0–3 (0=not palpated, 1=unsure, 2=palpated, but no details, 3=palpated and able to feel details of liver rim and surface). In cases of successful liver palpation the examiners documented the position of the LLE and graded the helpfulness of the clinical test towards palpating the liver on a scale from 0–3 (0=confusing, 1=not helpful, 2=helpful, 3=exact position). Directly following the clinical examination session, all participants underwent ultrasound examination (US) (Siemens Acuson Antares PE, model number 10032746 with a 4-1 MHz curved array transducer using the manufacturer abdominal preset) by an advanced radiology trainee competent in ultrasound and blinded to the clinical test results. The liver location was documented in the MCL during quiet inspiration and expiration and on maximum inspiration. The presence of ascites (none, mild, moderate, large) and extent of liver below the xiphoid (none, <1cm, <2cm, >2cm) was also documented.

Study outcomes

The primary outcome of the study was accuracy of the scratch and percussion tests in identifying the LLE, defined as test result within 2cm of the ultrasound reference. This

was assessed overall and in the subgroups of young trainees (trainee interns and house surgeons) and experienced examiners (registrars and consultants). The secondary outcomes included scratch versus percussion test comparisons for examiner confidence in clinical tests, success and confidence with liver palpation, training effect and Body Mass Index subgroup analysis (BMI<25, BMI 25–30 and BMI≥30).

Statistical analysis

The dichotomous primary outcome measure from the study was the correct identification of the LLE within 2cm of the ultrasound reference. The nested study design meant that all examiners examined each participant with both scratch and percussion techniques. A generalised linear model was used to test the effects of examiner (including experience sub-groups) and participant BMI on the primary and secondary outcomes. The dichotomous primary outcome used a generalised linear model with a binomial distribution for the dependent variable with a logit link function. The other outcome measures used a generalised linear model with a normal distribution and a linear link function. Means with standard deviations or 95% confidence intervals were generated from these models and were used to summarise the differences between groups. A two-tailed p-value <0.05 was taken to indicate statistical significance.

Table 1: Study group characteristics.

Characteristic	Statistic	Study group n=50
Sex (no.)	Female	28 (56%)
	Male	22 (44%)
Age (years)	Mean (range)	48 (20–92)
Height (cm)	Mean (range)	170 (150–195)
Weight (kg)	Mean (range)	76 (45–128)
BMI (kg/m ²)	Mean (range)	26.2 (16.7–44.3)

Given that each examiner examined all participants with both tests, bias at the time of the second examination cannot be ruled out. Therefore, several results were also calculated using only the first performed tests.

Results

The same eight examiners examined 50 participants as per study protocol. The characteristics of our study cohort are shown in Table 1. Of the participants, 30% (n=15) were

inpatients and 70% (n=35) were outpatients and/or hospital staff members.

Ultrasound examination

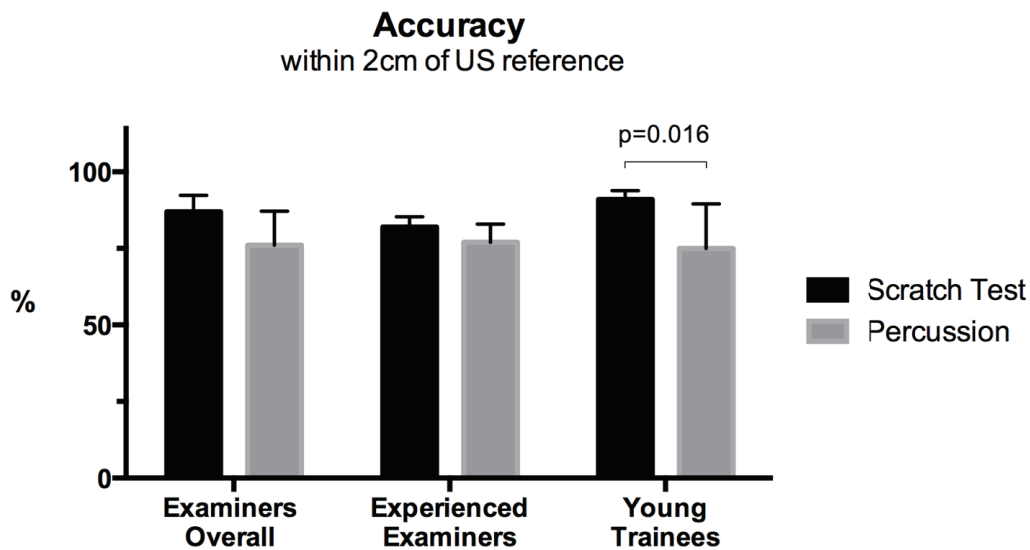
Ultrasound examination revealed that 66% of the livers extended below the RCM during quiet respiration (n=33; range >0–16cm). The mean LLE movement during quiet respiration was 1.3cm (range 0.5–3.5cm; SD 0.67) and from quiet expiration to maximum inspiration, a mean of 3.8cm movement was detected (range 1.5–8cm; SD 1.72). All results of the ultrasound examination are detailed in Table 2.

Table 2: Reference imaging results.

Ultrasound examination findings	n (%) mean in cm (range/ SD)
Ascites	0 (0%)
Livers extending below xiphoid during quiet respiration (stethoscope position)	
>2cm	41 (82%)
>1–2cm	5 (10%)
>0–1cm	4 (8%)
0cm	0 (0%)
Livers extending below RCM in MCL during	
Quiet expiration	25 (50%)
Quiet inspiration	33 (66%)
Livers remaining above RCM during quiet respiration	
Livers below RCM in MCL on maximum inspiration	47 (94%)
Livers remaining above RCM on maximum inspiration	3 (6%)
LLE position at (only livers below RCM included; n=25)	
Quiet expiration	2.8cm (0.5–14/ 3.0)
Quiet inspiration	4.1cm (1–16/ 3.2)
Maximum inspiration	6.6cm (2.5–17/ 3.3)
Respiratory liver motion in MCL	
During quiet respiration	1.3cm (0.5–3.5/ 0.85)
Quiet expiration to maximum inspiration	3.8cm (1.5–8/ 1.7)

Table 3: Results for scratch test versus percussion.

		Scratch test	Percussion	Significance	
Mean differences Compared to ultrasound reference in cm (95%CI)				p-value	
Quiet respiration		-0.8 (-0.97– -0.66)	-1.1 (-1.25– -0.95)	0.01	
Maximum respiration		-2.2 (2.38– -2.03)	-2.7 (-2.89– -2.53)	<0.001	
Accuracy within 2cm of ultrasound reference in % (SD)					
Below ribs					
Overall		84 (5.2)	81 (4.7)	n.s.	
Overall (1 st)		87 (5.3)	76 (11.2)	n.s.	
Exp. examiners (1 st)		82 (3.3)	77 (5.9)	n.s.	
Young trainees (1 st)		91 (2.9)	75 (14.6)	0.01	
Above ribs					
Overall		68 (20.4)	83 (13.6)	0.79	
Incl. 2cm below ribs		96 (3.5)	96 (2.5)	n.s.	
Confidence with test result Confidence score 0–3					
Livers below RCM					
Overall		2.2	1.8	<0.001	
Overall (1 st)		2.3	1.8	<0.001	
Young trainees (1 st)		2.4	1.7	<0.001	
BMI subgroups Accuracy within 2cm of ultrasound reference following 1 st tests in % (SD)					
<25	n=22	95 (21.3)	88 (32.3)	0.17	
≥25–<30	n=17	86 (34.8)	76 (43.5)	0.29	
≥30	n=11	77 (43.0)	53 (50.7)	0.08	
Palpation success Lower liver edge following 1 st tests in % (SD)					
Overall		61.5 (24.3)	61.5 (21.7)	n.s.	
Exp. examiners		76 (21.9)	73 (18.6)	n.s.	
Young trainees		47 (16.8)	50 (18.2)	n.s.	
Test helpfulness for palpation Helpfulness score 0–3					
Overall		2.0	1.8	0.13	
Confidence with liver palpation Confidence score 0–3					
Overall		1.7	1.7	n.s.	
Training effect Accuracy within 2cm of ultrasound reference in % (SD)		First 25 subjects	Last 25 subjects		
Scratch (1 st)		Overall	88 (5.5)	86 (9.0)	n.s.
		Exp. examiners	85 (2.8)	80 (8.1)	n.s.
		Young trainees	90 (6.2)	92 (5.0)	n.s.
Percussion (1 st)		Overall	71 (15.5)	84 (11.3)	0.03
		Exp. examiners	71 (11.6)	85 (9.8)	0.08
		Young trainees	70 (18.5)	82 (11.1)	n.s.

Figure 2: Accuracy within 2cm of the ultrasound reference.**Accuracy during quiet respiration**

Overall, the scratch test accurately identified 87% of the LLEs that were present below the RCM during quiet respiration compared to 76% with percussion (only 1st tests, $p=0.162$).

The young trainees achieved a significantly better accuracy of 91% with scratch testing compared to 75% with percussion (only 1st tests, $p=0.016$) (Figure 2).

The mean difference between the LLE estimation by clinical tests compared to the ultrasound reference was calculated using negative values for underestimation and positive values for overestimation of the LLE

position. The scratch test was overall significantly more accurate (p -value=0.01) with a mean difference of -0.8cm (95%CI -0.97–-0.66) compared to percussion -1.1cm (95%CI -1.25–-0.95) (Table 3).

Of the 17 livers that were located behind the ribs during quiet respiration (LLE location at or above the RCM), 68% and 83% were accurately identified as behind the ribs with the scratch and percussion method ($p=0.79$). The sensitivity for identifying a liver located behind the ribs increased to 96% for both tests if test results within a 2cm margin below the RCM were determined as ‘correct’ tests (Table 3).

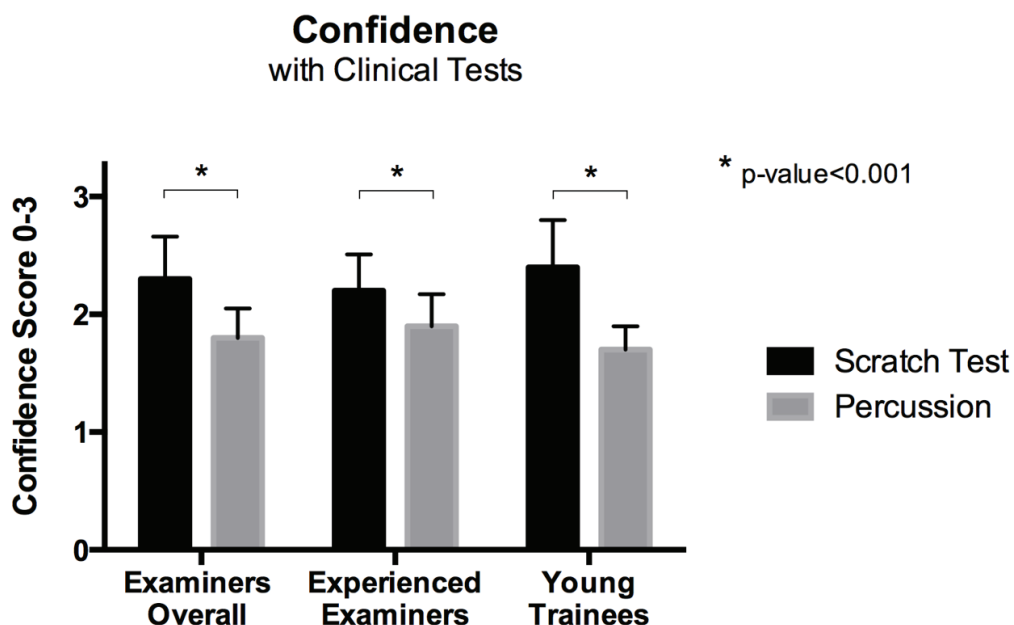
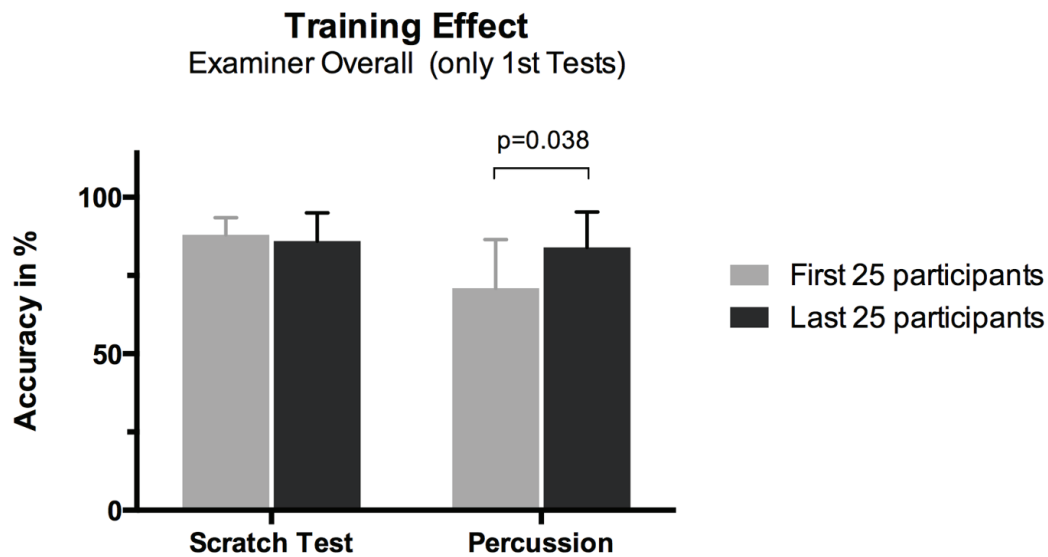
Figure 3: Examiner confidence with the clinical tests.

Figure 4: Training effect (only first performed tests included).



Confidence

All examiners were significantly more confident with their test results using the scratch test compared to percussion in identifying the liver below the RCM with an average of 2.2 compared to 1.8 on a confidence scale from 0–3 ($p < 0.001$) (Table 3 and Figure 3).

Maximum inspiration

The identification of the LLE on maximum inspiration was performed to demonstrate that clinical tests detect underlying liver that moves with respiration. Overall, the scratch test identified the LLE significantly better ($p < 0.001$) with a mean difference of -2.2cm (95%CI -2.38– -2.03) compared to -2.7cm (95%CI -2.89– -2.53) with percussion.

Training

Comparing the examination results for the first and last 25 subjects assessed the training effect. Only first performed clinical tests were included in this analysis. There was no training effect with scratch testing noted overall or in any subgroup. However, accuracies improved from 71% to 84% with percussion ($p = 0.038$) (Table 3 and Figure 4).

BMI

The performance of the clinical tests was compared between different BMI groups: BMI < 25 (normal weight and under), BMI 25–<30 (overweight), BMI \geq 30 (obese). There was a significant decrease in accuracy with increasing BMI ($p = 0.015$) but there was no significant difference between the scratch

and percussion tests within any of the BMI groups (Table 3).

Palpation

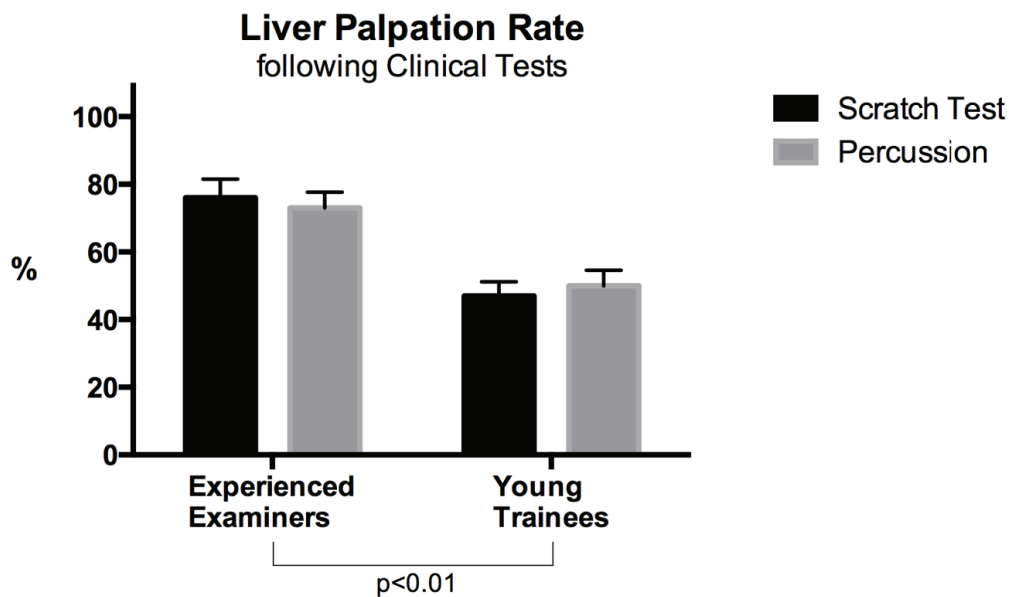
Only results for palpation following the first-performed tests were analysed to avoid bias. Both percussion and scratch tests led to a mean liver palpation rate of 61.5%. However, there were significantly more livers palpated successfully in the subgroup of experienced examiners following the scratch and percussion method with 76 and 73%, respectively, compared to the young trainees with 47 and 50% respectively ($p < 0.001$ for both tests) (Table 3 and Figure 5).

Overall, for the scratch and percussion tests, 57 and 54% of the palpated livers respectively, were identified within the ultrasound defined range of quiet expiration to maximum inspiration. Using palpation results within 2cm of this range, 84 and 82% of livers were palpated following the scratch and percussion tests respectively. We note that liver palpation is a more dynamic technique usually co-ordinated with deep breathing and therefore accuracy results cannot be directly compared with scratch and percussion results, which were strictly performed during quiet respiration.

Liver palpation confidence

Confidence with liver palpation on a scale from 0–3 averaged 1.7 for all examiners. There was no statistical difference between young trainees and experienced examiners. The young trainees and the experienced

Figure 5: Liver palpation rate following clinical tests.



examiners rated their confidence with palpation as 1 in 56% and 49%, as 2 in 36% and 39% and as 3 in 8% and 12% respectively (Table 3).

Test helpfulness for palpation

Both clinical tests were felt to be helpful for subsequent liver palpation with a mean of 2.0 for the scratch test and 1.8 for the percussion method ($p=0.133$) (Table 3).

Discussion

Liver examination performed with percussion and palpation requires experience and remains challenging for young trainees. We compared the scratch test, a newer and possibly easier examination method for trainees, with percussion in a randomised trial.

We found that the accuracy of the scratch test in identifying the lower liver edge was similar overall to the percussion method but was significantly better than percussion in the young trainee group. Furthermore, both clinical tests performed considerably better than previously reported.^{1,7-12} We have reviewed our findings compared to earlier published results.

Sullivan et al used hepatic scintiscan as a reference and in this study the upper liver border was always percussed and the LLE identified by percussion, scratch or palpation.¹ As in our study, accuracies of

scratch and percussion tests were similar, although accuracies within 2cm of the reference were only 42% and 40% respectively. However, these results cannot be compared with ours as the liver size was assessed rather than LLE and the major variation affecting accuracy resulted from upper liver border percussion variability leading to a significant underestimation of the liver size.

Only three studies in the English literature have assessed the scratch test by using ultrasound as a reference and have come to quite differing conclusions.^{7,8,9} Fuller et al used the scratch test as an adjunct to percussion and palpation to identify the LLE and accuracy of trainees improved from 44% to 78%.⁷ This appears similar to our results of 84% accuracy overall for the scratch test alone and a subsequent successful palpation rate of 61.5%. However, the poor performance of percussion in this study deviates from our results and is difficult to explain.

