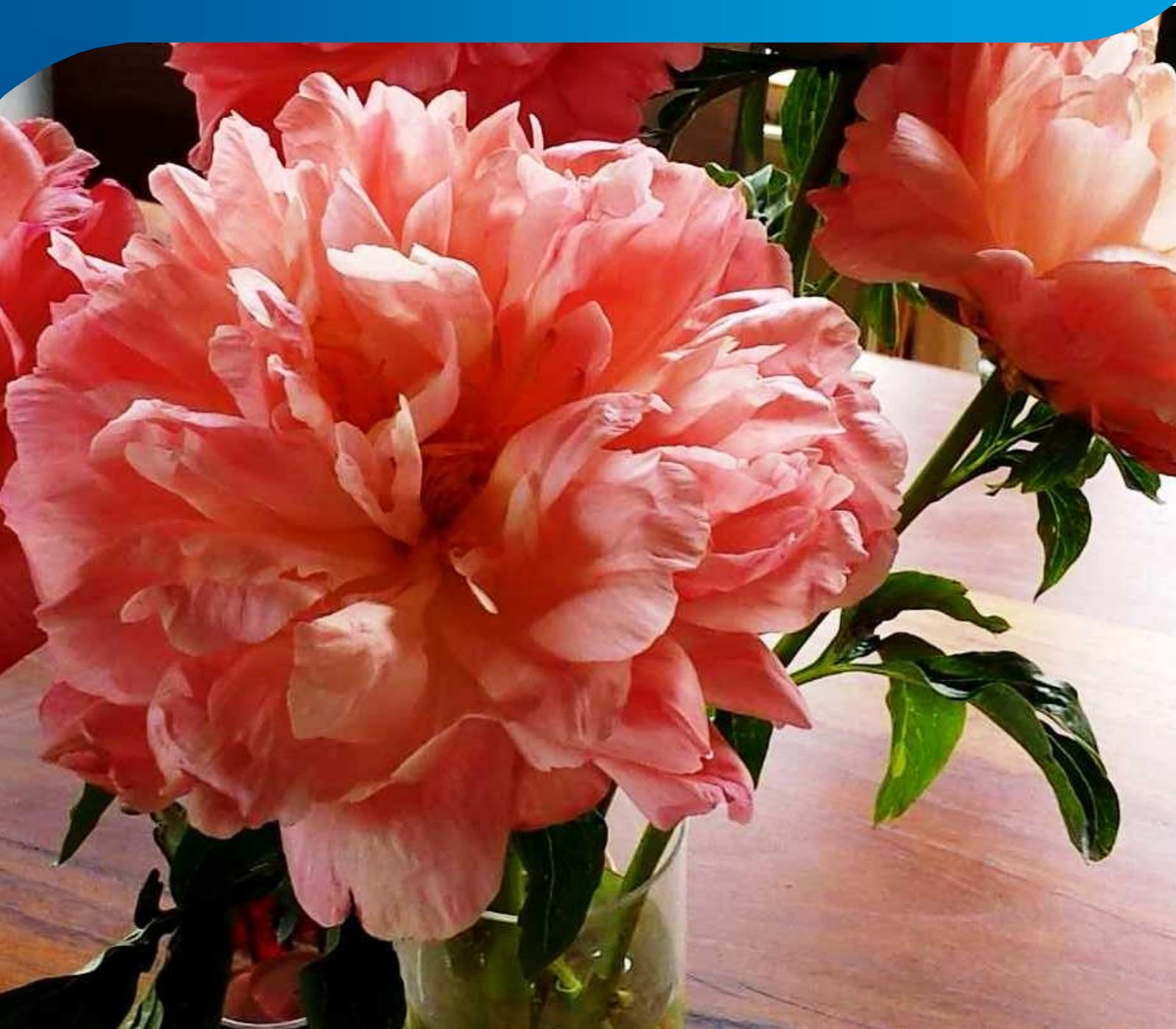


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# THE NEW ZEALAND MEDICAL JOURNAL

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## **In this issue:**

- Infant care practices related to sudden unexpected death in infancy: a 2103 survey
- HealthPathways: making the right thing the easy thing to do?
- HQSC: making good health care better

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## CONTENTS

### This Issue in the Journal

- 4 A summary of the articles featured in this issue

### Editorials

- 6 HealthPathways website: making the right thing the easy thing to do?  
*Timothy W Kenealy, Nicolette F Sheridan, Martin J Connolly*
- 10 New Zealand is far behind Australia in offering weight loss surgery  
*Steven Kelly, Richard Flint*
- 13 Reducing the risk of sudden infant death—a steady gain but still room for improvement  
*Dawn Elder*

### Articles

- 15 Infant care practices related to sudden unexpected death in infancy: a 2013 survey  
*B Lynne Hutchison, John M D Thompson, Edwin A Mitchell*
- 23 Hospital admissions for chronic obstructive pulmonary disease in New Zealand  
*Richard J Milne, Richard Beasley*
- 36 Is HealthPathways effective? An online survey of hospital clinicians, general practitioners and practice nurses  
*Graham McGeoch, Peter McGeoch, Brett Shand*
- 47 Regional differences in echocardiography provision in New Zealand—results from the 2013 SCANZ Workforce Survey  
*Belinda A Buckley, Katrina Poppe, Mark J Farnworth, Gillian Whalley*
- 56 A comparison of laparoscopic adjustable gastric band and laparoscopic sleeve gastrectomy: a single surgeon's experience  
*Richard Flint*
- 62 Use of an Accelerated Diagnostic Pathway allows rapid and safe discharge of 70% of chest pain patients from the Emergency Department  
*Andrew Munro, Tom Jerram, Tom Morton, Suzanne Hamilton*
- 72 Projected costs of colorectal cancer treatment in New Zealand in the absence of population screening  
*Ian Sheerin, Terri Green, Diana Sarfati, Brian Cox*

### Viewpoints

- 86 Consensus pathways: evidence into practice  
*Graham McGeoch, Ian Anderson, Juanita Gibson, Carolyn Gullery, David Kerr, Brett Shand*
- 97 The Health Quality and Safety Commission: making good health care better  
*Carl Shuker, Gillian Bohm, Dale Bramley, Shelley Frost, David Galler, Richard Hamblin, Robert Henderson, Peter Jansen, Geraint Martin, Karen Orsborn, Anthea Penny, Janice Wilson, Alan F Merry*

## Clinical Correspondence

- 110 Sarcoidosis presenting with acute hydrocephalus in a New Zealand European female  
*Arjun Chandna, Christopher Todd, David Murphy, Ronald Boet, Roderick Duncan*
- 114 A classical image of dumbbell-shaped neurofibroma  
*Tony Ete, Sumantra Mondal, Debanjali Sinha, Jyotirmoy Pal, Alakendu Ghosh*

## 100 Years Ago in the NZMJ

- 116 Some remarks on the treatment of tuberculosis amongst the Maoris at Tuahiwi Park

## Methuselah

- 117 Cardiovascular risk with non-steroidal anti-inflammatory drugs

## Proceedings

- 118 Proceedings of the Annual Scientific Meeting of the NZ Society of Gastroenterology: 26–28 November 2014

## Obituaries

- 136 David John (Jack) Gudex
- 138 Meredyth Colston Gunn (nee Wilson)

## Erratum

- 140 Self-rated health, health related behaviours and medical conditions of Māori and non-Māori in advanced age: LiLACS NZ (4 July 2014)

## Notices

- 141 NZMJ Publication Dates and Themes in 2015
- 142 Reviewers for the NZMJ in 2014

## SUMMARIES

### **Infant care practices related to sudden unexpected death in infancy: a 2013 survey**

B Lynne Hutchison, John M D Thompson, Edwin A Mitchell

In 2013, a survey of infant care practices related to the risk of sudden unexpected death in infancy (SUDI) was carried out with mothers of infants aged between 6 weeks and 4 months. Compared with the same survey carried out in 2005, there was an increase in mothers' knowledge of SUDI risk factors, with more mothers sleeping their infant on the back in the parental bedroom, and fewer mothers smoking and bed-sharing. These results suggest possible reasons for the falling SUDI rate in New Zealand.