In a second study using ultrasound as a reference, the scratch test was reported to be unreliable for detecting the LLE.⁸ However, no landmarks were defined and clinical tests were performed in end-tidal inspiration whereas the ultrasound reference was performed in suspended end-tidal inspiration.

During a pilot study conducted by our study group it became apparent that the measurement of the LLE position by scratch

and percussion testing was only adequately reproducible and comparable when performed along a pen marked MCL that included measurement markings. Without this, there is a wide possible measurement area and poor intra- and inter-examiner agreement occurred. This was also reported in a study from Naylor et al who observed variations in estimating the position of the MCL of up to 10cm between different examiners.¹⁰ Only the studies from Fuller and Gupta et al recognised this considerable source of error whereas most others appear not to have predefined relevant landmarks.^{7,9} We also found that any interference with normal breathing activity affected reproducibility. Therefore we chose to assess clinical tests during quiet respiration, accepting that the true LLE position in our study and in 'real life' is in fact a 1.3cm wide band given the average liver motion during quiet respiration in our cohort. This finding is in keeping with previous imaging studies that have reported an average liver motion of 1.0–2.5cm during quiet, and 3.7–5.5cm during maximum, respiration.^{13–15}

In the most recent study by Gupta et al, skin markings were made and subsequently excellent inter-examiner agreement was found, however, ultrasound reference measurements were performed after the command 'hold your breath', which was not given prior to the scratch test.⁹ In our experience, such a command always led to a variable inspirational effort that was neither reproducible nor in keeping with the lower liver edge position during quiet respiration. It appears that this study therefore contains a variable systematic error that is not correctable and probably contributed to the reported poor accuracy of 37% for the scratch test.

It seems that the absence of defined landmarks, inadequate reference imaging or inappropriate timing of reference imaging were the most likely causes for the significantly lower performance outcome of the scratch and percussion tests in previous studies.

Furthermore, our stethoscope position directly below the xiphoid is closer to the liver surface than in most previous studies where the stethoscope was placed on the xiphisternum or in various locations above the ribs, which may have affected sound

transmission. However, to our knowledge this variable has never been assessed.

Interestingly, a significant training effect was only noted with the percussion method ($p=0.038$) but not with scratch testing where the performance was excellent from the start. Also compelling is the lack of a training effect with scratch testing, given the few training sessions prior to our study. Percussion was also performed during these sessions to calibrate the technique and for comparison, and yet there was an ongoing training effect for percussion. This is surprising as the technique forms part of the standard clinical examination and is formally taught and assessed throughout medical training, raising concern that periodic training may be required to maintain expertise in percussion.

From our own experience we also note the added difficulty in performing percussion confidently compared to the scratch test in a noisy environment, which is frequently encountered in emergency departments or medical wards. Our study was performed in a highly controlled and quiet environment, however, despite this confidence in the test result was significantly better for the Scratch test. We speculate that this difference may be even more relevant in above clinical real life scenarios.

Not surprisingly, our study and the study from Gupta et al clearly showed that increasing BMI worsens clinical test accuracy.⁹

The examiners rated clinical tests after each examination in regards to their helpfulness for subsequent liver palpation and there was no statistical difference noted between scratch and percussion tests. Even in the young trainee group where the scratch test achieved a significantly better accuracy, the subsequent liver palpation rate remained statistically similar to that following percussion, and this accuracy advantage may therefore not be clinically relevant.

As expected, experience was associated with a significantly more accurate palpation rate of over 70%, however, the ability to feel details of the liver surface (confidence rating 3) was only achieved in 12% of all palpated livers and this was only marginally superior to the trainee group. This appears disappointing, however, our cohort was

overweight on average (average BMI>26) and not preselected for liver disease. The presence of cirrhosis or liver malignancy is likely to increase palpation success and confidence given the associated alterations in liver edge position and firmness. This is underlined by a study from Zoli et al that reported an excellent palpation rate of over 95% in a cirrhosis cohort.⁴

Our study only assessed the performance of the clinical tests in identifying the LLE and not the liver span. This was based on the facts that the liver span does not appear to correlate well with liver volume and that the upper liver border is hidden in the depth of the rib cage, which leads to a poor performance of sound transmission based clinical tests.¹⁻⁴ We believe that the true value of percussion and especially the scratch test lies in facilitating within a few seconds a confident and targeted palpation of the LLE and liver surface. In our experience, using targeted light palpation is then already

frequently successful. On the basis of our study results we suggest such a targeted approach as an alternative to the existing clinical examination methods of the liver.

Conclusion

We conclude that the accuracy of percussion and scratch testing to locate the lower liver edge is considerably better than previously reported. The scratch test performed with the stethoscope directly below the xiphoid is at least as accurate as percussion overall and significantly more accurate for young trainees. Furthermore, the scratch test was easier to learn, achieved excellent results from the start and all examiners were significantly more confident with their results using the scratch test compared to percussion. Given our results, we suggest a targeted liver palpation approach following a confident scratch or percussion test result as an alternative to the existing clinical examination methods of liver palpation.

Competing interests:

Nil.

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The electronic tracking of referral and attendance at cardiac rehabilitation in Counties Manukau Health: a potential model for New Zealand

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ABSTRACT

AIM: Cardiac rehabilitation (CR) programmes for patients surviving an acute coronary syndrome (ACS) event are important and recommended by clinical guidelines. Referral and attendance, however, remain suboptimal and tracking both of these aspects to inform quality improvement has been difficult. The aim of this study was to describe the use of an electronic registry to capture referral and attendance at CR in CMH and to report the characteristics of the initial cohort.

METHOD: We developed and implemented an electronic tracking tool, designed to be compatible with ANZAC-QI to monitor referral and attendance in a cohort of patients with confirmed ACS between 1 January 2013 and 1 January 2015.

RESULTS: Over 90% of patients with confirmed ACS had in-hospital phase 1 CR and three quarters were referred for post-discharge phase 2 CR. Of those with an ACS diagnosis, half attended at least one CR intervention but only a third completed their planned programme. Older patients and women were less likely to be referred for CR and those without in-hospital revascularisation, current smokers and with prior CVD were least likely to attend after referral.

CONCLUSION: Despite offering a range of CR options including community, clinic one on one and home based CR, the uptake of CR in patients with ACS remains suboptimal. An electronic tracking process was easy to use and has identified referral and attendance deficits that can be improved. Exploring new models of structured secondary prevention process, alongside encouraging referral and supporting attendance at established CR programmes, will offer benefits.

Ischaemic heart disease continues to be a major cause of morbidity and premature mortality for New Zealanders.¹ Consequently, reducing cardiovascular events remains a priority across all levels of prevention—primary, secondary and tertiary.² With almost half of all major cardiac events occurring in survivors of acute coronary syndrome (ACS),³ optimising secondary preventive management following an ACS admission has the potential to make a significant impact on cardiovascular morbidity and mortality.⁴

Cardiac rehabilitation (CR) is a multi-faceted, complex secondary prevention

intervention⁵ preferably delivered by a multidisciplinary team.^{6,7} A recent Cochrane review reported that exercise-based CR reduces cardiovascular mortality (26–36%), as well as resulting in a 28–56% reduction in unplanned hospital readmissions.^{8,9} Furthermore, attendance at CR improves exercise capacity, quality of life and psychological well-being.^{10–12}

In New Zealand, CR programmes face multiple challenges and, like CR programmes in other jurisdictions, are underutilised by patients for a variety of reasons.^{13–17} Furthermore, there is substantial variation and heterogeneity

in CR services nationally.¹⁸ The lack of a nationally agreed set of CR specific process and outcome measures means the efficacy of CR programmes in New Zealand is uncertain, the various models of CR are incomparable and as an intervention, the utility and cost-effectiveness of CR cannot be demonstrated to the funders and planners of cardiology services.

One of New Zealand's 20 district health boards, Counties Manukau Health (CMH) has implemented a range of options for the delivery of CR over the last 10 years and as a result referral and attendance has increased.^{19–21} The ability to accurately assess the usefulness and impact of these various options has been hindered by the hospital IT system, as recording referral to CR programmes is cumbersome and tracking CR engagement inaccurate. In an attempt to address these issues and with a view to developing a minimum dataset, which could potentially have utility for CR nationwide, the CR team and a small group of software developers from Enigma Publishing Ltd developed and implemented a real-time electronic CR tracking process in 2013.

This paper describes the initial cohort of those referred to CR and entered into a new electronic tracking tool following an ACS event and their engagement or otherwise with the CR service.

Method

The electronic CR tracking process has been designed to capture referral, subsequent attendance and reason for non-referral/non-attendance to CR at CMH. Minimal extra data collection is required, making it straightforward to use, which has encouraged consistent use by staff. The system is integrated with the All New Zealand Acute Coronary Syndromes – Quality Improvement (ANZACS QI) registry, currently used in the majority of New Zealand hospitals to support quality improvement (QI) for patients with ACS.¹⁹ Patients with confirmed ACS admitted to the coronary care unit and entered into the ANZACS QI registry made up the cohort for investigation. A previous local audit identified that over 90% of all ACS admissions were captured in the ANZACS QI registry, although this may not be a realistic target across the country where ACS patients may

be managed in a less consistent cardiology-led process.²⁵

An important challenge was capturing and reporting activity accurately across multiple patient flow scenarios and referrals. This included capturing data at each of the following steps: ACS patient registration; referral; and attendance at one or other of the multiple CR programme options available at CMH. Because the system potentially captured multiple referrals/non-referrals and attendance/non-attendance for each patient, a prioritisation algorithm to “clean” the data was created to ensure patients were only counted once for each episode of care.

Attendance is defined, as any attendance at a phase-2 programme and completion is assessed as having attended all of the programme sessions available, eg the evening programme provides a weekly session for three weeks, therefore completion was attendance at all three of the sessions.

An electronic report is generated to capture referral/non-referral and attendance/non-attendance, and this has the ability to be linked to demographic and clinical variables. A manual check was added to ensure all patients entered into CR tracking have a telephone follow-up after discharge, as part of the CR workflow. This provides another opportunity to encourage patients who did not wish referral or did not attend to engage with CR.

Descriptive statistics for continuous variables were summarised as mean and standard deviation and median and interquartile range. Categorical data are reported by frequency and percentage. For continuous variables, the Wilcoxon Mann-Whitney test was used for comparison between two groups as the data is not normally distributed. For categorical variables, Chi-squared test or Fisher exact test were used where appropriate. All P-values reported were two tailed, and a p-value <0.05 was considered significant. Data was analysed using SAS statistical package, version 9.3 (SAS Institute, Cary, NC).

Stepwise multivariate logistic regression was also developed to investigate the predictors of attendance of CR for those referred. Covariates adjusted for in the

Table 1: Baseline and referral data.

	Total (n = 1538*)	Referred to CR (n = 1119, 72.8%**)	Not referred to CR (n = 419, 27.2%**)	P-value
Age				
Mean ± SD	62.8 ± 12.5	61.4 ± 12.1	66.3 ± 12.8	
Median (IQR)	63 (53–72)	61 (53–71)	67 (57–76)	<.0001
Range	22–96	30–91	22–96	
Gender, n (%)				
Male	1104 (71.8)	829 (75.1)	275 (24.9)	0.001
Female	434 (28.2)	290 (66.8)	144 (33.2)	
Ethnicity, n (%)				
Māori	168 (10.9)	121 (72.0)	47 (28.0)	
Pacific	307 (20.0)	234 (76.2)	73 (23.8)	0.1043
Indian	212 (13.8)	164 (77.4)	48 (22.6)	
Other Asian	68 (4.4)	52 (76.5)	16 (23.5)	
European/Other	783 (50.9)	548 (70.0)	235 (30.0)	
Type of ACS, n (%)				
Unstable angina	143 (9.3)	116 (81.1)	27 (18.9)	
NonSTEMI	1047 (68.1)	740 (70.7)	307 (29.3)	0.0128
STEMI	348 (22.6)	263 (75.6)	85 (24.4)	
PCI and/or CABG	987 (64.2)	796 (80.6)	191 (19.4)	<.0001
Previous CVD, n (%)	507 (33.0)	330 (65.1)	77 (34.9)	<.0001
Type 2 diabetes, n (%)	483 (31.4)	346 (71.6)	137 (28.4)	0.5040
Smoking, n (%)				
Non-smoker	732 (47.6)	526 (71.9)	206 (28.1)	0.1596
Ex-smoker	378 (24.6)	267 (70.6)	111 (29.4)	
Current smoker	428 (27.8)	326 (76.2)	102 (23.8)	
Body Mass Index, n (%)				
<25	292 (19.0)	195 (66.8)	97 (33.2)	0.0019
25–30	558 (36.3)	416 (74.6)	142 (25.4)	
>30	558 (36.3)	435 (78)	123 (22)	
Missing data	130 (8.5)	73 (56.2)	57 (43.8)	
Low density lipoprotein median (IQR)	2.6 (1.8–3.3)	2.6 (1.9–3.4)	2.3 (1.7–3.2)	0.0015
Systolic blood pressure median (IQR)	138 (122 – 156)	138 (122–156)	136 (120–155)	0.3187
Grace score, probability of death in hospital,²² n (%)				
Low (<1%)	473 (30.8)	376 (79.5)	97 (20.5)	<.0001
Intermediate (1–3%)	724 (47.1)	532 (73.5)	192 (26.5)	
High (>3%)	341 (22.2)	211 (61.9)	130 (38.1)	

*Percentages calculated by column.

**Percentages calculated by row.

*** P value reflects referred to CR compared to not referred.

PCI—percutaneous coronary intervention.

STEMI—ST segment elevation myocardial infarction.

NSTEMI—non ST segment elevation myocardial infarction.

model were age, gender, ethnicity, PCI (percutaneous coronary intervention), CABG (coronary artery bypass graft surgery), current smoker, type 2 diabetes, type of ACS (unstable angina/non ST segment elevation myocardial infarction/ST elevation myocardial infarction and prior history of cardiovascular disease (CVD).

Results

Between 1/1/13 and 1/1/15, 1,538 patients were admitted with a diagnosis of ACS and were entered into the ACS database. All of these patients were accounted for in the CR tracking system, which means that at least 90% of all ACS patients received the inpatient (phase 1) aspect of CR. The patients were predominantly male, of working age and their ethnic breakdown reflected the local population with almost half being non-European. One third had a previous diagnosis of CVD and the main ACS presentation was non ST elevation myocardial infarction (NSTEMI) with almost two thirds receiving a subsequent coronary intervention (percutaneous or surgical). Obesity, smoking and type 2 diabetes were common comorbid risk factors (Table 1).

Of the cohort with ACS, 419 (27%) patients declined referral or were not referred to CR. Compared to those referred; this group were older and more likely to be female. Ethnic

distribution, however, was similar. Higher rates of acceptance of referral were noted following PCI, post CABG and in those with no heart failure or previous CVD history. Having diabetes or being a current smoker did not influence significantly the uptake of a CR referral. Those with the highest calculated risk of death in hospital had the lowest referral rate.

Of the cohort, 1,119 (72.8%) patients accepted referral to CR and 813 (52.9%) attended at least one session, with 456 (29.6%) patients completing the full programme, 317 (20.6%) partially completing and 40 (2.6%) attending only one session. Figure 1 lists the reasons underpinning the non-referral of the 419 (27.2%) patients. Despite telephone follow-up and at least three attempts to reschedule and engage, 306 (20%) patients did not attend any CR sessions following referral.

A multivariate logistic regression model to identify factors associated with at least one attendance at any of the CR interventions offered identified that age, gender and ethnicity were not predictors of attendance after referral (Table 2). Patients following PCI and post CABG, however, were more than twice as likely to participate, while patients currently smoking and those with a prior CVD diagnosis were half to two thirds, respectively, less likely to attend following referral.

Figure 1: Flow diagram of referral and attendance.

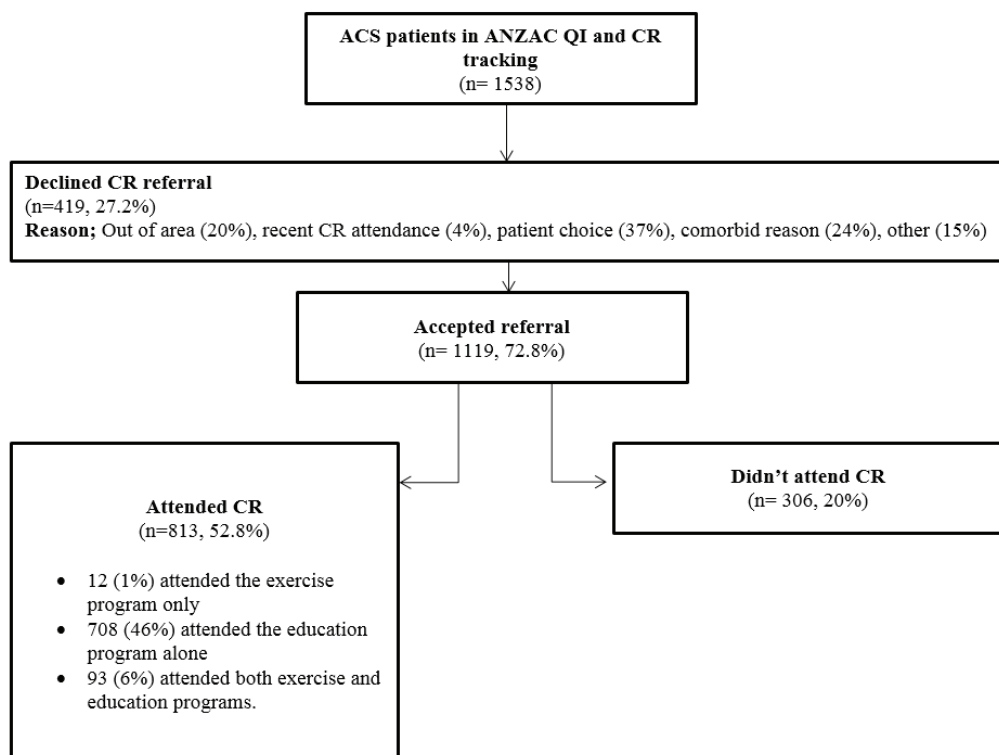


Table 2: Multivariate logistic regression to predict attendance of CR.

Independent variables	Odds (95% CI)	P-value
Age	1.014 (1.000–1.028)	0.0422
Gender		
Male	0.814 (0.582–1.139)	0.2305
Female	1.00	-
Ethnicity		
Māori	0.849 (0.537–1.342)	0.4830
Pacific	1.053 (0.722–1.535)	0.7893
Indian	0.996 (0.652–1.520)	0.9845
Other Asian	2.746 (1.123–6.714)	0.0268
European/Other	1.00	-
PCI and/or CABG		
Yes	2.235 (1.722–3.207)	<.0001
No	1.00	-
Current smoker		
Yes	0.595 (0.430–0.823)	0.0017
No	1.00	-
Prior cardiovascular disease		
Yes	0.710 (0.520–0.970)	0.0315
No	1.00	-

*Factors associated with cardiac rehabilitation participation shown in Table 3 were entered into the logistic regression model, and independent predictors were determined using stepwise backward elimination C statistic = 0.658

Discussion

The aim of this study was to describe the use of an electronic registry to capture referral and attendance at CR in CMH and to report the characteristics of the initial cohort. Over 90% of patients with confirmed ACS had in-hospital phase 1 CR and three quarters were referred for post discharge phase 2 CR. Over half attended at least one CR session but only a third completed their planned programme. Older patients and women were less likely to be referred for CR and those without in-hospital revascularisation, current smokers and with prior CVD were least likely to attend after referral.