### **Hospital admissions for chronic obstructive pulmonary disease in New Zealand**

Richard J Milne, Richard Beasley

Hospital admissions for chronic obstructive pulmonary (lung) disease cost New Zealand taxpayers about \$60 million each year. They are more common for rural, elderly, socioeconomically deprived and Māori and Pacific peoples than for other groups. More effective treatments are required to reduce the severity of this debilitating fatal disease.

### **Is HealthPathways effective? An online survey of hospital clinicians, general practitioners and practice nurses**

Graham McGeoch, Peter McGeoch, Brett Shand

HealthPathways is a website that was developed in Canterbury to provide general practitioners and practice nurses with locally relevant clinical information required during a patient appointment. An online survey was carried out in 2013 to determine the opinions of general practitioners, practice nurses and hospital doctors on HealthPathways. The survey showed a very high level of acceptance of HealthPathways in the three groups, with the website considered easy-to-use, and as having contributed to increased healthcare in the community and an improved referral and triage process. More than half of the respondents considered HealthPathways had improved their working relationships with other healthcare professionals. Analysis of the data showed some small but interesting differences in the responses of female, younger or rural general practitioners.

### **Regional differences in echocardiography provision in New Zealand—results from the 2013 SCANZ Workforce Survey**

Belinda A Buckley, Katrina Poppe, Mark J Farnworth, Gillian Whalley

A 2013 survey of NZ public hospital echocardiography services demonstrates unequal regional distribution relating to regional population size and demographics (age, ethnicity and socioeconomic status). Additionally there are regional differences in the distribution, population-based size and demographics of the cardiac sonographer workforce. This is the first study to describe the relationship of the cardiac workforce distribution to regional echo service provision.

### **A comparison of laparoscopic adjustable gastric band and laparoscopic sleeve gastrectomy: a single surgeon's experience**

Richard Flint

Laparoscopic adjustable gastric band (LAGB) and laparoscopic sleeve gastrectomy (LSG) are two forms of laparoscopic weight loss surgery. LAGB has been very popular as people have been attracted to its low complication rate and robust weight loss. Recently the LSG has gained more popularity. This current study suggests this is because LSG has greater weight loss and fewer problems than LAGB over the longer term.

### **Use of an Accelerated Diagnostic Pathway allows rapid and safe discharge of 70% of chest pain patients from the Emergency Department**

Andrew Munro, Tom Jerram, Tom Morton, Suzanne Hamilton

We show how a pathway of care in the Emergency Department (ED) for people who present with chest pain (and who are not clearly having a heart attack on the first ECG), can allow rapid and safe discharge for the non-high risk group.

### **Projected costs of colorectal cancer treatment in New Zealand in the absence of population screening**

Ian Sheerin, Terri Green, Diana Sarfati, Brian Cox

In NZ, between 2014 and 2026, increased numbers of people will present to health services with diagnosed colorectal cancer and this will entail an annual health service cost estimated at \$100.2 million by 2026. NZ should plan for this estimated increase in order to resource diagnostic, treatment and follow-up services so that bottle-necks and delays in treatment can be avoided.

## EDITORIAL

## HealthPathways website: making the right thing the easy thing to do?

Timothy W Kenealy, Nicolette F Sheridan, Martin J Connolly

Two papers in this edition of the *Journal* report enthusiastically on HealthPathways in Canterbury—“a website that provides general practice teams with guidance on clinical assessment and management of medical conditions, relevant to local services and resources”.<sup>1</sup> One paper reports a user survey of health professionals (but not patients).<sup>2</sup> The other paper describes the history, processes and some results.<sup>1</sup>

HealthPathways grew from a need for an “integrated healthcare system”, which would reduce demand for secondary care services, and a recognition that redesigning the interface between primary care and secondary care was essential to reach this goal.<sup>1</sup>

Providing best health care can be considered in two components—determining the right thing to do, and making sure this happens. The first can be embodied in evidence-based guidelines and the second in implementing these. Implementation almost always requires changing human behaviour—frequently that of health professionals. It is commonplace to see high quality guidelines with poor implementation, and system changes that are not evidence-based.