Many health systems around the world have grappled with improving referral rates and tracking attendance and patient outcomes with varying levels of success.²³ Our study is comparable with many others,

reporting that women and older people are less likely to accept a CR referral, despite proven benefits in these cohorts.²⁴ This possibly reflects patient choice²⁵ but may also suggest the need to find alternative strategies to meet the rehabilitation needs of these patients and support the desired goal of prevention of further events.²⁶

Most global health systems have recognised the value in reporting of key performance indicators and audit to accurately reflect the capabilities of CR services and the identification of service deficits for QI.²⁷ These registries can help target health providers and resource where need is greatest. The UK have developed the longest running CR registry called the National Audit of Cardiac rehabilitation which provides reports yearly to all participating CR groups to support research²⁸ and increase awareness of service availability.

The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) have also initiated a registry to track and provide comparative data for benchmarking of clinical, behavioural, health and service outcomes. An important goal is to provide a solid base of scientific data to promote more widespread use of CR services for eligible patients (<http://www.aacvpr.org/Registry/Cardiac-Rehab-Registry>).

In Australia, The South Australian State-wide Cardiology Clinical Network undertook an analysis of CR services in South Australia in 2007–2008 and identified gaps in service delivery. These included a lack of coordinated rehabilitation pathways or referral processes; no standardised tools; limited resources; including staff; no data collection systems and few flexible programs to meet patient's needs. Significant investment has been made in the development of standard care pathways for the provision of CR, which includes an IT platform and this is currently being introduced across Australia.^{29,30}

Frequently, implementing effective CR data capture and reporting is hindered by administrative barriers resulting in incomplete datasets.¹³ In addition, data capture can be hampered by software not designed with the busy clinician in mind, resulting in data being captured that is not reported on. Data entry needs to be kept to a minimum and where feasible, variables such as cholesterol results, blood pressure and demographic fields need to be electronically imported/populated from existing data repositories.

In New Zealand, CR has arguably been largely overlooked in the drive to improve the quality of care of patients with cardiac conditions. Over the last three years, real-time access to key performance indicators has been available to regional networks and district health boards for a range of cardiology-led targets relating to in-hospital and pre-hospital management of ACS.³¹ To date there are no fields related to referral or attendance at CR despite CR's recognised ability to positively impact on patient health outcomes.⁹

In the current fiscally constrained environment where the importance of effectiveness and value for money is clear, it is vital that health systems develop

quality measures and prove the interventions offered are achieving their goal of improving quality of ACS care for all New Zealanders. Understanding, in real time, the referral and engagement pattern of people at risk of further cardiac events is important to allow deficits to be addressed and to advocate for the maintenance of, or the addition of resources, to enhance services.²⁷

Strengths and limitations

This paper describes the first New Zealand attempt, for many years, to systematically record referrals and engagement with CR services in a population with significant health needs.³² Although outcome data remains absent, the CR tracking process will facilitate research by identifying a high risk cohort who have attended or not attended CR services. These patients can then be matched using an encrypted NHI process to large national databases identifying deaths, hospital admission and pharmaceutical use, to identify if CR programmes are associated with improved patient outcomes. Ideally all New Zealand CR programmes will eventually use the same process to answer the important question “is attending CR associated with better outcomes for our community?”

Conclusion

Cardiac rehabilitation programmes in New Zealand vary in their mode of delivery and content. Currently there is no nationally agreed minimum dataset with which these programmes can monitor their own performance and compare themselves with their peers in relation to patient outcomes or to CR outcomes noted in the literature. The introduction of an electronic CR tracking process into a busy cardiac unit has been widely accepted, facilitated a more robust understanding of who uses and does not use the CR service, as well as providing many opportunities to identify areas for improvement within CR pathway of care. Consideration of funding a national rollout of this system should be given serious consideration as a way of ensuring the services received by patients following an ACS are of a high and consistent standard and fit for purpose nationwide.

Competing interests:

Nil.

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Rheumatologists fail to advise people with RA to get immunised, which matters if you are under 65: An audit in a New Zealand rheumatology service

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ABSTRACT

AIM: To assess if yearly-influenza and five-yearly pneumococcal vaccines are recommended to people with rheumatoid arthritis (RA) in a New Zealand rheumatology service in accordance with guidelines and determine patient immunisation status for these respiratory pathogens.

METHODS: Retrospective review of electronic health records of all outpatients with RA attending a regional rheumatology centre in New Zealand over a one-month period immediately after the release of the 2015 influenza vaccination.

RESULTS: The 232 people with RA in the sample had a mean age of 60.4 years with 59% having RA for more than five years. Documented advice was infrequent (<5%) at the index visit and other clinically relevant time points. Despite this, many patients were immunised. People with RA over 65 years of age were more likely to receive influenza vaccination, however, the vaccination rate was similar to the general population over 65 years of age.

CONCLUSIONS: People with RA receive recommended respiratory vaccinations despite infrequent advice for immunisation from rheumatology specialist services. However, immunisation rate in people with RA, particularly those under 65 years, remains suboptimal and multi-level interventions are required to improve this.

Rheumatoid arthritis (RA) is the most common autoimmune inflammatory arthritis in adults. People with RA have twice the risk of infection compared to the healthy population¹ with risk attributable to treatment with systemic glucocorticoids and biologic disease modifying anti-rheumatic drugs (bDMARDs), immunological alterations of RA itself and comorbidities.^{2,3} International guidelines recommend annual vaccination against influenza and five-yearly vaccination against pneumococcus for all people with RA, ideally before starting methotrexate or bDMARD therapy.⁴⁻⁶ Despite these recommendations, suboptimal rates of vaccination against respiratory pathogens among people with RA have been reported internationally, with higher vaccination

rates among the elderly (≥ 65 yrs) or in the presence of additional risk factors.⁷⁻¹⁵ Vaccination rates against respiratory pathogens have not been reported for people with RA in any Australasian setting.

In New Zealand, the influenza vaccination is recommended and has been funded for all people over 65 years of age since 1997 and to people with chronic health conditions, including RA, since 1999.¹⁶ Vaccination against pneumococcal disease is also recommended in the New Zealand Immunisation Handbook for people who are immunosuppressed, which will include some people with RA, but neither of the licensed vaccines PCV-13 (Prevenar®) or PPV-23 (Pneumovax®) are currently publically funded for this indication.¹⁷ While immuni-

sation typically occurs in primary care, an important factor influencing vaccination in people with RA is recommendation from the treating specialist.⁷⁻¹¹

This audit of practice in a New Zealand regional rheumatology centre was conducted to determine the rate of recommendation of vaccination against influenza and pneumococcal disease to people with RA by specialist rheumatology clinicians, and ascertain the rates of annual influenza immunisation and pneumococcal immunisation within the last five years in these people in primary care.

Methods

Setting and subjects

Hutt Hospital is the regional tertiary centre for rheumatology, servicing a population of approximately 500,000. Outpatient clinics are provided by seven rheumatologists and three rheumatology clinical nurse specialists at three hospitals and one rural primary care medical centre. A letter from the clinician to the patient's general practitioner (GP), which details assessment and management at the clinic visit, is stored in the Hutt Hospital electronic health record (EHR). This archive contains all clinic letters, laboratory data and radiology reports since 2003. For the last year, access to the 'shared care record' has allowed limited data from the primary care electronic record to be available in the hospital electronic record, linked by the unique National Health Index number. This retrospective audit included all people with RA attending clinics 1-31 March 2015. March was chosen as the annual influenza vaccine usually becomes available in primary care clinics from early March. The peak of influenza infections occurs in New Zealand from June to September.¹⁸

Letters from all outpatient attendances at rheumatology clinics for March 2015 were reviewed. Patients were included if 1) a consultant rheumatologist had recorded a diagnosis of RA according to EULAR/ACR 2010 or ACR 1987 criteria,^{19,20} 2) data in the electronic record confirmed the individual met EULAR/ACR 2010 criteria for RA, or 3) after review of the electronic record a consultant rheumatologist (RG) determined a diagnosis of RA was highly likely.

Audit design

All available clinic letters for eligible patients were reviewed between September and November 2015 when the funded influenza vaccination season had concluded. Clinic letters not on the electronic health record were termed 'not available'. Demographic and clinical data were recorded as at the index visit in March 2015 including: age, gender, rheumatoid factor or anti-CCP antibody status (positive or negative using local laboratory cuts offs), date of RA diagnosis, and current or past use of methotrexate, bDMARD or long-term prednisone (≥ 5 mg daily for over three months). All available clinic letters were reviewed to identify visits when 1) RA first diagnosed 2) methotrexate first prescribed and 3) bDMARDs were commenced. The identified letters were read to ascertain if the rheumatology clinician advised the patient or GP that influenza and/or pneumococcal vaccine were indicated, per recommendations in international guidelines.⁴⁻⁶ Since vaccination occurs in primary care, and can be independent of recommendations from the rheumatology service, the shared care record was used to determine influenza and pneumococcal vaccination status over the preceding five years (or since diagnosis if RA diagnosis < 5 years), including 2015. If shared care record was unavailable, general practices were contacted by telephone or email to determine immunisation status and funding indication.

Adherence to influenza vaccination was defined as three or more influenza vaccinations in the last five years, or influenza vaccination in more than 3/5^{ths} of years since diagnosis of RA if RA for less than five years, with 'Optimal' adherence being annual influenza vaccination since diagnosis and 'Any' standard for having at least one influenza vaccination in the past five years.¹² Adherence to pneumococcal vaccination was defined as administration of any pneumococcal vaccine in the last five years. Statistical analysis, including descriptive statistics, Fisher's exact test and χ^2 -test as appropriate, was performed using SPSS (version 22). This audit was undertaken as a quality improvement activity by employees of the organisation. As an audit it was outside the scope of the New Zealand Health and Disability Ethics Committee and therefore formal ethics review was not required.

Table 1: Characteristics of people with RA at index visit (n=232).

	Mean (SD*)	n (%)
Age	60.5 (14.75)	-
Female	-	174 (75)
Seropositive	-	172 (74.4)
Duration >5 years	-	137 (59.1)
Specific medications		
Methotrexate	-	158 (68.1)
Long-term prednisone	-	51 (22.0)
bDMARD	-	52 (22.4)

*SD to 95% Confidence.

Results

In the one month audit period, 232 people with RA attended rheumatology outpatient appointments; mean age was 60.5 years; 75% were female and 59% had RA for more than five years (Table 1). Clinic letters were available for all index visits. At the index visit, 158 (68.1%) were on methotrexate, 52 (22.4%) were on bDMARDs and 51 (22%) were on long-term prednisone. Clinic letters for visits when medications were initiated were available for 120/158 (75.9%) for methotrexate and for 45/52 (86.5%) for bDMARDs. Shared care records were accessible for 168 people, with data for 64 people collected via phone or email (RG).

Clinic letters from the index visit infrequently documented advice regarding influenza or pneumococcal vaccination, with four (1.7%) recommendations of annual influenza vaccinations and one (0.4%) for five-yearly pneumococcal vaccination (Table 2). One patient received advice on both vaccines. In the last five years, 165 patients (71.1%) had received at least one influenza vaccination, with 111 (47.8%) having at least 60% of indicated influenza vaccinations. Pneumococcal vaccination in the last five years was lower than influenza vaccine (16, 6.9%). Eleven (4.7%) patients were documented to decline influenza vaccination on the shared care record. No patients were documented to have declined pneumococcal vaccine.

Table 2: Documented vaccination recommendations in rheumatology clinic letters and vaccinations recorded in primary care records.

	Annual influenza vaccine	%	Pneumococcal vaccine	%
Documented vaccination recommendations in rheumatology clinic letters				
At index visit	4/232	1.7	1/232	0.4
At RA diagnosis	0/124	0.0	0/124	0.0
At initiation of methotrexate	2/120	1.6	3/120	2.5
At initiation of bDMARD	1/45	1.9	1/45	1.9
Documented vaccinations in primary care				
Any in five years	165/232	71.1	16/232	6.9
Received >60% of indicated vaccines in last five years*	113/232	48.7	N/A	N/A
Optimal influenza (5/5)#	85/232	36.3	N/A	N/A

Denominator indicates number of people with RA with data available.

*Or >60% since RA, and #or every year since RA diagnosis, if RA diagnosis <5 years.

Table 3: Documented vaccination status by age (<65 and ≥65 years).

	<65 years	%	≥65 years	%	P value [†]	Odds Ratio (95%CI)
Annual influenza vaccination						
Overall 3/5 years	37/132	28.0	74/100	74.0	<0.0005 ^{†***}	6.90 (3.84–12.39)
Optimal	21/132	15.9	64/100	64.0	<0.0005 ^{†***}	8.42 (4.59–15.46)
Any	77/132	58.3	88/100	88.0	<0.0005 ^{†***}	5.96 (2.91–2.18)
Pneumococcal vaccine in last five years	7/132	5.3	9/100	9.0	0.262 [†]	0.58 (0.21–1.61)

[†] χ^2 -test of <65 vs ≥65 years.

*** Statistically significant.

A higher proportion of people with RA over the age of 65 received three or more influenza vaccinations in the five-year study period when compared to people with RA under 65 years ($X^2 = 48.183$, 1 df, $p(\text{exact}) < 0.0005$) (Table 3). This pattern was also observed for 'Optimal' and 'Any' influenza vaccination rates. No difference was seen in pneumococcal vaccination rates for age ≥65 years ($X^2 = 1.259$, 1 df, $p(\text{exact}) 0.262$).

Discussion

This audit showed documented advice from rheumatology specialists in a hospital rheumatology clinic for people with RA to be vaccinated against common respiratory pathogens was infrequent (<5%). However, people with RA had received vaccinations, albeit at a suboptimal rate. Influenza vaccination rates were three times higher for patients over 65 years. The failure of rheumatology specialists to give advice regarding vaccination against respiratory pathogens is consistent with previous studies reporting higher recommendation rates from GPs or practice nurses than secondary care clinicians.^{7–11} This is of concern, as the commonest reason identified for non-vaccination is not being offered (or advised) vaccination by a health professional.^{7–10} In New Zealand, common reasons for not getting influenza vaccination include being unaware of eligibility, low perceived susceptibility to influenza, perceived lack of efficacy and dislike or distrust of the vaccine.²¹ All of these could be addressed during discussion with a rheumatologist, if that discussion were to occur. No studies have explored why rheumatologists do not routinely advise

people with RA to have recommended vaccinations, however commonly identified barriers are likely to include prioritising other health care, lack of awareness of guidelines, disbelief in vaccine effectiveness or forgetting.²² A multifactorial intervention in a hospital rheumatology clinic, which included notices on clinic walls, automatically generated paper reminders attached to patient files, and ordering of vaccination at time of visit has been shown to increase the pneumococcal vaccination coverage from 50% to 97% over a six-year period.²³

Internationally there is high variation in rates of both influenza and pneumococcal vaccination but the optimal rates are infrequently achieved.^{7–15} This phenomena is seen across all conditions for which influenza vaccination is indicated.²⁴ A recent large post-hoc analysis of a 17 country RA cohort reported the global influenza vaccination rate was 25.3%, ranging from <1% in Morocco and Egypt to 66.2% in Japan.¹² The pneumococcal vaccination rate in this study (6.9%) is below the reported international range of 12–66%.^{9–15} At the time this audit was conducted there were no clear protocols in New Zealand for timing of the pneumococcal vaccinations available nor government funding of pneumococcal vaccines for eligible people with RA, which could have contributed to failure of rheumatologists to recommend vaccination. The 2016 update of the NZ Immunisation Handbook provides a clear strategy for administration of pneumococcal vaccinations, however, RA is not one of the chronic health conditions recognised as conferring increased risk of pneumococcal disease

nor is therapy-related immunosuppression a listed indication for pneumococcal vaccination.¹⁷ Since current New Zealand guidelines are at odds with international rheumatology guidelines for pneumococcal vaccination, rheumatologists should initiate discussions about pneumococcal vaccination based around the patient's risk of pneumococcal disease, particularly use of combination DMARDs or bDMARDs.¹⁷

The low rates of influenza vaccination in patients with RA in New Zealand needs addressing, and is likely to require multi-level intervention including community-demand and system-based interventions.²⁸ Significant improvements in vaccination rates of children have occurred with a multi-level approach in New Zealand, where >90% of children under two years are now vaccinated.²⁹ Evidence-based strategies to increase community-demand include pamphlets, letters to patients and concurrent nurse education and vaccination clinics.²⁸ Evidence for these strategies are strongest in the elderly, and strategies utilising technology including text messages,³⁰ app-based reminders³¹ and patient access to EHR,²³ may be more relevant for younger people.

System-based interventions should be targeted towards general practices, who as vaccine administrators currently achieve high vaccination rates in >65 years age group.¹⁸ The most significant factors contributing to high vaccine coverage of New Zealand infants include appropriate practice organisation and stable staffing with dedicated time and knowledge to champion vaccination.²⁹ Electronic health record alerts are effective^{28,32} and could be easily adapted to generate recalls for vaccination for people with RA in New Zealand general practices, where EHRs are almost universal. An integrated quality improvement programme to provide regular clinician feedback can be effective²³ and has increased rates of influenza vaccination in the under 65 age group across GP surgeries in the UK and for infant vaccination New Zealand.^{33,34} A unified national EHR accessible to all treating clinicians could also allow secondary care clinicians to directly highlight to primary care the imperative to offer respiratory pathogen vaccination to people with RA. This functionality would also be relevant for other secondary care services including providing

care to people under 65 years with other chronic health conditions where influenza vaccination is recommended.^{23,35}

There are several limitations to this study. As a retrospective audit of electronic health records, data may be incomplete. Vaccination advice data at diagnosis and pre-therapy was unavailable for a substantial proportion of patients as letters were included in the EHR from 2003. Since vaccination guidelines for RA have been published within the last 10 years,²⁵ reviewing hard copy files pre-2003 was unlikely to be relevant. It is also possible that clinicians recommended vaccination but failed to communicate this to the general practitioner responsible for vaccination in the clinic letter. The shared care record may not consistently document if a vaccine was offered by the GP and declined by the patient. Furthermore, patients may have received influenza vaccine in their workplace or pharmacy with this not communicated to, or recorded in, the primary care record although there is an expectation to do so.²⁶ Nevertheless, directly accessing primary care records gives more accurate vaccination rates than previous studies using questionnaires, which are susceptible to recall bias.^{8-10,27} This single centre study may not be representative of wider rheumatology practice in Australasia, however, the rate of low vaccine advice and suboptimal rates of vaccination, with higher rates in the aged, is in keeping with international data. Data on disease activity, active comorbidities, activity of specific GPs or infection rates were not recorded in this study, as it was primarily about specialist recommendation of vaccines. Further information on these topics could provide further direction in targeting interventions.

Conclusions

Best-practice advice from rheumatology clinicians recommending vaccination against common respiratory pathogens influenza and pneumococcus to people with RA were infrequent. Despite this, vaccination does occur in primary care although at suboptimal rates. Further interventions are needed to increase these rates, with multiple strategies targeting the rheumatologist practice, patients, GPs and system interventions.

Competing interests:

Nil.

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The effectiveness of hyperbaric oxygen therapy (HBOT) in radiation-induced haemorrhagic cystitis

Vincent Chong, Michael Rice

ABSTRACT

INTRODUCTION: Radiation cystitis is one of the possible complications from pelvic radiotherapy. Hyperbaric oxygen (HBOT) improves tissue oxygenation and healing of scarred tissue.

AIMS: To assess the efficacy of hyperbaric oxygen therapy (HBOT) in the management of radiation-induced haemorrhagic cystitis in patients with urological cancers.