Integrated care is variously defined, but the central element is always care that is coordinated over time, place and care provider.<sup>3</sup> Requirements to achieve this are also variously listed,<sup>4</sup> but here we emphasise elements derived from the Chronic Care Model<sup>5,6</sup> and re-articulated by Ham:<sup>7-9</sup> improving organizational and professional relationships, distributive leadership (beyond the heroic individual), linking health and social services, supporting patient self-management, using health information and communication technologies including data monitoring and management, and linking these within an overall system of care. We will consider HealthPathways against each of these criteria.

The survey respondents are clear that HealthPathways has improved organisational relationships between primary care and secondary care, and professional relationships between general practitioners and hospital specialists. This is likely to be due to the process of developing the pathways more than the product, but reinforced by mutual use of the product. Similarly, distributive leadership is embodied in the process, and is embodied in the use of the product within which individual clinicians standardise their work.

The language of HealthPathways refers to linking primary care and community care, but the scope of community care is not defined. In a New Zealand context this is generally constrained to referrals to allied health professionals. The language of the Chronic Care Model and primary health care go well beyond this to include specific focus on links to social services and care,<sup>8</sup> and beyond this to social determinants of health.<sup>10,11</sup> Results from links to narrowly-defined community care will always be limited to more-of-the-same.

The patient voice is not obvious in the HealthPathways process or the assessments reported. Patient education material is built into the system but is for the convenience of general practitioners and practice nurses. Consultations using HealthPathways are thought to take a little longer. More time is generally considered positively by patients, but the report authors interpret this as negative from the presumed viewpoint of general practitioners and practice nurses.

Advanced use of information and communications technology is central to HealthPathways. So, it seems, is embedding HealthPathways in a process that is clearly defined, adequately funded, socially and professionally acceptable to the stakeholders and set up so that professional writers and technology supports the output agreed by stakeholders, rather than the other way around. All the right

priorities, all regularly ignored elsewhere. Apart from routine audit of HealthPathways processes, the authors point to the potential to monitor unmet need for secondary care services. This would require primary care to refer everyone who they think needs care, rather than limit referrals to those they think will be accepted. We think this is desirable but unlikely in practice as it would presumably take additional time from primary care and, in any case, the pathways by definition are defined around local service resources.

Is HealthPathways embedded within a wider, coherent and managed system of care? This is not known from the reports offered and would be an appropriate subject for further study. We have seen presentations from Canterbury that demonstrate the intention to take a systems view of health care and links to social services.

We are aware of ambitious work on a summary medical record based on the primary care record and accessible to an increasing number of health care professionals involved in the care of a given patient (electronic Shared Care Record). This Record is also provider-centred but does have strong patient privacy protection built in.<sup>12</sup> There are plans that eventually patients will be able to view their own record. Compared with what we are aware of currently, a full systems approach might include a patient portal, more developed support for patient / whanau self-management, more active data management and quality control across primary and secondary care, and a systematic population health programme using both a counting-individuals approach and a determinants-of-health approach.<sup>13</sup>

We think both papers go beyond the data they provide to produce strong conclusions in support of HealthPathways. Having said that, we think the data provided is sufficiently strong to congratulate the many people—and commend the distributive leadership approach adopted—who have made HealthPathways a success. We are sure they would agree that their job is not finished ... and it never will be.

Determining the right thing to do is, dare we say it, relatively straightforward inasmuch as the process of creating and synthesising evidence is relatively well-developed. The science of implementation, making sure the right things are done, is less well-developed. Evidence-based guidelines attempt to identify “universal truths” about what should be done. Implementation is local and requires statements about who does what and when. Little implementation occurs by diffusion of (cognitive) evidence; it is more accurately portrayed by theories of professional dominance<sup>14</sup> and spread of ideas by socialisation.<sup>15</sup>

Given the longstanding history of poor- or non-relationships between health professionals in New Zealand, particularly across the divide between primary care and secondary care,<sup>16</sup> it is not surprising that Canterbury addressed this issue as central to their quest for integrated care. Others have identified and addressed the same issue, often without the degree of success that Canterbury appears to have achieved.<sup>16</sup>

One of the many challenges for Canterbury will be—having addressed issues of professional dominance by starting with general practitioners and hospital doctors as central to developing HealthPathways—that they do not continue to reinforce inappropriate professional relationships. Medical dominance poses an obstacle to interprofessional cooperation and may reduce the contribution of nurses and allied health professionals. Best care is provided by teams.<sup>17</sup>

HealthPathways is popular and widely used in Canterbury and the process, together with most of the pathways, has been taken up by an increasing number of other health providers in New Zealand and Australia. Presumably health care providers find it easier and/or more useful than their alternatives. The ideal of implementation is to make the right thing to do the easiest thing to do.

HealthPathways seems to have successfully developed a process that makes using their product the easiest thing to do. The authors have so far produced little evidence to confirm that their product is the right thing to do. We are not implying doubts about patient benefit or harm, but merely point to the

considerable work remaining and needing to be done to prove effectiveness, cost effectiveness and equity with data that go beyond provider impressions and indirect or process indicators.

**Competing interest:** Nil.

**Author information:** Timothy W Kenealy, Associate Professor of Integrated Care, Department of Medicine and Department of General Practice and Primary Health Care, University of Auckland; Nicolette F Sheridan, Associate Professor, School of Nursing; Associate Dean of Equity, Faculty of Medical and Health Sciences, University of Auckland; Martin J Connolly, Freemasons' Professor of Geriatric Medicine, Department of Medicine, University of Auckland

**Correspondence:** Associate Professor Timothy Kenealy, South Auckland Clinical School, Middlemore Hospital, Private Bag 93311, Otahuhu, Auckland 1640, New Zealand. [t.kenealy@auckland.ac.nz](mailto:t.kenealy@auckland.ac.nz)

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## EDITORIAL

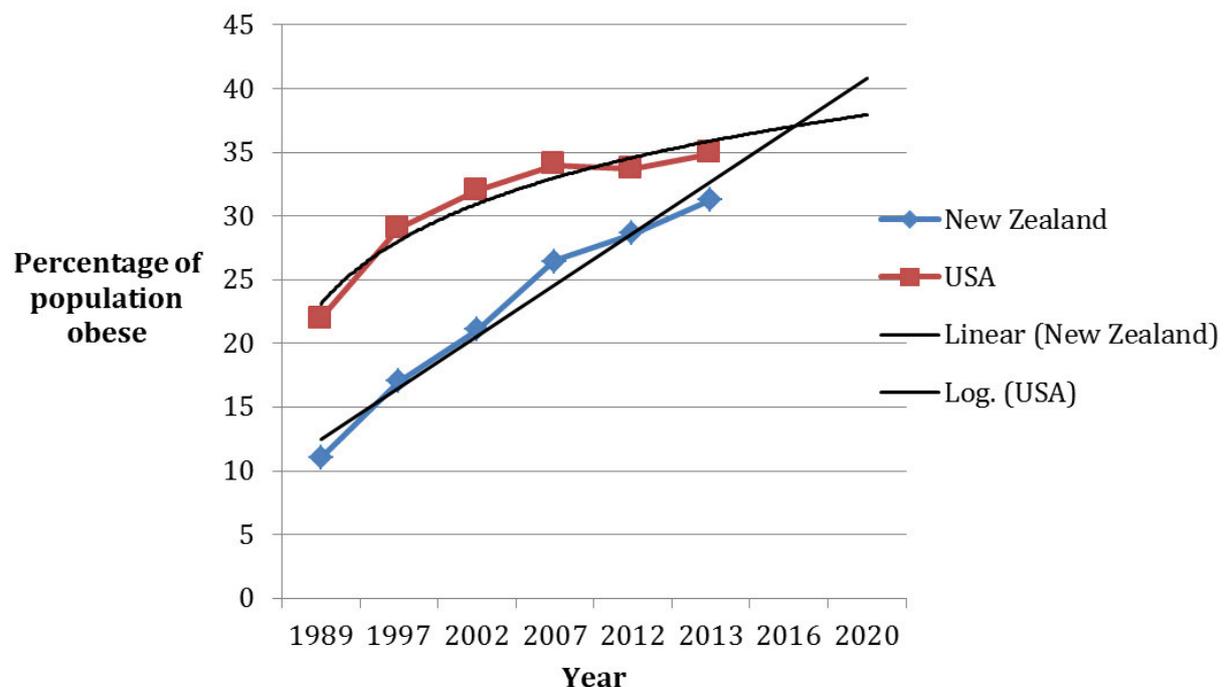
## New Zealand is far behind Australia in offering weight-loss surgery