METHODS: This is a retrospective review on all patients with macroscopic haematuria secondary to radiation induced haemorrhagic cystitis who were treated with hyperbaric oxygen therapy (HBOT) between 2009 and 2013. The primary outcome is symptomatic assessment (either complete resolution, partial resolution or no change).

RESULTS: A total of 12 patients with radiation-induced cystitis secondary to urological cancer were included in this study with a mean follow-up of 443 days. The mean age was 78 years. Complete resolution of haematuria was seen in six out of 12 patients. Partial response was achieved in two patients where one required two courses of HBOT and one required three courses of HBOT. As a result, the overall improvement of haematuria after HBOT was 67%. A total of four patients had no response to HBOT.

CONCLUSION: Radiation-induced cystitis is a difficult clinical problem to treat. HBOT is not a magic bullet but it may be another alternative treatment option we have at this point in time.

Radiotherapy is a non-invasive treatment targeting malignant cells and surrounding tissue. Technology advances have resulted in greater treatment efficacy while significantly reducing the level of toxicities. However, radiation cystitis is one of the possible complications from pelvic radiotherapy. It can occur six months to 10 years after irradiation.¹ It has been reported to develop in 6.5% of patients who had radiotherapy for cervical cancer.² Radiotherapy causes chronic fibrosis in the poorly oxygenated bladder tissues with eventual tissue scarring. This could lead to bladder mucosal sloughing and hemorrhagic cystitis.

This is a difficult clinical problem to treat. Multiple treatments options have been tried, such as administration of tranexamic acid; blood transfusions; local therapies such as bladder irrigation or instillation of formalin, alum or silver nitrate; invasive

procedures such as cysto-diathermy, embolisation and finally cystectomy. Overall results are disappointing.³

Hyperbaric oxygen (HBOT) improves tissue oxygenation in previously radiation tissue. This will result in capillary angiogenesis, an increase in fibroblast concentration and healing of scarred tissue.⁴

In this study, we aim to assess the efficacy of HBOT in the management of radiation-induced haemorrhagic cystitis in patients with urological cancers.

Subjects and methods

This is a retrospective review on all patients with radiation cystitis who were treated with hyperbaric oxygen therapy (HBOT) between 2009 and 2013 at Slark Hyperbaric Unit, Devonport and Quay Park Health, Auckland. Ethics approval was gained from the institutional review board.

Table 1: Patients referred “early” or “late” for initiation of HBOT.

		Early (within one year)	Late (after one year)	P value
Haematuria free	No	2	1	0.500
	Yes	4	5	
		6	6	

We included all adult patients presented with macroscopic haematuria secondary to radiation-induced haemorrhagic cystitis. All patients underwent a cystoscopy and imaging of the renal tract to exclude other causes of bleeding. All clinical notes from the hospitals were reviewed.

Data collection

We evaluated patient characteristics (age, gender and ethnicity), primary malignancy site, modality of radiotherapy, onset of haematuria post-radiotherapy, time from haematuria onset to the initiation of HBOT, number of admissions to hospital and prior intravesical management. The onset of haematuria was defined as the first episode of haematuria requiring hospital admission after radiotherapy.

The primary outcome of this study is symptomatic assessment after HBOT (either complete resolution, partial resolution or no change). Complete resolution was defined as absence of macroscopic haematuria. Partial resolution was defined as reduction in the severity or frequency of macroscopic haematuria or requirement for more courses of HBOT.

Oxygen protocol

HBOT was administered in a compression chamber. The overall treatment duration ranged from 90 to 120 min. Treatments scheduled daily for five days a week for 30 to 40 dives (six to eight weeks). Sessions varied in time and duration to ensure patient comfort.

Statistics

Statistical analysis was performed using SPSS 20. Descriptive statistics were expressed as mean, range and standard deviation. Analysis of categorical variables was performed using the chi square test. Statistical significance was reached at a *P* value of 0.05 or less.

Results

A total of 12 patients with radiation-induced cystitis secondary to urological cancer were included in this study. The mean age was 78 years (range 66 to 85, SD 6.8). All were European male. The primary indications for radiotherapy were prostate cancer in nine patients and bladder cancer in three patients.

The mean time interval between radiation therapy and HBOT was nine years (range 1–18, SD 5.5). The mean time interval between onset of haematuria and HBOT was two years (range 1–5, SD 1.7). The mean number of admissions to hospital for haematuria was four (range 1–6, SD 3.6) prior to HBOT.

Patients were subsequently split into “early” and “late” group where “early” is defined as initiation of treatment within one year of haematuria and “late” as initiation of treatment after one year. There was no significant difference in outcome of haematuria in patients referred early or late with a *P* value of 0.5 (Table 1).

Prior to HBOT, six patients had other treatments, namely cysto-diathermy, intravesical alum, intravesical prostaglandin and intravesical formalin.

Complete resolution of haematuria was seen in six out of twelve patients. Partial response was achieved in two patients where one required two courses of HBOT and one required three courses of HBOT. As a result, the overall improvement of haematuria after HBOT was 67% (Table 2).

A total of four patients had no response to HBOT. Two patients were on warfarin, one required a cystectomy and ileal conduit due to ongoing haematuria, and another one died during the course of HBOT and was counted as failure due to ongoing haematuria which did not improve.

Mean follow-up period was 443 days (59–1513, SD 474.245). Interestingly, seven patients were known to palliative care on

Table 2: Symptomatic assessment after HBOT (either complete resolution (Y), partial resolution (Y2) or no change (N)).

Patient	Age	Cancer diagnosis	Warfarin	RT (year)	HBOT sessions	Haematuria free	No of ED admission (pre)	No of ED admission (post)
1	70	Prostate	0	1996	2009	Y	3	0
2	83	Prostate	0	2001	2009, 2010	N	2	4
3	83	Prostate	1	2000	2009, 2010	N	4	7
4	83	Bladder	0	2010	2011, 2012, 2012	Y2	4	1
5	80	Prostate	0	1996	2012	Y	4	0
6	85	Prostate	0	2001	2012, 2012	Y2	4	1
7	69	Bladder	0	2011	2013	Y	5	1
8	74	Prostate	0	1999	2013	Y	2	0
9	85	Prostate	1	1995	2013*	N	6	Deceased
10	76	Prostate	0	2001	2012, 2013	N	4	2
11	66	Bladder	0	2009	2011	Y	1	0
12	84	Prostate	0	2001	2010	Y	5	0

* Patient 9 died during the course of HBOT and were counted as failure due to ongoing haematuria.

last follow-up date. The referral mostly came from the Urology service (nine patients) compared to Oncology (two patients) and General Practice (one patient).

Discussion

Radiation cystitis is a potentially debilitating side effect for patients. HBOT is the only form of treatment that promotes tissue healing and angiogenesis. Cochrane review⁵ concluded that there is some evidence that HBOT improves outcome in late radiation tissue injury affecting bone and soft tissues of the head and neck, for radiation proctitis and osteoradionecrosis. The pathology of radiation injury suggests that other tissues like bladder are likely to respond to HBOT but they did not find enough randomised studies to support this.

Our study showed an average short-term efficacy of 67% with HBOT. A review of literature showed that the majority of the studies also reported equivocal responses to HBOT. Among the best rate quoted was an improvement of 100% with 24 months follow-up by Nehemen,⁴ 86% with 10 to 120 months follow-up by Corman,⁶ 80% with 12 month follow-up by Chong,⁷ 73% with a 39 months follow-up by Oliai,⁸ and 76% with a 12 months follow-up by Oscarsson.⁹ A systemic review found that 145 (76%) of 190 reported patients demonstrated complete or partial resolution.⁵

On the other hand, long-term outcome is questionable with HBOT. A study from

Austria with 10 patients and a follow-up duration up to six years did not yield favourable results,¹⁰ whereas Nakada reported that 87.5% of patients showed an improvement with HBOT with a mean follow-up of 9.8 years.¹¹

Risk factors

The literature commented on several risk factors affecting the outcome of HBOT include age, total radiation dose and duration from onset of haematuria to HBOT.¹¹ Our mean age was 78 years and that may have contributed to the worse outcome as compared to other studies. We were not able to retrieve all the data on the total radiation dose. We hope that newer methods of radiation delivery should further decrease radiation complications. The timing of HBOT was not a significant factor in our study as opposed to the study by Chong where patients with early HBOT experienced a better response to HBOT with a rate of 96% compared to 66%.⁷

A study from Tasmania on the cost of HBOT revealed that HBOT gave major health cost savings over the study period of 2.5 years but noted that there are significant hidden costs not recorded. After successful HBOT, healthcare costs was saved with no emergency admission or inpatient fees.¹² However, HBOT is not widely accessible and the treatment is given over a relatively long period of six to eight weeks. Patients need to be able to commit to this long period of

treatment with equivocal success rate. In our study, none of the patients reported any serious complication as an effect of HBOT.

A limitation of our study was the small sample of patients who had radiation cystitis and proceeded to HBOT. This makes it difficult to deduce trends. The literature lacks good randomised trials to evaluate the long-term efficacy of HBOT. Most studies had only short-term follow-up of their patients. More data from larger and longer duration studies is essential to answer the question of efficacy of HBOT. A long-term follow-up with yearly evaluation is currently in progress.

In addition, we were unable to standardise pre-HBOT management. The

protocol of HBOT are not standardised between centres and is dependent on severity of problem and patients' factors. We only recorded haematuria requiring hospital admission. We considered this to be the only meaningful clinical outcome when patients seek medical attention.

In conclusion, radiation induced cystitis is a difficult clinical problem to treat. HBOT offered another treatment option but our study has only shown an overall improvement in 67% of patients. HBOT is not a magic bullet but it may be another alternative treatment option we have at this point in time.

Competing interests:

Nil.

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‘Out of the frying pan, but not into the fire’: quantifying commercial cosmetic tanning services in New Zealand to inform endgame regulation

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ABSTRACT

AIMS: In the context of possible regulation, to quantify and describe: (1) indoor tanning businesses in New Zealand; (2) sunbeds available for sale on Trade Me®.

METHOD: In January 2016, we conducted a national audit of businesses potentially providing sunbed services (solariums, beauty-salons, hairdressers, gyms and fitness centres) to assess the availability and cost of indoor tanning services (sunbeds and spray tanning). In addition, Trade Me®, New Zealand’s largest auction site for second-hand goods, was monitored for one year to determine whether ex-commercial sunbeds were being sold in the domestic market.

RESULTS: Overall, 176 businesses were currently providing sunbeds, which for most (92.4%), were supplementary to other ‘non-tanning’ services. Of 168 sunbeds for sale on TradeMe®, 42 were ex-commercial.

CONCLUSION: Given scientific evidence that there is no safe level of sunbed use for individuals of any age, a ban on commercial sunbed services would have a significant positive impact on skin cancer incidence. Since few New Zealand businesses depend on providing sunbed services, a ban would have minimal negative economic impact, affecting only a small number of businesses. There should be a total ban on the importation, manufacture, sale and rental of sunbeds for commercial or private use in New Zealand.

Excessive exposure to ultraviolet radiation (UVR), whether from sunlight or from artificial sources, such as sunbeds, causes skin cancer.¹ In New Zealand, skin cancer is by far the most common cancer type² and from it, nearly 500 New Zealanders die annually.³ It also places a substantial cost-burden on the health system for treatment.² New Zealand has the world’s highest mortality rate for cutaneous malignant melanoma (melanoma), the most deadly of the skin cancers.⁴ Yet, unlike many cancers, we know the main cause of skin cancer, and that the risk of developing a skin cancer can be mitigated by minimising exposure to ultraviolet radiation (UVR), either from sunlight or from artificial sources—such as sunbeds.⁵ Of particular relevance is the strong scientific evidence showing the association

between sunbed use and both melanoma and non-melanoma skin cancers.^{6,7} In Australia, it has been estimated that 3.2% of melanomas and 3.5% of melanoma deaths are due to sunbed exposure.⁸ In Europe, it is estimated that 5.4% of all new cases of melanoma may be related to sunbed use⁹ and this may account for the increasing rates observed among young women.¹⁰ Recent legislation in Australia bans commercial sunbeds nationwide. The Health (Protection) Amendment Bill 2014 will restrict sunbed use to those 18 years and older in New Zealand. However, the scientific evidence clearly shows that there is no safe level of sunbed use for individuals of any age^{6,7} and so legislation does not go far enough. The Ministry of Health is concerned that a ban on commercial sunbeds may result in

revenue loss, business closure and redundancies.¹¹ The first aim of this study is to quantify the number and type of indoor tanning businesses (sunbed and/or spray tanning businesses) in New Zealand in order to estimate how large an impact the banning of commercial sunbeds would have on businesses. The Ministry of Health appears to favour licencing sunbed operators and enforcing mandatory operational practices rather than recommend a ban.¹¹ One concern with this approach is that there is nothing to prevent old second-hand commercial machines being dumped onto the completely unregulated second-hand market. So, a second study aim is to assess the number of sunbeds, particularly ex-commercial ones, being sold on the second hand market.

Methods

Aim 1

In December 2016, a search of the Yellow Pages online was performed for businesses listed under “Beauty Therapy”, “Manicurists”, “Hair dressers”, “Health and Fitness Centres”, “Sporting and Recreational Facilities” and “Sun Tanning Services”. Web based searches (using Facebook, Google and The New Zealand Association of Registered Beauty Therapists (<http://www.beautynz.org.nz/>)) were also conducted. The Ministry of Health and Consumer New Zealand also provided their lists of sunbed operators. Businesses identified (along with their contact details and URL) were recorded in an MS Excel spreadsheet. Duplicate listings of a business were identified by using their associated phone number and/or addresses and removed from the spreadsheet. Businesses that provided services not applicable to the research question (such as swim schools) or that solely provided retail products (eg self-tanning products) were also excluded.

In January 2016, one of three trained interviewers telephoned each of the businesses identified, clearly stating that they were from the University of Otago and conducting a study on indoor tanning, and invited the person who answered the telephone to participate in the audit. At least five telephone contact attempts were made. For businesses which could not be contacted, an email/Facebook contact was attempted.

An assumption was made that businesses would not provide indoor tanning if they clearly identified as barbers, hairdressing franchises providing express haircut-only services, and medi-spas providing medical beauty procedures (such as laser treatment or Botox) not traditional spa services (such as facials or waxing)—so these were not telephoned. Businesses for which the phone had been disconnected or where the business operator was away for a sizeable length of time (eg on maternity leave) were removed from the spreadsheet. Following the telephone call, a dataset of businesses providing sunbed services was created. Two businesses that clearly provided commercial sunbeds could not be contacted because one was “closed for summer” and the other only had an answerphone. However, as both had current websites that clearly showed the provision of both sunbeds and spray tanning services, these were included even though telephone contact was not made.

The information collected included the availability of sunbed or spray tanning services, the number and type (ie horizontal or vertical) of sunbeds offered and the cost of a casual sunbed session or full-body spray tan. Descriptive analyses were conducted using SPSS.¹² Ethical approval was obtained from the University Of Otago Human Ethics Committee (D16/018 23 December 2015).

Aim 2

Trade Me[®], as New Zealand’s largest auction site for second hand goods, was monitored to estimate the number of sunbeds or sunlamps, in particular, ex-commercial sunbeds being sold in the domestic market. From 10th November 2015 to 9th November 2016, inclusive, the Trade Me[®] category website (<http://www.trademe.co.nz/health-beauty/sun-care-tanning>), “Health and Beauty—sun care & tanning”, was regularly scanned for listings of sunbeds or sunlamps. Re-listings of the sunbeds were excluded. If the description of the product did not contain information on the product’s age and whether or not it had been used commercially, then the trader was asked to provide that information. Information collected on sunbeds included: the closing date of the auction, product description and age, commercial use, the cost of the product and whether it sold.

Results

Aim 1

We identified 4,827 discrete businesses offering beauty or fitness-related services where sunbeds could potentially be housed or spray tanning services provided. Of these, 4,590 (95.1%) participated in the audit (28 declined to participate, 19 respondents had poor English language skills and 190 could not be contacted).

Nationwide, we found 176 businesses offering sunbeds commercially to customers, two of these were sunbed rental companies that did not provide 'in-house tanning services' and four businesses reported that their sunbeds were not currently being used—these six have been removed from further analysis. Of the remaining 170 sunbed premises (with an estimated 254 units) the majority only had one sunbed ($n=134$) 78.8%, 17 (10.0%) had two sunbeds and two (1.2%) had three sunbeds. Only 16 premises (9.4%) had four or more sunbeds. For most sunbed businesses (92.4%), the provision of tanning services was supplementary to other services. Only 13 sunbed premises (7.6%) relied on tanning as their sole source of income, but most ($n=9$) of these also offered spray tanning to customers. Very few businesses ($n=4$) were reliant on sunbeds as their sole source of income. This audit identified 975 businesses that provided a spray tanning service, including nearly half of all beauty salons (46.6%), but far lower percentages of hairdressers (8.7%) and fitness centres (2.0%). Spray tanning is more labour intensive than the provision of sunbeds, so the cost per unit is considerably higher (approximately \$45 full-body tan vs \$10 per casual sunbed session).

Aim 2

Over the past 12 months we identified 168 sunbeds or sunlamps for sale on TradeMe®. At least 42 of these were confirmed as having been used commercially. Seventeen of these commercial sunbeds have sold, most for less than \$250 and one for just \$1. No health warnings or advice on appropriate use were provided in the description field, and at least one claim of health benefits was made regarding vitamin D and psoriasis prevention—which would seem to directly contravene the Commerce

Commission Directive to not overstate the benefits of sunbed use.¹³

Discussion

Given that only four businesses were identified in the audit nationally, as being reliant on the provision of sunbed services as their sole source of income, we would anticipate that few, if any, job losses would result from a total ban on sunbeds. Spray tanning is an established, generally acceptable alternative service to New Zealand consumers.¹³ With the more labour-intensive nature of spray tanning, businesses should be able to re-orientate to providing spray tanning services in lieu of sunbeds and this may, in fact, create additional employment opportunities. As has happened in Australia, business owners could be compensated for the loss of cosmetic tanning equipment and methods for its safe disposal provided.¹⁴ This would largely reduce the risk of old and second-hand sunbeds being dumped onto the market, as it appears to be happening currently, a practice that seems likely to become more widespread if restrictions on sunbed operators are increased without the implementation of a total ban and provision of compensation. Not implementing a ban on commercial sunbeds will mean a continued and prolonged commitment for organisations working in the primary prevention of skin cancer (such as The Cancer Society and The Health Promotion Agency) to educate individual New Zealanders on the risks associated with using sunbeds. The already high and potentially increasing rates of skin cancer suggest that New Zealanders are either not well informed about the risks of solar UVR and/or artificially produced UVR or choose to ignore these risks. A survey of over 1,000 New Zealanders on their understanding of the risks associated with cancer in 2014/15 asked respondents "what increases your risk of getting melanoma", prompts were not given. Preliminary findings suggest that only 12% of respondents reported a sunlamp or sunbed.¹⁵ Even being educated about the risk of a specific behaviour does not necessarily change that behaviour. For example, a survey of young people in New Zealand showed that despite being aware of the risks associated with sunbed use they still chose to use them.¹⁶

The main limitations of the data used to address Aim 1 is that it likely underestimates the number of sunbed premises and sunbeds available in New Zealand. There will be businesses that we have missed, businesses which declined to participate or could not be contacted. The main limitation of the data collected to address Aim 2 is that it only measures the sale of sunbeds over a short time-period on one auction site.