Steven Kelly, Richard Flint

The size of our obesity problem continues to grow. It is no secret that a third of New Zealand's adult population are too fat, with a disturbingly high rate amongst the Māori and Pacific Island communities.<sup>1</sup> But the problem is getting worse. Ministry of Health data shows that overall the rate of obesity in New Zealand rises by 1% each year (Figure 1).

This suggests that New Zealand will become the fattest nation on earth within 5 years as the nations with greater incidences of obesity have either plateaued (USA)<sup>2</sup> or have developed nationwide programmes that will control the rising rate (Mexico).<sup>3</sup>

**Figure 1. National adult obesity prevalence trends comparing New Zealand and USA**



Therefore it is timely that New Zealand reflects on its utilisation of effective weight-loss strategies. Surgery still remains the most capable strategy for inducing robust and long-term weight loss. Patients can expect an average of 50–70% excess body weight loss that is maintained over several years. This cures or improves multiple obesity-related health comorbidities such as diabetes that confers a survival advantage.<sup>4,5</sup>

Bariatric (weight loss) surgery is highly cost-effective and in many cases will pay for itself within just a few years.<sup>6</sup> New Zealand's implementation of weight-loss surgery was recently assessed by a survey of all nine major bariatric surgical groups in New Zealand. The number and types of operations that the units performed for the year ending February 2014 were collated (Table 1).

There were a total of 889 bariatric operations during this 12-month period with an even distribution between the public and private sectors. The most prevalent procedure was the laparoscopic sleeve gastrectomy at 61% followed by the laparoscopic gastric bypass at 37%. The laparoscopic gastric band accounted for just 1% of all cases.

**Table 1. New Zealand weight-loss surgery procedures: February 2013 to February 2014**

	Total	Sleeve gastrectomy	Gastric bypass	Gastric band	Duodenal switch
<b>Number</b>	889	538	326	15	10
<b>Percentage</b>		61%	37%	1%	1%

Is this an appropriate number of operations to be performing each year considering New Zealand is one of the fattest nations on earth? In 2008 it was recommended that our District Health Boards (DHBs) should provide 915 bariatric operations annually; a number that equates to just 0.5% of the morbidly obese population.<sup>7</sup> This current study suggests that this extremely modest goal is far beyond the DHBs' current level of effort. But is this poor response unique to New Zealand?

Australia is like New Zealand in that over 5% of the adult population are morbidly obese (BMI >40 kg/m<sup>2</sup>). If we accept that morbid obesity is an absolute indication for bariatric surgery<sup>8</sup> then we can calculate and compare the bariatric intervention rate. Using these assumptions, New Zealand's bariatric surgery intervention rate is calculated at 0.4% procedures per year. However Australia performs 16,000 bariatric operations a year<sup>9</sup> that calculates to a three-fold greater rate at 1.4% procedures per year.

Considering that Australia has less of an obesity problem than New Zealand (currently fifth on the OECD list of obese nations at a prevalence of 28.5%) it seems remarkable that we should be performing surgery at such a poor comparable rate.

So why is bariatric surgery in New Zealand so weakly utilised when compared to Australia and other nations? The explanation for this may lie in a general unawareness of the threat that obesity poses to New Zealand. There also appears to be a lack of understanding of the safety and powerful efficacy of weight-loss surgery.