Conclusion

Given scientific evidence demonstrating that there is no safe level of sunbed use for individuals of any age, a ban on commercial

sunbed services would have a significant positive impact on skin cancer incidence. Since few New Zealand businesses depend on providing sunbed services, a ban would have minimal negative economic impact, affecting only a small number of businesses. Spray tanning is an alternative, higher value, more labour-intensive service that is already acceptable to consumers. Businesses that offer cosmetic sunbed services are selling exposure to a type-1 carcinogen for minimal financial gain. Accordingly, there should be a total ban on the importation, manufacture, sale and rental of sunbeds for commercial or private use in New Zealand.

Competing interests:

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Reducing harm from falls

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ABSTRACT

Serious adverse event reporting from district health boards (DHBs) brought in-hospital falls to the attention of the Health Quality & Safety Commission (the Commission) when it was incepted in 2010. In 2012, responding to the large numbers reported, the Commission began planning for a three-year programme to reduce harm from falls, initially to run 2013–2015. In this article we discuss the serious consequences of falls, and the challenges and practical considerations involved in reducing the risk of falling and the rate of falls. We explore the Commission's choice of an adaptive approach in its programme, and show how a targeted measurement framework and national action has led to a nationwide statistically significant reduction in fractured neck of femur (hip fracture) and associated costs resulting from in-hospital falls, from a median of 12 per 100,000 admissions to eight per 100,000 admissions, sustained as at June 2016 for six quarters. This reduction reflects nationwide implementation of two key care processes: 1.) the percentage of patients 75 and over provided with an assessment of their risk of falling upon admission to hospital has risen from 77% in the first quarter of 2013 to 91% nationally in June 2016, 2.) the percentage of those with identified risk who were provided with an individualised care plan that addressed those risks has risen from 77% of older patients in the first quarter of 2013 to 95% nationally in June 2016. (These results are also reflected in a 14% decrease to 30 June 2016 in numbers of falls reported by DHBs as serious adverse events). Finally, we give a call to arms to the disparate health practitioners and services across all settings for individualised responses to prevent falls one patient at a time, and for leadership responses that promote an integrated approach to falls in older people.

Serious adverse event (SAE) reporting from district health boards (DHBs) brought in-hospital falls to the attention of the Health Quality & Safety Commission (the Commission) when it was incepted in 2010. In response to the large and apparently increasing numbers reported,¹ the Commission developed a three-year programme to reduce harm from falls, launching in 2013 with an initial and continuing focus on reducing falls in hospital and promoted via the national patient safety campaign *Open for better care*. Such falls are a priority in patient safety, but present a challenge given the complexities associated with an older inpatient population. In this article we discuss the serious consequences of falls for older people—most dramatically demonstrated in the burden of hip fracture (see below)—and the challenges and practical considerations involved in reducing the risk of falling and the rate of falls. We explore the Commission's choice of an adaptive approach in its programme, and show how targeted measurement and

national action has led to wide national uptake of two key care practices known to reduce falls, and a nationwide statistically significant reduction in fractured neck of femur (broken hip or hip fracture) resulting from in-hospital falls, from a median of 12 per 100,000 admissions to eight per 100,000 admissions, a reduction sustained as at June 2016 for six quarters.

This reduction is paralleled with and supported by serious adverse event data reported by New Zealand district health boards (DHBs): in the period 1 July 2015 to 30 June 2016, all falls-related serious adverse events reported by DHBs had decreased by 14% from 2014/15 (277 to 237—this latter figure including reported falls of visitors and outpatient events).²

Finally, we give a call to arms for individualised and integrated approaches to falls prevention from all the disparate health practitioners and services dealing with older people, whether in hospital, aged residential care or the community.

Unbundling care and an “adaptive approach”

Internationally, approaches to improving patient safety in hospitals have frequently involved ‘bundles of care’. A bundle for improving quality of care is “a small, straightforward set of evidence-based practices—generally three to five—that, when performed collectively and reliably, have been proven to improve patient outcomes”.³

However, in many jurisdictions, ‘bundles’ have failed to reduce harm from falls—implementing a ‘set menu’ of programme components does not assure success.⁴⁻⁶ While reviews have established that multi-component programmes reduce fall rates by about 20 to 30 percent,^{4,7,8} it is difficult to tell which components are working best, and unclear what the ‘ideal’ mix is.⁴ Since a fall is a complex interaction between an individual’s environment and his or her risk factors,⁹ what is needed in hospital and residential care settings is local leadership and learning to determine appropriate programme components targeting environmental hazards and an adaptive approach that addresses individuals’ risk factors related to falls.¹⁰⁻¹²

In line with these findings internationally, and with experience ‘on the ground’ as the programme evolved, the Commission promoted a number of robust, evidence-based interventions that providers could choose to implement, and provided resources that could be added to established programmes or be used to build a set of components if no programme was in place. Rather than attempting to impose a grand plan, the Commission supported “the principle of multiple [small] improvements throughout any given process collectively achieving a far superior output”—that is, the “aggregation of marginal gains”.¹³ This concept has been deployed successfully in organised sport^{14,15} and also in human resources and organisational theory,¹⁶ anaesthesia,¹⁷⁻¹⁹ care of acute stroke,²⁰ medication safety²¹ and perioperative patient management.¹³ The Commission has aimed to achieve multiple gains in reducing falls through promoting a range of programme components and resources for providers to use in a response appropriate to their context. Across all settings, the most important focus is on addressing person-specific risk factors, along with safe environments and safe mobilising. In the hospital setting, the intention is that raised

awareness and guidance across multiple parts of the process, along with targeted performance measurement, will lead ultimately to focused, proactive and empowered falls prevention at the clinical front line.

The problem of falls in older people extends far beyond the hospital and institutional settings. The Commission’s commitment to older people’s independence and well-being through an integrated and evidence-informed approach to falls prevention is reflected in the expansion of the programme’s focus from hospitals into aged residential care in its second year, and primary care and the community in the third year.

Fall-related injuries

In 2014, 205,000 New Zealanders aged 50 or over had an ACC claim accepted for a fall-related injury, representing a 20% increase since 2011.²²

Compared to 50–64-year-olds, people aged 85 or over were twice as likely as to have an ACC claim for a fall-related injury. One in four people in this older age group (21,854) had an accepted ACC claim for a fall-related injury, equating to 60 ACC claims per day. They were also 17 times more likely to be admitted to hospital as a result, had more hip fractures (in fact, 49% percent of all hip fractures) and stayed in hospital three times longer (average of 15.5 days compared with 4.6 days).²²

About one in 20 of those who fall will have a fracture or other serious injury requiring hospital admission, with the likelihood of injury increasing with age.⁹ Figures for accepted ACC claims don’t capture the many falls which don’t result in physical injury and where no medical attention is sought. Nevertheless many of these falls may result in a damaging loss of confidence.²⁰

Hip fracture (in this context, fractured neck of femur or FNOF) results from about one percent of falls, and incidence rates increase exponentially with age in both men and women.²⁴ Hip fractures are more common than wrist fractures after the age of 75, probably because of slower reflexes and age-related changes in balance strategies for fall-avoidance.^{24,25} From the age group 75–84 years old to those 85 years and over, the hip fracture rate per 1,000 of the population quadruples from 6.1 to 23.3.²² Hip fractures are 10 times higher in residential care than in the community but the consequences for all older people are profound and protracted (see Box 1).²⁶

Box 1: The burden of hip fracture.

Hip fracture is a very serious injury, and the most common serious fall-related injury in the over 80s.²⁷

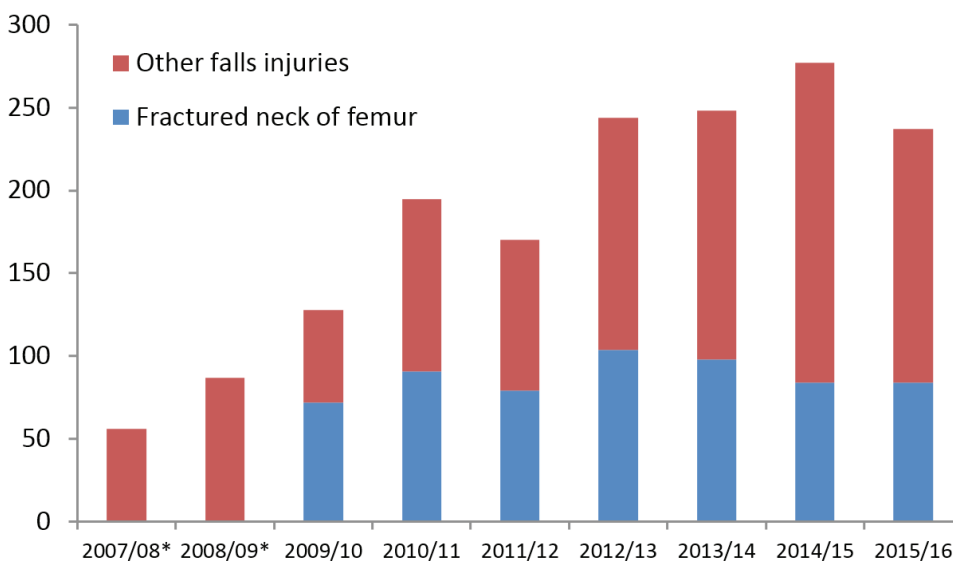
- Only half of those who survive a hip fracture will walk unaided again,²⁸ and many will not regain their former degree of mobility.^{29,30}
- Between 10 and 20% will be admitted to residential care as a result of the fracture.^{31,32}
- Sixty percent will require assistance with activities of daily living a year after the event.³³
- Twenty-seven percent will die within a year of their hip fracture, and of these, just under two-thirds would have lived if they had not fractured their hip.³⁴
- Hip fractures accounted for 14% of fractures in the US in 2005, but 72% of total fracture-related costs.^{24,35}
- More than 3,640 people over 50 presented to New Zealand hospitals with a hip fracture in 2014 (an 8% increase from 2013), directly costing the system approximately \$171m.³⁶⁻³⁸
- A hip fracture resulting in three weeks in hospital costs \$47,000 (on average). A hip fracture with complications, followed by discharge to an aged residential care facility costs \$135,000.³⁸

Hip fracture: targeted measurement, serious adverse event reporting and the Atlas of Healthcare Variation

Part of the Commission’s role is the monitoring of patient harm and promotion of safe care in New Zealand public hospitals. The Commission collects information on hip fractures in three ways:

1. As an outcome measure of the national **Quality and Safety Marker (QSM)** for the Commission’s national Reducing Harm from Falls programme. QSMs track the implementation of quality improvement process changes in New Zealand hospitals and the outcomes that follow (the latter from data extracted from the NMDS).
2. As part of the voluntary reporting of **serious adverse events (SAE)** by hospitals to the Commission for the purposes of transparency, learning and prevention (see Figure 1).

Figure 1: Inpatient falls adverse events, including fractured neck of femur, 2007–08 to 2015–16.



Source: Health Quality & Safety Commission. Learning from adverse events. Years marked with an asterisk (*) did not include breakdown by injury.

3. As a domain in the **New Zealand Atlas of Healthcare Variation**, which measures areas of variation in practice and outcomes between DHBs to identify potential areas for quality improvement.

Quality and Safety Marker (QSM)

Measuring the quality of health care and communicating the results openly is a powerful way to stimulate improvement.

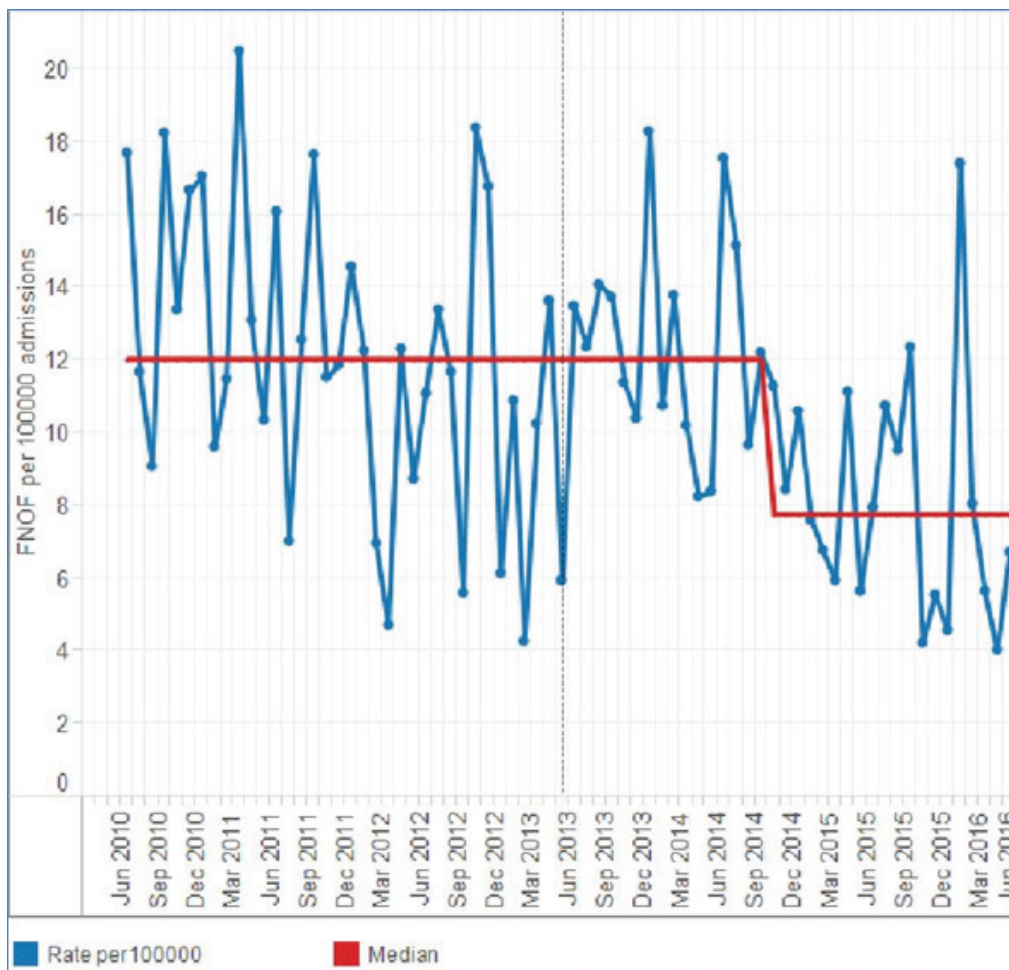
The Commission’s QSM helps drive change by giving providers feedback on uptake of two care processes known to be effective in preventing falls and monitoring that they are being implemented consistently, then linking these to the outcome we want to reduce: the number of cases of fractured neck of femur after an in-hospital fall, and related costs.

Since December 2014 there has been a 40% statistically significant reduction in in-hospital falls that resulted in fractured neck of femur, from a median of 12 per 100,000 admissions to eight per 100,000 admissions. This has now been sustained for six quarters (see Figure 2).⁴⁴

The two care processes we measured that contributed to this reduction were:⁴⁴

1. the percentage of patients 75 and over who were provided with an assessment of their risk of falling upon admission to hospital. Seventy-seven percent of older patients in in New Zealand hospitals were assessed for their risk of falling in first quarter of 2013, this has risen to 91% nationally in June 2016.
2. The percentage of those with identified risk who were provided with

Figure 2: Outcome measure: run chart showing in-hospital falls leading to a fractured neck of femur (FNOF) per 100,000 by month, 2010–2016.



Source: Health Quality & Safety Commission.

an individualised care plan that addressed those risks. Seventy-seven percent of older patients were given an individualised care plan in first quarter of 2013; this has risen to 95% nationally in June 2016.

Based on the New Zealand Institute of Economic Research (NZIER) 2010 estimate of \$47,000 health and health service costs per hip fracture incident,³⁸ this reduction conservatively represents a saving to the health system of \$1.9m in the year ending June 2016. Further, NZIER estimates suggest a saving of up to \$2.6m in the same period from 20% fewer admissions to aged residential care after hip fracture in hospital.^{38,45}

Serious adverse event (SAE) reporting

At the time of the Commission's inception in 2010, falls in hospital accounted for more than 50% of all reported hospital SAEs, and about half were associated with hip fractures. Reports had increased in number by 50% every year after 2007, presumably in part as engagement in reporting improved.¹ No other category of reportable event was as large as falls, and they clearly constitute a substantial cost in both human and financial terms. As these injurious falls have occurred while patients are in our care, the Commission made reduction of injury due to in-hospital falls a high priority.

In the period 1 July 2015 to 30 June 2016, all falls reported by DHBs as serious adverse events (including outpatient and visitor falls not included in the NMDS figures) reduced from 277 (2014/15) to 237 (a 14% reduction).²

New Zealand Atlas of Healthcare Variation

Much of the data on the burden of hip fracture in Table 1 above is drawn from the Atlas.²² The Atlas draws on multiple data sources such as ACC claims for fall-related injuries, the Ministry of Health's NMDS and the Pharmaceutical Collection to present data in map form by DHB over eight falls-related indicators. These include, for all patients across New Zealand aged 50 years and over from 2011: ACC claims, hospital admissions, hip fracture rates as well as time to surgery, length of stay and prescribing for hip fracture patients on discharge. Where possible, these measures are further broken down by age, ethnicity and gender. DHBs

can compare their rates as well as trends to identify potential areas to improve practice.

What do hip fractures tell us about falls in older people?

Hip fracture rates are a usefully quantifiable tip of the nearly unquantifiable iceberg of falls and fall-related injuries in older people both in and out of hospital. A hip fracture tells us that multiple opportunities to prevent falls and reduce harm from falls have been missed. These opportunities start with healthy lifestyles that promote bone health. The first fragility fracture is an indication that the risk of hip fracture has doubled³⁹ and should prompt evaluation and consideration of active therapy—hence the importance of systematic approaches to assessment of bone health and fracture risk in primary and secondary care. Hip fracture is often a late event in an 'osteoporotic career' fuelled by decreasing bone strength and increasing risk of falls.^{40,41}

Far more fractures occur out of hospital than in hospital, but the objective of hospitalisation is to heal, not to harm; patients in hospital have a right to safe care;⁴² and health professionals have a duty of care to the patients in their charge. Hip fractures in hospital provide an outcome indicator for a Quality and Safety Marker (QSM) to monitor initiatives to reduce falls in hospital. FNOF is an injury with a clear diagnosis that will not generally be missed. These fractures occur often enough for changes in rates to be identified in a statistically meaningful way and data can be matched to the National Minimum Dataset (NMDS).⁴³

The larger volume of falls is in the community

The Commission is using these data to inform and support an expanding focus across primary and community care settings. For every hip fracture in a public hospital, our analysis suggests there are approximately 30 hip fractures in the community.^{46,47} An economic analysis of the cost of falls and the case for investment indicated that the volume of falls in the

community³⁸ and return on investment⁴⁸ warrants giving attention to preventing falls and reducing harm from falls in community-dwelling older people.

This larger task poses a question of where to start: should the focus be on the smaller group at immediately higher risk of injurious falls or should a longer-term public health approach be taken, aiming to keep older people on their feet? The question can be answered through a system-wide approach that reconciles these equally important strategies, rather than advancing one and not the other. Consequently, activities in the third year of the programme included promoting 10 priorities for an integrated approach⁴⁹ and making the Stay Independent Falls Prevention Toolkit for Clinicians⁵⁰ available to primary care and community providers.

A system-wide integrated approach is needed as falls in older people present a complicated set of challenges and opportunities for a population group that ranges from those generally healthy and active to the very frail or debilitated. Meeting the needs of this diverse group and ensuring sustainability of services for older people requires:

- primary prevention of injurious falls in older people: preventing falls in the first place, for example through promotion of exercise programmes to improve balance and strength; ensuring safe civic and home environments; and screening bone health from age 50 for early prevention and treatment of osteoporosis
- secondary prevention for those who have had a fall with or without injury—as demonstrated in the ACC data cited above, special attention should be given to the age group 85 and older.²²

The Commission's approach is two-fold: promoting *a system-wide integrated approach to falls in older people*; and at the same time, *supporting clinicians in better management of older persons identified as being at risk of injury from falling*.

Clinicians can take practical leadership actions within their sphere of influence

to support an integrated approach to falls in older people. At a system level, such an approach incorporates effective falls prevention programmes, improvements in service delivery and specific actions to keep falls on the agenda and ensure a commitment to progress (the latter encompassing data collection and system capability). At the individual level, determining the particular falls risk factors for each person, and then working with him or her to address those factors, is the most effective way of reducing harm from falls. Frances Healey, a leading international patient safety expert and falls researcher recommends focus on the individual to overcome the enormity of the task: "Every older person is different. Don't try to answer the question 'What will stop older people falling?' and just repeatedly ask 'What might stop this person falling?'"⁵¹

Falls in older people often have causes related to underlying medical conditions, so we cannot manage falls effectively without taking the whole picture of older people's health into account, particularly the interplay between independence, physical activity, fragility, frailty and dementia.⁵²⁻⁵⁴ An individual with dementia is up to three times more likely to sustain a hip fracture than a cognitively intact older adult, for example.^{52,53} Further, thinking outside 'the health sector box' means giving attention to important gaps, such as the links between the built environment and falls,⁴⁸ and requires alliances at many levels to bring policy, provider and consumer perspectives together.

The challenge for the Commission is how to reduce harm associated with older people's falls in care settings while supporting older people in the community in taking the positive actions which will help them avoid falls and maintain independence. To help focus effort and attention, the Reducing Harm from Falls programme determined 10 priorities for an integrated approach to falls in older people, promoting this approach when the national patient safety campaign *Open for better care* revisited falls prevention in mid-2015.

An integrated approach to falls in older people—10 priorities

1. **Exercise programmes** reduce falls and fall-related injuries in community-living older people.⁵⁶ Effective programmes typically include balance retraining and lower limb strengthening exercises.⁵⁶ A range of programmes caters to different levels of physical function and personal preferences. The Otago Exercise Programme (OEP), based in the home, has been associated with a reduced falls rate in programme participants of 35%.⁵⁷

2. **Multifactorial risk assessment and multicomponent interventions** are recommended for patients at risk of falling and reduce the rate of falls for inpatients⁷ and older community-dwellers.⁵⁶ Providing a multifactorial risk assessment and plan of care is a key component of the Commission's recommendations and resources for inpatient and community settings.^{58,59}

3. **Home safety assessment and modifications** reduce the risk of falling and rate of falls, and are more effective for those at higher risk of falling and when delivered by an occupational therapist.⁵⁶

4. **Medicine use review** to target and modify the use of falls-risk-increasing medicines (especially psychotropics) reduces the rate of falls.^{56,60} Prescribed vitamin D supplementation for older people likely to be at risk of vitamin D deficiency/insufficiency helps prevent osteomalacia. While there are findings that also point to a reduced risk of falling, the evidence for prescribed vitamin D supplementation is at present contradictory and emerging at pace.^{7,56,61–65}

Service delivery

5. Locally developed, **integrated falls pathway and referral processes**, in which 'any door is the right door' for assessment of falls risk and referral for appropriate interventions.⁶⁶

- Nelson Marlborough DHB's coordinated 'single point of entry' for falls referrals is a multi-agency alliance with primary health organisations (PHOs) and ACC. The programme identifies as a 'herald faller' people

who have sustained at least one fall. All herald fallers seen by health professionals are internally referred to a centralised triage point from where triage coordinators refer them externally to appropriate community falls prevention services, primary or secondary care, physiotherapy, Māori Health Providers, vitamin D supplementation, occupational therapy and other services to reduce the likelihood of subsequent and more serious falls.⁶⁷

6. Systematic approaches to **assessment of bone health and fracture risk** and appropriate interventions for primary and secondary prevention of fragility fractures; and improvement of **fracture care and recovery**.⁶⁸

- Fracture Liaison Services (FLS),⁶⁹ mandated by the Ministry of Health and to be implemented by all DHBs, ensure that all patients presenting with fragility fractures to the particular service or institution receive fracture risk assessment and treatment where appropriate.
- The Australian & New Zealand Hip Fracture Registry (ANZHFR)⁷⁰ is a trans-Tasman partnership to develop and define shared guidelines and clinical care standards supported by international evidence. The registry will allow for better analysis of national data, and improve quality and consistency of care after a hip fracture through the use of a set of key quality indicators.

7. For older people identified as frail, **comprehensive geriatric assessment** is a key to safe, compassionate integrated care in primary, long-term care and acute settings, especially for those with problems which contribute to falls risk, such as impaired mobility and dementia.^{71,72}

Leadership actions

8. **Keep falls on the agenda as everyone's business**. The causes of falls in older people are complex—we should not be surprised that service improvement is difficult and takes sustained effort, attention and leadership.⁷³ Leadership support was shown to be one of the strongest factors for success of falls reduction programmes in a study of 34 Veterans Affairs health centres in the US.⁷⁴

- An organisational audit tool is available for clinical leaders to review their service's performance against the 10 Priorities for an integrated approach.⁷⁵
- Leadership also means partnering with patients and families. Older people's views are critical in service planning and provision as to what will work for them. Using patient stories at all levels is a powerful reminder and motivator.

9. Ensure systems and processes are in place to **collect, monitor and analyse data** related to fall prevention measures and falls incidents. Providing **meaningful feedback** to those involved promotes learning and shows where to improve practice.

- The Commission's falls QSM reports quarterly the compliance of all DHBs in providing older patients with a falls risk assessment and tailored care plan (ie, process measures) and the number of falls in hospital resulting in a fractured neck of femur, and associated costs (outcome measures).⁴⁴ The falls domain of the Commission's New Zealand Atlas of Healthcare Variation gives clinicians, patients and providers an overview of the prevalence of falls in people aged 50 and over, including those treated in the community and in hospital. Admission rates for hip fracture are shown, and

indicators on how these patients are managed, by DHB.³⁶

- The Commission has also conducted a review of reports on 48 falls with serious harm from a subset of DHBs. These reports provide valuable learning, which is 'hard won'—the reports are only generated when a patient or resident suffered a significant injury related to a fall.⁷⁶ This review demonstrated that the quality of the analysis left room for improvement and that learnings did not always translate to sustainable actions.

10. Ensure **system capacity and capability** for quality improvement and innovative practice for falls prevention. Both evidence and experience-based fall prevention practices require behaviour change and new competencies for staff, and change management to support organisational and system change.⁷⁷ Networks can be energising, build resilience and spread knowledge and learning.⁷⁸

Each of the above 10 Priorities for an integrated approach to falls in older people will intersect with different clinicians' spheres of influence in different ways. The case study below presents multiple points where better care might have changed the story—as also might have a better system integration (see Box 2).

Box 2: Gordon's story: from a community fall to a hospital fall to residential care.⁷⁹

Gordon is elderly, lived in a rural area, and had suffered several prior falls at home before the fall that led to his admission. "I tripped on the carpet, I think. Or the lip that goes across the sliding door. I could have kicked that", he said. "And over I went".

He had multiple comorbidities, many of which signal a risk of falling—including glaucoma and poor vision, gout, frailty and memory problems. Gordon was admitted for injuries sustained in this fall. Then his niece received a phone call from the hospital.

"He was stretching out to get a walker that was too far away from his chair", his niece said. On the ward, Gordon had fallen again and fractured his hip. Surgery was required. "Once they got him back on his feet they turned around and says well he can't manage at home so you'll have to look for a rest home".

The pain and waste is dramatic—suffering for Gordon, sudden, unexpected and ongoing costs to his family for residential care, additional costs to the hospital and the bitter disappointment for his caregivers and nurses. His ability to live at home and his quality of life have been abruptly curtailed in the place and at the moment he should have been safest.

Falls in older people: starting with this patient

What might have stopped Gordon falling? The clinician's personal leadership role in moving toward an integrated approach to prevent falls is the longer term priority. Perhaps just as challenging is their role for each older person in their care.

Older people can regard falls as a common problem for their age group, yet not a problem for them personally.^{80,81} Fear of falling can create a downward spiral of restricted activity, which increases the risk of falling.⁸² Moreover, older people don't necessarily mention falls. A 2014 survey found that more than half of people would not report a fall even if there was a minor injury.⁸³ Older people need to be helped to develop a personally relevant awareness of risk matched to an understanding that falls are much more preventable than inevitable. Asking the older person about falls begins that conversation.

It is not surprising that older people in hospitals and in care settings are prone to fall and susceptible to injury. In these settings, age-related physiological changes (such as slower protective reactions) combine with a high prevalence of clinical conditions implicated in increasing risk of falling (such as postural hypotension) or risk of injury (such as osteoporosis or anticoagulant therapy).⁹ Further, older people present with an array of co-morbidities, to which are added the effects of treatments and medicines, some of which increase the risk of falling or of injury. As an additional challenge, the older person in hospital must orient to and safely negotiate an unfamiliar and often hazardous environment. Any tendency to move less in consequence of all these factors presents its own array of risks, including deconditioning and pressure injuries.

People at risk of falling, or their families, typically want to be engaged in their own care. A study engaging consumers who had already fallen in hospital found that, with the benefit of hindsight, they "wanted to be informed and told of why they were at risk".⁸⁴ They further wanted to know "what specific activities the nurse wanted them to

do to reduce their risk and the role of the health care team in their fall prevention".⁸⁴

Finally, throw into the mix the reality that a significant proportion of older inpatients will not be able to undertake the protective tasks of looking after themselves, due to cognitive impairment or acute confusional states (which themselves significantly increasing risk of falling).^{85,86} Dementia will affect more than 2.6% of the population by 2050—more than 14,000 people (probably over-represented among inpatients).⁸⁷ Delirium affects up to half of older inpatients and is associated with poor functional outcomes and increased mortality, but it is preventable and reversible in many cases.⁸⁶

Conclusion

On the International Day of Older Persons in 2012, United Nations Secretary-General Ban Ki-moon reminded us that, "Longevity is a public health achievement, not a social or economic liability ... let us pledge to ensure the well-being of older persons, and to enlist their meaningful participation in society so we can all benefit from their knowledge and ability".⁹⁸ Addressing the challenge of adding 'life to years' includes reducing the impact that falls and resulting injuries have on well-being, coping and independence.

The New Zealand Triple Aim is the simultaneous pursuit of improved quality, safety and experience of care for the individual, improved health and equity for all populations, and best value for the health system.⁹⁹ The point of a Triple Aim approach is to integrate and balance apparently competing priorities simultaneously.

It is often said "It takes a village to raise a child." Equally, it takes a village to prevent an older person from falling.⁶⁶ A clinical community can aggregate the marginal gains available from attention to many details throughout the continuum of ageing. The apparently good results noted above may attest to the value of such an approach—raising awareness, interest and engagement; provision of knowledge, resources and tools; and influencing attitudes towards culture and behaviour change coupled with robust measurement approaches.

The challenge for individual clinicians, and the teams in which they work, includes

Box 3: Resources and support.

Five main programme components developed for the Reducing Harm from Falls programme are: multifactorial interventions, safe mobilisation, learning from analysis of fall events, engagement and education on falls issues for the workforce and other stakeholders, and a toolkit for primary care. The first four components were launched with the national patient safety campaign mid-2013.

- **Ask, assess, act**⁸⁸—a process based on clinical practice guidelines for prevention of falls in older people^{65,89-91} encompassing screening for falls risk, multifactorial assessment and individualised interventions for modifiable risk factors. The ‘Ask, assess, act’ process applies in any setting and is an integral part of the Toolkit. It supports a conversation in which each older person’s individual perspective and experience—and that of their family and/or carers—is the key to discovering his or her priorities and the steps he or she would be willing and able to take to reduce the risk of falling.
- **Signals for safe mobilising**⁹²—a system of symbols and visual aids signalling the level of assistance needed for safe mobilisation was developed, trialled and made available as a nationally standardised system.
- **Learning from fall incidents**—based on a review of falls-related serious adverse events reported to the Commission, a suite of resources was developed to support consistency in the classification of harm related to falls and improve quality in the analysis of events requiring root cause analysis, including a human factors guide and framework, and a template for reporting. Ultimately, an incident management system⁹³ only produces improvements when action is taken to improve patient safety.
- **10 Topics and other resources**⁹⁴—a set of resources covering key issues in falls in older people were developed and made available online, including a survey and competition (the national annual April Falls Quiz⁹⁵), learning activities structured to meet continuing professional development requirements (10 Topics in reducing harm from falls⁹⁴) and four videos highlighting effective programmes in hospital, aged residential care and community settings.⁹⁶
- **Stay Independent Falls Prevention Toolkit for Clinicians**⁵⁰—this was developed by BPACNZ (Best Practice Advocacy Centre New Zealand) in partnership with the Commission, adapted from the US Centers for Disease Control and Prevention’s STEADI (Stopping Elderly Accidents Death and Injuries) materials⁹⁷, with input from Nelson Bays Primary Health. Made available from mid-2015, the Toolkit contains resources intended to help screen, assess and support older people in preventing falls and maintaining their independence. The tools can be used to identify and address an older person’s modifiable risk factors for falling, allowing positive steps to be put in place to increase strength and mobility, and reduce the likelihood of falling.

Additionally, there have been projects to produce patient and resident information and signage, to promote prescribed vitamin D supplements for older people likely to be at risk of insufficiency or deficiency, and a small-scale targeted quality improvement initiative in a group of aged residential care facilities.

capitalising on every opportunity to provide appropriate individualised care, and taking actions to ensure joined-up care in an integrated system. These actions are naturally part of a commitment to the general good care of older people, and are necessary for system sustainability. Moreover, effective,

carefully targeted falls prevention strategies—starting with a heightened awareness of the importance of falls and simply asking older people about falls—are a relatively low cost investment that returns potentially substantial savings, both financial and in terms of human suffering.⁴⁸

Competing interests:

All authors report they either work for or have an affiliation with Health Quality & Safety Commission.

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Anomalous systemic arterial supply to the lung

Jumpei Katayama

A 51-year-old woman was presented to the emergency department with fever and cough since four days prior. On physical examination, she had coarse breath sounds in the left- lower lung. A chest radiograph showed a left-lower lung infiltrate and an abnormal shadow behind the cardiac shadow (Figure 1). She underwent computed tomography (CT) for suspected lung cancer. CT showed an infiltrate in the left-lower lobe (Figure 2) and an arterial branch from the abdominal aorta to the basal segment of the left-lower lobe (Figure 3). She was treated with amoxicillin-clavulanate for seven

days. After two weeks, contrast-enhanced CT showed an aberrant artery originating from the abdominal aorta and no confined sequestrated area (Figure 4). The patient is scheduled to undergo lower lobectomy. Anomalous systemic arterial supply to the basal segments of the lung is a rare congenital anomaly and is known as Pryce type 1 sequestration.¹ The recommended treatment is surgical resection or endovascular embolisation because this anomaly can cause recurrent or massive hemoptysis, congestive heart failure and pneumonia.²

Figure 1: A chest radiograph shows a left-lower lung infiltrate and an abnormal shadow behind the cardiac shadow.



Figure 2: A chest CT shows an infiltrate in the left-lower lobe.

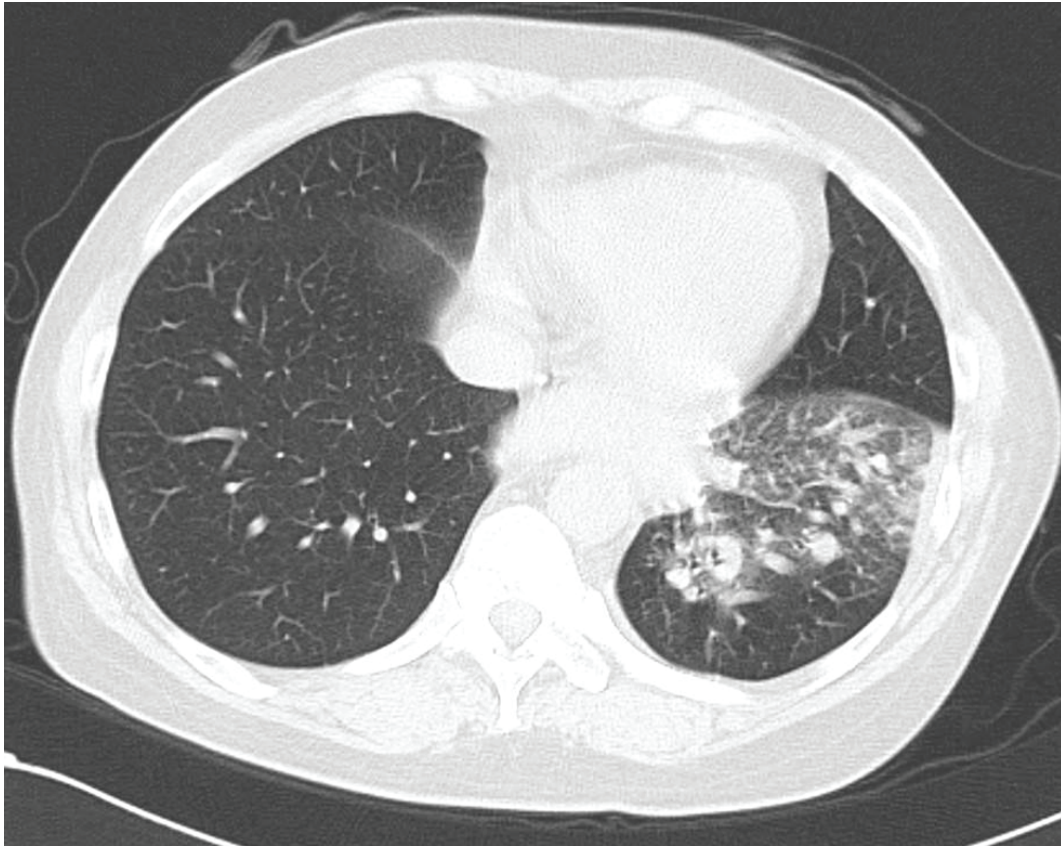


Figure 3: A chest CT shows an arterial branch from the abdominal aorta to the basal segment of the left-lower lobe (arrow).

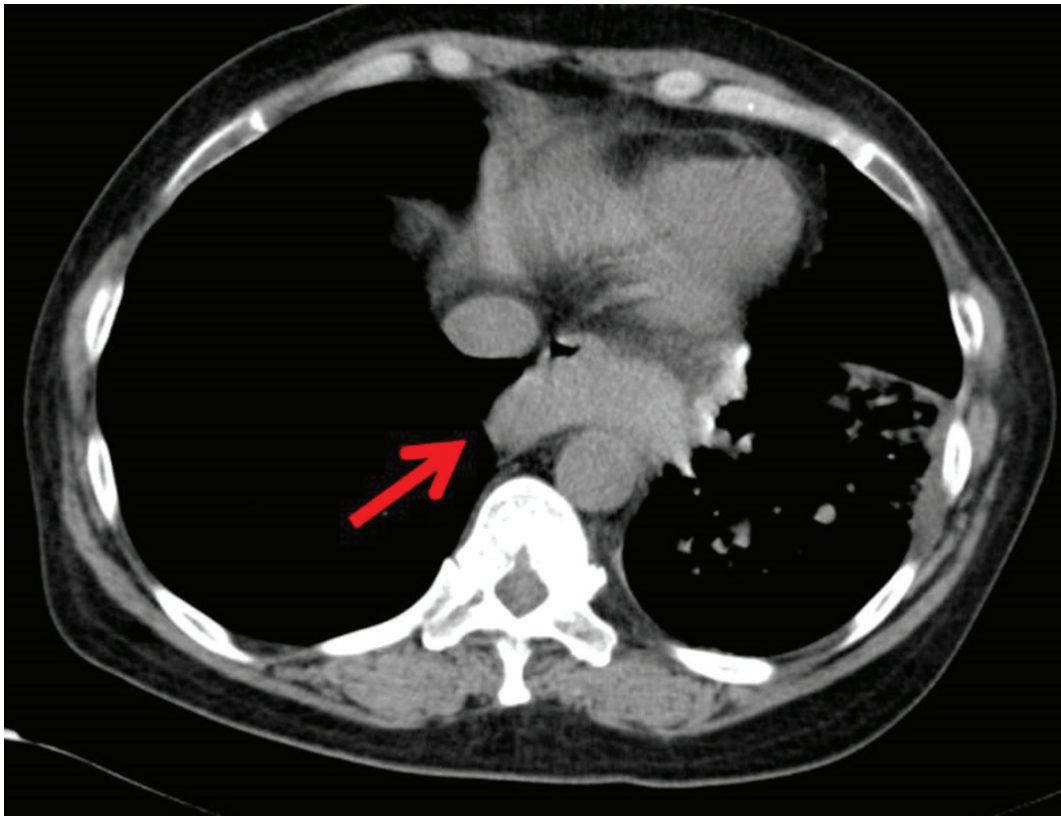
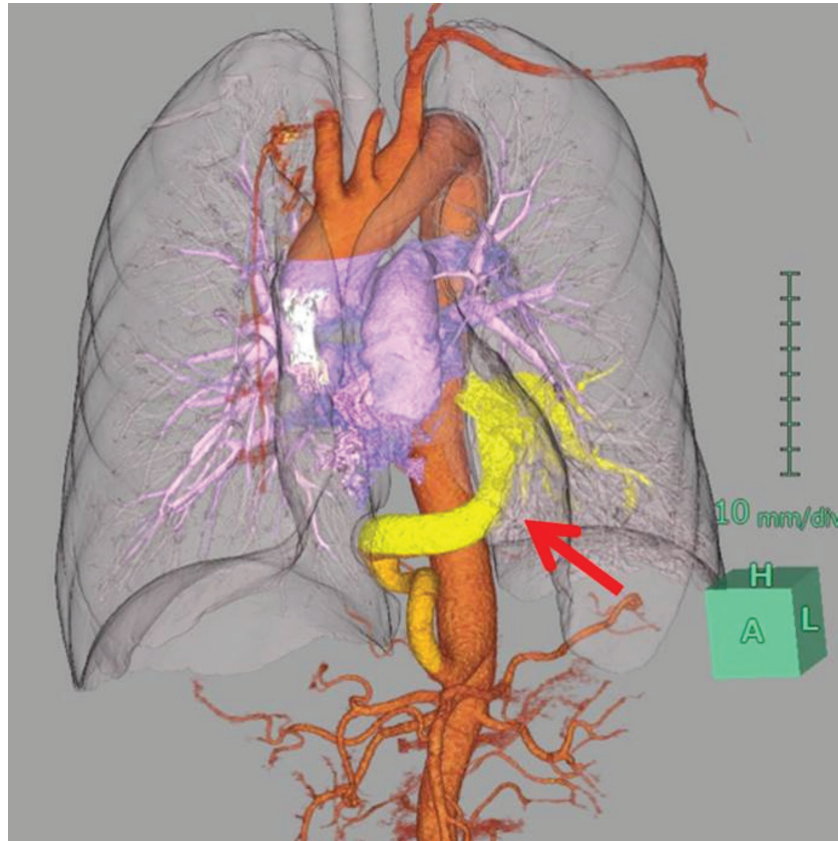


Figure 4: A contrast-enhanced CT shows an aberrant artery originating from the abdominal aorta (arrow).



Competing interests:

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Accidental abdominal rectus sheath infiltration with chlorhexidine-alcohol

Tess Brian, Winston McEwan

Case report

A 43-year-old Caucasian female underwent abdominal rectus divarication repair, abdominoplasty and liposuction of hips and legs under general anaesthesia at a private hospital in January 2016.

Shellfish allergy was reported by the patient. So, perhaps unnecessarily,¹ the surgeon's usual pre-surgery skin antisepsis with povidone-iodine was abandoned. Instead, faintly tinted chlorhexidine gluconate (0.5% w/v)-isopropyl alcohol (70% v/v) was used. Then, anticipating that further leg preparation may be required during the procedure, the unlabelled transparent bowl of residual solution was placed on the corner of the instrument trolley.

Standard liposuction, abdominoplasty and plication of the rectus sheath were performed.

Local anaesthetic was poured into an unlabelled transparent bowl on the trolley. The scrub-nurse drew 20mls into a syringe. As part of a multimodality approach to post-surgery pain relief, this was infiltrated as a rectus sheath block on one side. The surgeon then reloaded the syringe from the bowl on the corner of the trolley and injected the contents on the second side. It was immediately realised that 20mls of chlorhexidine-alcohol had been injected in error.

Aspiration was quickly used to remove chlorhexidine-alcohol from beneath the sheath. Ten millilitres of fluid were recovered, leaving perhaps up to 50mg of chlorhexidine and 7ml of isopropyl alcohol in situ. Intravenous fluid administration was increased. The National Poisons Centre was contacted and an internet search conducted. Consequently, other than more intensive vital sign monitoring, no further interventions were undertaken.

On the first post-operation day, the wound and patient had suffered no apparent ill-effect. Elevations of serum alanine transaminase (104 units/l; normal ALT<45) and gamma-glutamyl transferase (232 units/l; normal GGT<50) were noted. These had returned to normal four days later.

Post-operation, the abdominal site healed routinely.

The patient has made a full recovery. However, the outcome may have been different.

Discussion

Skin disinfectants are not for parenteral administration. Intravenous, intra-arterial and intrathecal injection of these may cause local and distant tissue damage, and result in organ failure and death. When locally infiltrated, transient and permanent local tissue damage may occur. However, the authors have found no cases in the literature of significant morbidity or mortality from localised injection of chlorhexidine-alcohol.²

Cytotoxicity of chlorhexidine in varying concentrations and exposure times continues to be reported.³⁻⁶ And the sclerosing and neurotoxic effects of alcohol are used clinically. That such damage from these agents was not apparent clinically in this case may have been because of the injection site and/or early recognition of the error with prompt aspiration.

While acute chlorhexidine hypersensitivity with anaphylaxis is uncommon (but increasingly recognised), vigilance needs to be maintained.⁷ Although no such reaction occurred in this case, parenteral administration may increase the risk.^{8,9} Therefore, in these circumstances, the possibility of both toxic and hypersensitivity contributions to any systemic changes exhibited by the patient should be considered.

The lessons from this incident for theatre policy and surgical practice both in and out of theatre are:

1. **Only highly tinted skin preparation solutions to be used.** Recognisably coloured external-use preparations should be easily differentiated from clear injectables such as local anaesthetic.
2. **Skin preparation solutions to be handed off the sterile field immediately after use.**
3. **All injections to be prepared in closed systems.**^{10,11} When non-in-
- jectable and injectable solutions are kept in proximity in “open systems” such as bowls in the sterile field, there is potential for confusion. Medication for injection should not be kept in bowls. All injections should be drawn from source bottles or ampoules directly into the syringes to be used.
4. **All syringes containing injectable medicines to be labelled**^{10,11} (preferably with pre-printed labels). The source container and labelled syringe should be checked at drawing-up and before medication administration.

Competing interests:

Nil.

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New Zealand's voice at the World Health Organization (WHO)

Frank Houghton

Many eyes are currently focused on the US, where Hillary Clinton and Donald Trump have begun the first in a series of live televised debates in the presidential race there. However, it is important not to overlook other elections with real potential to impact global health. The most important of these is undoubtedly the post of the Director-General of the World Health Organization (WHO). The (second) term of the current incumbent, Dr Margaret Chan, expires on June 30 2017, and jockeying for the prime position is already underway. Historically there have been many accusations and assumptions of bribery and corruption in the process, although there is, to date at least, very little evidence to support such claims.¹

In the past the World Health Assembly was simply presented with one candidate to endorse.² This rubber-stamping exercise however, has now been replaced with a new system which rather bizarrely manages to combine influence and democracy, as well as transparency and secrecy. What is clear in the process is that, in the final round at least, the decision as to who will become Director-General of the WHO will be decided by a vote of all 194 WHO member nations.²

Following the deadline for proposed candidates in September 2016, there are now six nominees for the position of Director-General (see Table 1 for details).

Under the new rules governing the election process, up to five of these candidates may be shortlisted for interview by the Executive Board of the WHO in January 2017. Three of these candidates will then be chosen to go forward for a deciding vote by the World Health Assembly. Interestingly, at that point all 194 nations will have an equal vote, albeit a secret equal vote. Therefore this process “gives Niue, population of 1,612, an equal vote with China, population of 1.4 billion—and Lichtenstein, equal voting power with India, population 1.25 billion”.¹

So where does New Zealand stand in this process? New Zealand is fortunate in being just one of thirty-four nations represented on the Executive Board of the WHO. This Board will in effect whittle the field of six initial candidates down to three. New Zealand is represented there by Dr Stewart Jessamine, a Scotsman by birth. Dr Jessamine is Director of Public Health at the New Zealand Ministry of Health, and a member of the Executive Leadership Team there.³

Voting on traditional geo-political and cultural lines would presumably result in New Zealand supporting the UK's candidate, Dr David Nabarro. However, it must be acknowledged that Dr Nabarro is in fact a highly experienced candidate with a wealth of relevant expertise and experience.⁴ It

Table 1: Candidates for the WHO Director-General post.²

The Government of Ethiopia has submitted the nomination of Dr Tedros Adhanom Ghebreyesus.
The Government of Italy has submitted the nomination of Dr Flavia Bustreo.
The Government of France has submitted the nomination of Professor Philippe Douste-Blazy.
The Government of the United Kingdom of Great Britain and Northern Ireland has submitted the nomination of Dr David Nabarro.
The Government of Pakistan has submitted the nomination of Dr Sania Nishtar.
The Government of Hungary has submitted the nomination of Dr Miklós Szócska.

might also be said perhaps that this once dogmatic allegiance is not as strong as it once was.⁵⁻⁶

Readers are undoubtedly familiar with political and ideological voting blocs, perhaps most notably at the UN,⁷ but also possibly within the European theatre.⁸⁻⁹ It is vitally important however, that the skills, knowledge and experience, including political adroitness of course, determine the next Director-General of the WHO, rather than rampant geo-political cronyism.

The WHO is suffering financially and politically from a lack of popular global support.¹

Hopefully these 'baby steps' towards full transparency in the electoral process should help restore confidence in both the process and the institution. In line with this therefore, health professionals in New Zealand should put prescriptive political geography aside and explore for themselves the relative merits of all of the candidates for the Director-General position. Based on their appraisal they should make their preferred choice known to the Ministry of Health (the Ministry operates a simple email address formula: Firstname_Lastname@moh.gov.nz).

Competing interests:

Nil.

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Biliary dilatation induced by different opiate drugs: a case series of eight patients

Duncan Smyth, Nigel Stace

There is a described association between chronic methadone use and biliary dilatation but this is not widely appreciated and may lead to unnecessary, invasive and costly investigations. It was first described in 2000 in chronic hepatitis C patients who were current or former intravenous drug users on methadone substitution therapy.¹ A 2009 study of 323 patients found that mean common bile duct (CBD) diameter was greater in methadone users compared to non-methadone users, and that methadone users were many times more likely to have biliary dilatation.² In 2012, a retrospective cohort study of 618 patients found methadone users with initially normal calibre bile ducts were more likely to develop new biliary dilatation compared to non-methadone users.³ There does not seem to be a fixed obstructive aetiology behind the association.¹⁻⁴

Most patients studied in the literature had chronic hepatitis C, as they are often found to have incidental biliary dilatation on routine abdominal ultrasound. There are also a number of studies which have found an association between the recreational use of opium and increased bile duct diameter.⁵⁻⁸ This suggests a possible class effect of opiates but an association between biliary dilatation and other opiate drugs (eg morphine, oxycodone) has not been reported previously. There are also few data on liver function tests.

We studied eight patients with biliary dilatation who were taking methadone or another opiate drug. We report the effect on liver function tests in greater detail for the first time. We discuss appropriate investigation of newly diagnosed CBD dilatation.

Patients who were taking various opiates and found to have biliary dilatation on ultrasound were identified from gastroenterology outpatient clinics. Apart from taking opiates

there was no reason for biliary dilatation. Relevant data were obtained by review of the medical records. Further investigations were performed in selected cases.

Patient data is summarised in Table 1. The mean CBD diameter was 14.4mm. No patients had relevant symptoms. Six cases were associated with methadone, one with morphine and one with oxycodone. Six patients had both intrahepatic and extrahepatic biliary dilatation while the other two patients had only extrahepatic dilatation.

Five patients were investigated with either magnetic resonance cholangiopancreatography (MRCP) or endoscopic retrograde cholangiopancreatography (ERCP), with no obstructive cause identified. The other three patients had ultrasound scans over several years, with unchanged findings. Seven of eight patients had follow-up imaging, with persistent biliary dilatation in all cases.

Seven of eight patients had normal bilirubin and seven of eight had normal alkaline phosphatase (ALP). The two values which were raised were only just above the upper limit of normal. This indicates that the ALP and bilirubin will likely be normal in the majority of these individuals. Other studies on methadone-associated biliary dilatation have not provided much information on liver function tests. Meyer² found higher levels of AST (aspartate aminotransferase), ALP and bilirubin in patients on methadone compared to controls, but did not compare liver function tests between those with and without biliary dilatation.

Our study reports an association of biliary dilatation with morphine and oxycodone for the first time. Physiologically, it is most likely that the tonic effect of opiates on the sphincter of Oddi is responsible for bile duct dilatation in these cases. Studies of these patients utilising functional imaging,

Table 1: Clinical characteristics.

Case	Sex	Age at first diagnosis	Medication and dose	Duration of use at diagnosis	Bilirubin	ALP	Max CBD diameter	Extra or intra-hepatic ducts	Hep C status	Persistent dilatation proven	Other studies
1	M	48	Methadone 150mg/day	6 years	7	72	12mm	Both	Yes	Yes	MRCP, serial USS
2	M	58	Methadone 450mg/day	36 years	23	104	10mm	Both	Yes	Yes	MRCP, serial USS
3	M	49	Methadone 200mg/day	>10 years	8	115	15mm	Both	Yes	Yes	Serial USS, CT abdo
4	M	50	Methadone 100mg/day	3 years	6	94	15mm	Both	Yes	Yes	Serial USS, CT abdo, ERCP (unsuccessful), MRCP
5	M	58	Morphine 300mg/day	18 years	11	47	15mm	Extrahepatic	Yes	Yes	MRCP, ampullary inspection and biopsy, CT abdo
6	F	83	Oxycodone 20mg/day	9 months	8	84	15mm	Both	No	No	ERCP - ? tight sphincter of Oddi
7	F	70	Methadone 60mg/day	3 years	10	99	25mm	Both	Yes	Yes	CT abdo, MRCP, serial USS
8	F	36	Methadone 80mg/day	2 years	6	63	8mm	Extrahepatic	Yes	Yes	Serial USS

MRCP = magnetic resonance cholangiopancreatography; ERCP = endoscopic retrograde cholangiopancreatography; USS = ultrasound; CT abdo = CT abdomen.

such as secretin-MRCP and HIDA (hepato-biliary iminodiacetic acid) scintigraphy, would be useful to further define their physiologic abnormalities.

The effect of opiates is a diagnosis to consider in patients with asymptomatic bile duct dilatation on opiate treatment. This is important because there are now a large number of patients on long-term opiates for management of conditions causing chronic pain as well as those on opiate substitution therapy.

A strategy to investigate people on long-term opiates with asymptomatic bile duct dilatation is outlined. Causes for biliary dilatation, such as choledocholithiasis, malignancy, CBD stricture and choledochal

cyst should be excluded. Given that most methadone users found to have biliary dilatation also have chronic hepatitis C, and many have cirrhosis, there is a significant risk of hepatocellular carcinoma. We recommend investigating patients with an ultrasound, plus either an ERCP, MRCP (with or without endoscopic ampullary visualisation) or endoscopic ultrasound (EUS).

In conclusion, a number of different opiate drugs appear to be associated with biliary dilatation when used long-term. This may involve both intrahepatic and extrahepatic dilatation. ALP and bilirubin are likely to be normal. Knowledge of this association may help clinicians alleviate patients' anxiety and allow more focused investigation, potentially leading to cost savings.

Competing interests:

Nil.

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Response to Sarfati et al

Brian Cox

The assessment by Sarfati et al¹ of the cost-effectiveness of flexible sigmoidoscopy (FS) is both highly selective and biased. Sarfati et al have only included cost-effectiveness studies of FS screening studies published since 2010. Essential information for the conduct of cost-effectiveness studies was published much earlier by the randomised controlled trial investigators and other authors. For example, lesion detection by size and stage, interval cancer rates, the sensitivity and specificity of FS screening and other key parameters were published well before 2010. In addition, earlier well-designed non-randomised studies had already accurately estimated the effect of FS screening on bowel cancer mortality and incidence. These estimates were confirmed by the randomised trials. Thus, the information required to establish simulation models and conduct cost-effectiveness analyses was present well before 2011 and resulted in several evaluations of the cost-effectiveness of FS screening.²⁻⁷ The randomised trials subsequently proved that FS screening can be introduced as a screening programme in the general population.

Where studies of the cost-effectiveness of FS conducted before publication of the randomised trial incidence and mortality results have used assumptions largely confirmed by the trials, they are, of course, as scientifically valid as subsequent studies. Thus, the studies chosen by Sarfati et al, by using the decision of only reviewing evidence of the cost-effectiveness of FS screening published since 2010, represent a selective convenience sample of studies.

The cost-effectiveness of one-off FS screening has been reviewed previously by the International Agency for Research on Cancer and the large group of world experts found that FS screening may be cost saving⁸ (graded as level III evidence).

Sarfati et al claim that:

“The main area of uncertainty in relation to sigmoidoscopy-based programmes arises because three of the RCTs were carried out within populations who had previously

indicated a willingness to participate in screening. This means that participation rates were higher than would be expected if the entire population was invited, and so the estimates of reduction in both incidence and mortality are likely to be greater than would be expected in a population-based programme.”

It is of note that the participation of the one trial of FS screening that randomised the general population directly, and not criticised by Sarfati et al, obtained a participation rate for FS screening of 64.8%. A slightly lower participation of 60% was obtained in the only New Zealand study of FS screening participation. Sarfati et al, by assuming New Zealanders have the same relationship with their health service as the UK, only consider that 43% participation could be achieved. Even at 43% participation FS performs better in New Zealand than iFOBT, particularly in those 55–64 years of age when screened. If FS screening was offered first, with iFOBT only offered to those that declined the invitation as in the New Zealand study, the load on colonoscopy services would be greatly reduced and much more manageable.

When the trials were conducted, the evidence for the effectiveness of FS screening was not strong, but sufficient for funding of the trials to be obtained. The invitation to participate, in the three trials of FS screening for which Sarfati et al have reservations about the generalisability of the participation rates, would have stated that there was not strong, or no, evidence that FS screening worked and that even if you participated you may be in the group that does not receive any screening. An invitation today would be much more positive about the benefits of FS screening and how it will be conducted. Sarfati et al consider these two invitations to be equivalent. Neither the Ministry of Health in New Zealand, nor its advisors, have initiated a study of FS screening participation in New Zealand. They have chosen bluster about FS screening instead. This is very poor public health practice.

Our research group has conducted a national survey of people 55–69 years of age randomly selected from the electoral roll in New Zealand. A greater preference for one-off screening by FS than two-yearly FOBT screening was found, particularly among men and those with a first degree relative with bowel cancer. These groups have an increased risk of bowel cancer compared to women, or those without a first degree relative with bowel cancer, respectively. Comparison of the detection rates of FOBT and FS needs to include the bowel cancer risk in the people who choose a particular screening option. Sarfati et al did not weight participation rates of the screening modalities by these risk factors.

A 43% reduction in bowel cancer incidence can be expected in those that undergo

screening by FS. Thus, this 20-minute procedure offers much greater protection from subsequent bowel cancer than providing a faecal specimen for analysis every two years for 10 or more years. Health promotion of the benefits of FS screening in those 55–64 years of age is considerably overdue. The reduction in the incidence of bowel cancer will be greater with FS than FOBT screening even if participation in FS is lower. The omissions and interpretation bias of Sarfati et al, whose authors have been advising the Ministry of Health, provides insights into why the Ministry of Health has been fixated on iFOBT screening over the past five years. A more thorough, scientific, unbiased and independent assessment of the options for bowel screening is long overdue.

Competing interests:

Nil.

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Response to Cox letter

Diana Sarfati, Caroline Shaw, Melissa McLeod, Tony Blakely, Ian Bissett

Public, well-informed debate about screening is important given that very few decisions to screen populations are without areas of uncertainty and controversy. However, it is important to base these debates on the best available evidence. The letter from Cox has not addressed the evidence presented in the paper published in August this year.⁹ This paper presented evidence on all comparative cost-effectiveness studies published since 2010 on the basis that that was when evidence from randomised controlled trials on the effects of flexible sigmoidoscopy on colorectal cancer (CRC) mortality became available. All of these studies showed that both flexible sigmoidoscopy (FS) and immunochemical faecal occult blood test (FIT)-based programmes would be cost-effective interventions in reducing mortality (and incidence) of CRC. All studies showed that FIT was likely to be more effective than one-off flexible sigmoidoscopy in population-based CRC screening. All countries similar to New Zealand which have recently assessed this and related evidence of the kind highlighted by the author of the letter, have concluded that FIT-based programmes are more likely to result in substantially greater mortality and incidence reductions than population-based programmes based on one-off flexible sigmoidoscopy.

To address some specific points in the letter:

- The author of the letter states that we have been “highly selective and biased” because we only included all relevant studies published since 2010. This restriction was in place because prior to 2010, randomised controlled trial evidence on the effectiveness of flexible sigmoidoscopy on CRC mortality was not available. The authors of the UK FS trial state in their paper that “*Economic analyses... with pre-existing assumptions... now need to be repeated with the inclusion of our trial data*”.¹ Studies published after 2010 clearly also used best

available evidence published prior to that time, including the types of studies the author of the letter cites. The studies that we have included all suggest that a flexible one-off FS based programme would be cost-effective, which we clearly state in the paper. However, they also all show that such a programme would be substantially less effective than a FIT-based programme in terms of incidence and mortality reductions. The author of the letter specifically cites five additional studies that could have been included had we not set the 2010 deadline. Of these five, two have been updated and the updated versions are included in our review (Whyte et al² is an update of Tappenden et al,³ and the US Preventive Services Taskforce have recently updated the work of Pignone et al^{4,5}) and the remaining three studies were not relevant to our reviews as they were focused on either CT colonography^{6,7} or faecal DNA testing,⁸ and did not specifically compare FS with FIT-based population screening.

- The author of the letter points out that one of the four RCTs on flexible sigmoidoscopy achieved participation rates substantially higher than in other populations which have not been replicated in other general population samples.⁹ The author uses this study to imply that participation rates of 60% have been demonstrated in New Zealand. In fact, the New Zealand study cited was very small (n=232), and the majority of participants had a strong family of colorectal cancer (n=137), so it is not very informative in terms of likely uptake rates in the general population.¹⁰
- The author twice makes the claim that FS performs better than FIT at participation rates of 43%. This is inconsistent with all recent comparative international evidence published on this topic since 2010 (as provided

in our paper¹¹). It is not clear on what basis Cox makes these claims.

- There seems to be some confusion about the two-stage process that was used in the UK FS trial (and other trials). Participants were provided with brief information about bowel cancer screening and then asked the question “If you were invited to have bowel-cancer screening test, would you take up the offer?”¹ Only those who agreed were then consented to the full study and provided with relevant information about that process. The authors of the UK FS trial state in their study “*This [two-stage recruitment] procedure increased the power of the study to examine the efficacy of flexible sigmoidoscopy. However, it meant that the compliance rate in the trial was higher than would be expected in a population-based programme*”.¹ The effect of this is very clearly seen. In the UK trial with this two-step process in place, participation rates were 72% while in the UK general population (where information on the effectiveness of FS was fully available), participation rates were 26 percentage points lower at 46%.
- Information from an unpublished study about stated or hypothetical screening preferences in New Zealand is difficult to critique given lack of detail of the study, particularly relating to what information was

provided to participants. However, the findings of that study are inconsistent with what is revealed from actual participation rates for FS compared with faecal occult blood tests generally. For example, the only RCT to directly compare uptake rates of different modalities found that those offered FIT had participation rates of 61% and those offered FS had participation rates of 32%.¹²

- Several very thorough assessments of bowel screening options have occurred recently in countries similar to New Zealand including England, Ireland and the Netherlands. They have, without exception, concluded that FIT is the optimal primary screening strategy in those countries.

New Zealand has high rates of bowel cancer mortality that warrant greater attention, including the implementation of a high-quality national bowel cancer screening programme. There are a number of considerations that must be weighed in order to select the most appropriate bowel cancer screening test for the New Zealand population. From a cost-effectiveness perspective, both FS and FIT perform well. However, FIT performs better than FS in terms of effectiveness in reducing incidence and mortality from bowel cancer, and likely screening coverage. The decision to proceed with a biennial FIT-based national bowel cancer screening programme is entirely consistent with the current state of evidence.

Competing interests:

Nil.

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Comparative efficacy and tolerability of antidepressants for major depressive disorder in children and adolescents

Major depressive disorder is common in young people with an estimated point prevalence of 2.8% in school-age children (aged 6–12 years) and 5.6% in adolescents (aged 13–18 years). Psychological treatments are still considered the first-line treatments in many clinical guidelines but antidepressants are widely used.

In this network meta-analysis the researchers have investigated the efficacy and tolerability of 14 antidepressant drugs. They found 34 eligible trials including 5,260 participants, in which the antidepressant used was compared with a placebo.

They reached the conclusion that when considering the risk-benefit profile of antidepressants in the acute treatment of major depressive disorder, these drugs do not seem to offer a clear advantage for children and adolescents. Fluoxetine is probably the best option to consider when a pharmacological treatment is indicated.

Lancet 2016; 388: 881–90

Stockings to prevent post-thrombotic syndrome

What is the effect of stopping elastic compression stocking (ECS) therapy 12 months after a diagnosis of proximal deep venous thrombosis versus continuing ECS for 24 months on the occurrence of post-thrombotic syndrome and disease specific quality of life?

That is the question asked in this multicentre trial performed in the Netherlands. Five hundred and eighteen patients were randomised to either 12 or 24 months of treatment. The proportion of patients that developed the post-thrombotic syndrome was 19.9% in the group that stopped ECS at 12 months and 13% in those who continued ECS for 24 months. The authors estimate that 14 patients would have to continue ECS to prevent one case of post-thrombotic syndrome.

They believe that ECS therapy should ideally be continued for 24 months in ECS compliant patients after deep venous thrombosis.

BMJ 2016; 353: i2691

Efficacy of the herpes zoster subunit vaccine in adults 70 years of age or older

A trial involving adults 50 years of age or older showed that the herpes zoster subunit vaccine (HZ/su) containing recombinant varicella-zoster virus glycoprotein E and the AS01B adjuvant system was associated with a risk of herpes zoster that was 97.2% lower than that associated with placebo.

This report concerns a similar trial conducted in subjects 70 years of age or older. Thirteen thousand nine hundred participants (mean age 75.6 years) were randomised to receive either HZ/su or placebo. At 3.7 years follow-up the incidence of herpes zoster was 89.8% lower in those vaccinated with HZ/su compared with the placebo group. Serious adverse effects, potential immune-mediated diseases and deaths occurred with similar frequencies in the two groups.

The researchers conclude that the use of HZ/su is efficacious and safe when used in adults 70 years of age or older.

N Engl J Med 2016; 375: 1019–32

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Some Disadvantages in Clubs

By GORDON MACDONALD, M.D.

I had dealings with friendly and benefit societies for some twenty years. During the whole of that period my list averaged between 500 and 600 members per annum. They comprised Oddfellows, Foresters, Druids, Railway and Police Society members. For many years I only had dealings with Oddfellows and Police, so that my remarks are principally based upon my experiences amongst them. Both those bodies are largely recruited from the tradesman and farmer class. They represent men of some ambition. Amongst the Oddfellows the earning power of members varied greatly. The bulk of them averaged from £3 to £5 per week. Some earned as much as £10 per week, and a few rose to £1,000 a year or over. The comparatively rich men, as a rule, did not avail themselves of my services. Some of them, however, did so, and upon my giving them some hints regarding the matter said they had joined the Society when poor men and continued supporting it all along, and hence they thought they were justly entitled to any benefits going. Their reasoning may have been sound, but their sense of generosity unsound. To rise to be a master tradesman or small merchant seemed to be the ambition of most of them, and numbers of them accomplished their purpose. When they arrived at that point many of them were much more comfortably situated than their struggling medical adviser. In their success some stood by their friend of other days, and some threw him overboard. The men joining the Police Force seemed to do so from various motives. They were all picked men physically, but their mental capacities varied immensely. Some joined in the hope that police duty might enable them to arrive at something better, but the great majority were "steady job seekers." The aims of the ambitious men were towards the higher ranks of the service, or the possibility of qualifying as lawyers, or becoming publicans. In each of those fields several succeeded in gratifying their ambition. The ambitious

men in both bodies were my most troublesome customers. This I attributed to the tear and wear of their nervous systems. Their digestive and nervous systems were frequently upset demanding purgatives, sedatives, and stimulants. Many of the young constables were men accustomed to hard outdoor work and much eating. On joining the police they were thrown into barrack life. Here they formed a mess of their own, employed a Chinese cook, and lived well. Their duties were light, their appetites good and butcher meat abundant. After a few months of this life and fare, most of them began to suffer from stomach and bowel troubles. This I attributed to excessive eating, especially of proteins, and the lack of their accustomed hard work. On showing them their error a few of them reformed, but the many went on piling Pelion on Ossa, and closing themselves with various warranted cures. Those societies are both serviceable and objectionable in the life of the community. They tend towards a loose and haphazard method of medical work. The club doctor, in order to overtake his work, is frequently compelled to make a rapid diagnosis, and thus treat symptoms rather than causes. The habit of treating symptoms grows, and ultimately destroys scientific medicine. The method is easy and temporarily effective, but it blunts the investigating, deliberative faculty upon which scientific medicine is based. The treating of symptoms also tends to the forming of the medicine habit, and that, once acquired, is almost as destructive as the alcohol habit. My experience of club practice particularly has shown me that there is a considerable number of men and women in the community who are addicted to the drug habit. Those of a weakly, nervous and sensitive constitution are particularly apt to drop into this habit. They are worried or disappointed or in poverty, and hence can neither eat nor sleep. Then comes the desire for something to charm life's ills away. The men have alcohol, tobacco, and clubs to indulge their

fancy—while most women are confined to tea, novels, and picture shows. A certain number of them reason thus: “Let’s go and see the doctor, perhaps we may get something good from him.” Now, it does not concern the club doctor’s finance how much medicine members may consume, for the society provides free medicine as well as free medical attendance. But he, poor man, often finds himself in a dilemma, for should he confine himself to advice without the usual bottle, he is no good, and if he gives them pills, powders and potions ad libitum, he does something which his better judgment disapproves of. Should his drugs not have some immediate effect he is liable to an urgent call at bedtime, or during the night, to see someone with a bad headache or painful stomach demanding immediate relief. That, as a rule, can be readily accomplished, but it is merely treating symptoms, and sets the doctor deeply thinking. This evil does not end with the adult, but extends to the children. The medicine-loving father or mother creates a similar habit in their children. Every ache, every fretful exhibition, every blotch or pimple demands a soothing powder, a purgative or some ointment. The medicine-dosed child becomes the medicine-taking man or woman, and thus the vicious circle is perpetuated. Much of this child-dosing is carried on by parents and guardians independent of any medical advice. The patent medicine bill of the country also shows that self-dosing is extensively practised throughout the community.

The whole system leads one to think that as a people we have much to learn regarding the simple laws of health, and that instead of leaning upon those enduring laws, we lean upon artificial props of a very evanescent character.

Should the club doctor desire peace or kudos, he presses his own ideas upon those individuals, but merely supplies their wants. They, from conversation and reading, come to know the effects of certain substances, and frequently suggest or ask for them: It requires a man of angelic temperament and iron will to withstand the varied methods of attack of the drug habituates. Medicines can do much, but to expect them to cure all the ills of life is indeed

fatuous. In this respect it would be well if people and doctor remembered the scene between Macbeth and his doctor:—

Macbeth:

Canst thou not minister to a mind diseased,
Pluck from the memory a rooted sorrow,
Raize out the written troubles of the brain,
And with some sweet oblivious antidote
Cleanse the stuffed bosom of that perilous
stuff

Which weighs upon the heart.

Doctor:

Therein the patient must minister to himself.

Macbeth:

Throw physic to the dogs. I’ll none of it.

The desire to soothe or to excite the nerve-centres is one of the signs of our times. This is probably the explanation of the enormous consumption of tea, tobacco, alcohol, and certain drugs, together with the craze for exciting books and amusements. Whether this state be due to abundance or poverty, competition or ambition, disappointment or custom, degeneration or civilisation, lack of resource or lack of religion, is hard to determine. It is probable that each of those causes claims its victims. Those engaged in charitable, religious or medical work will, no doubt, observe various causes at work. Whatever the reason be it is evident that a considerable number of our people suffer from that train of symptoms called “nerves.” The remedy is as hard to determine as the cause. The Socialist says: “Give us equality of pay and sacrifice”; the philosopher says: “Give us culture and contentment”; the physician says: “Mix the breed”; and the theologian says: “Ye must be born again.” All those things are being preached and practised daily, but the cure is far off. It is safe to assert that it would be well for a large number of our people that much of the medicine dispensed, especially at the friendly societies’ dispensary, and to a lesser extent at private shops, were left undispensed. They may please and temporarily relieve, but they do not cure. This applies very pertinently to that class of medicines coming under the head of analgesics, sedatives, and soporifics, and to a lesser extent of aperients and so-called tonics. Chemists have informed me that

in their opinion these classes of medicines are being abused; that scientific medicine seems on the decline, or that the doctors lend a too willing ear to suggestions from their patients. Possibly those men are not the best judges, but they form their own opinions from the work passing through their hands. Some of the managers of the friendly societies' dispensary have also remarked to me that we doctors are "softies," and order costly and useless drugs and repeat bottle without stint, all to gain a little kudos or to get rid of some troublesome customer. The laymen who control the purse evidently take notice of the class of drugs upon which there is a great demand. They have also pointed out to me the wisdom of a doctor of the olden times who dispensed all his own club medicines. This sage had a large jar on his shelf labelled "Aqua Camph," and every doubtful, new and repeat bottle was filled from this mysterious jar. In this respect friendly societies are a distinct disadvantage to the community. If those people had to pay out of hand for every pill, powder and potion consumed, far less would be used, and hence fewer bad habits established. Yet the patent medicine bill seems to dispute this statement. It is extremely foolish to think that medicines can perform miracles. Common sense, attention to the laws of health, proper food, rest and nursing, together with the assuring words of the doctor will do quite as much as his wonderful drugs. The people, however, will not be satisfied unless they receive that scrap of paper written in mysterious caligraphy ordering them to swallow something, *ter die post cibis*. To pour a little of this, that or the other drug into a vexed stomach, in the hope that it may expel "Duncan's ghost," is poor reasoning. Cupidity is the incentive in some natures, or the desire to have something for their money, and so they go on swallowing ghosts until they themselves become ethereal. Others find the battle of life a dreadful struggle and an almost unbearable burden. Those people are glad to fly to anything that offers a moment's relief, and are soon the victims of unwise habits. The nervous organisation of many of our people seems to be degenerating, for they are unable to stand any strain. They are ambitious, but

are both mentally and physically unfitted to carry ambition's burden. Many of them are enamoured of riches and many of social distinction—neither can be had without effort, whilst the effort frequently leads to disaster. We cannot all be millionaires, nor dukes, nor leaders, and assuredly he or she who aspires in that direction must pay the price. Several of my club patients began business with little capital and as little knowledge of business. They struggled for a time and then for one who succeeded two failed. The same thing is observed in public life. Vanity or ambition fires them to undertake duties for which they are poorly equipped, and sooner or later they are failures or breakdowns. It must be patent to every observer in our midst that many of us strive to seem to be that which we are not. Wolsey's advice to Cromwell "to fling away ambition, for by it fell the angels," is to the point, yet ambition is a good and useful quality. Only he or she who gives rein to it must be well-equipped mentally and physically to sustain the fight.

The sick funds are indeed a blessing to many, and yet a stumbling block to others. A member is out of a job or has the prospect of losing it or is getting old, or sickness visits his family, or he is indolent or misbehaves, or is otherwise not up to the mark. He visits the doctor, gets his bottle, and asks to be put upon the funds for a few days. Once there the days develop into weeks and the weeks into months. The bottle comes regularly for a repeat, but it is a sphinx, and holds its secret well. The brethren visit him, the doctor is busy, and so long as he is silent all is well. Policemen have no sick fund, as their pay is not interrupted while temporarily incapacitated, but some of them are artful dodgers, and would require a Doyle to counter them. Some of them also are members of other societies, and thus they have two strings to their bows. Their weaknesses take the form of sickness while on night duty, or when ordered upon dangerous or unpleasant work, or when shifting beat, or in family sickness or jubilation, or when engaged in domestic duties, or in pique, etc., etc. In either case should the doctor make any reference to their resuming work or duty, then he is no good, and shortly afterwards certain names disappear from his list or

a more sympathetic and diplomatic practitioner is summoned to effect the cure. Popularity is the bane of our times, and every institution run upon popular lines suffers materially. Every leader, from the Premier downwards, has to live upon this elusive element, while their elevators groan continually. Treatment by contract seems to be necessary in our complex social system, but it is far from satisfactory to either party, and it would be well if some remedy could be devised for the weak spots in the system. As there is at present much talk regarding the payment of club doctors, I may as well state that for three years I kept an exact record of all the work done, and it barely gave me 6d. per visit and consultation. I

appealed to the lodge for increased remuneration, stating my reasons for so doing, but was met with the answer: Others are quite willing to do the work on our terms, and you yourself were also quite willing. In common parlance I saw that "I had made my bed, and must lie upon it," and so I continued doing my duty to the best of my ability until the hard work and irregular hours threatened to end my existence. There are some excellent people in lodges and some quite otherwise, and were it not for the former the life of the lodge doctor would be intolerable. Thus the world rolls on and wise is the man who surveys it in a calm and philosophic spirit.

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