The health authorities need to take leadership in this instance and be encouraged to front up to the current challenge that obesity poses. They need to seriously address the impediments to access publically funded bariatric surgery. Health insurance companies should consider their moral obligation toward funding a surgery that improves health and mortality.

Furthermore, health resource managers need to accept that ignoring obesity incurs a greater cost than surgical treatments—because the size of the solution will only increase as the extent of New Zealand's obesity problem grows.

**Competing interests:** Both authors are bariatric surgeons.

**Author information:** Steven Kelly & Richard Flint, Bariatric Surgeons, Department of Surgery, Christchurch Public Hospital, Christchurch

**Correspondence:** Steven Kelly, Department of Surgery, Christchurch Hospital, PO Box 4345, Christchurch, New Zealand. [stevenkelly@clear.net.nz](mailto:stevenkelly@clear.net.nz)

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## EDITORIAL

## Reducing the risk of sudden infant death—a steady gain but still room for improvement

Dawn Elder

The term ‘sudden infant death syndrome’ (SIDS) describes the sudden death of an infant in the first year of life (apparently occurring during sleep) that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and clinical history.<sup>1</sup>

Sudden unexpected death in infancy (SUDI) is now the preferred terminology and describes cases at presentation that range from those that remain unexplained following full investigation (SIDS), to those that are fully explained after investigation and in particular post mortem—i.e. cases clearly attributable to factors which on their own alone would be sufficient to cause death. In the middle are the ‘unascertained’ cases where a pathologist or coroner is unclear to what extent the deaths are explained by circumstances at the time of death such as bedsharing or placement in another non-recommended sleep position. The term ‘unascertained’ is usually used because there is incomplete information available about the circumstances of death to determine exactly whether a particular sleep environment would have resulted in the accidental asphyxia of an otherwise completely normal and healthy infant.

In the 1980s, New Zealand had the unenviable reputation of having one of the highest rates of sudden infant death in the world.<sup>2</sup> There was also a north–south differential with a higher prevalence documented in the south than the north. This led to the development of the New Zealand Cot Death Study, which found that four modifiable factors, prone sleeping, bedsharing, maternal smoking during pregnancy, and not breast feeding were risk factors for SIDS.<sup>3</sup> These findings were confirmed by other international epidemiological studies undertaken both concurrently and since and have been the basis of the ‘reduce the risks’ and ‘safe sleep’ campaigns developed locally and worldwide that have brought about the reductions in sudden infant death rates seen today.<sup>4</sup> The question remains, however, if we have the knowledge now to prevent these deaths why are they still happening today, albeit as lower rates.

The paper by Hutchison et al in this edition of the *Journal* describes changes over time from 2005 to 2013 in mothers’ knowledge of (and practice related to) risk factors for sudden unexpected death in infancy.<sup>5</sup> These changes are positive and reassuring. Avoidance of bed-sharing has at times been a controversial part of the ‘reduce the risk’ message. For those of us who have had to provide information and support to parents who have had a baby die in a bedsharing situation, it seems to be straightforward. These are preventable deaths.

An interesting development in more recent times is that the Police in New Zealand are now choosing to charge some parents of infants who have been found dead in a bedsharing situation, usually when excessive use of alcohol has been associated.<sup>6</sup> The charges laid are usually from Part 8, Section 152 of the Crimes Act entitled ‘Duty of parent or guardian to provide necessaries and protect from injury’. There is some bias here as parents who have their baby in bed every night but their baby does not die, are not charged with failure to provide the ‘necessaries of life’ and yet the ‘crime’ committed, if any, appears the same. For those infants who die it is most likely the associated underlying vulnerability of the infant in bed with the adult that it is the issue not the act of bedsharing alone.

Despite a huge increase in the literature describing a number of differences between those infants who are at risk of dying unexpectedly and those that thrive, we cannot yet prospectively pick each individual infant who will succumb in a potentially compromising situation such as bedsharing nor do we fully understand the final mechanism of death for these all of these infants. If there has been an

independent observation that an adult was found lying completely over an infant obstructing the airway then the mechanism of death is usually clear, but that is rare.

So we now know enough to provide information for parents about how to greatly decrease the risk of their infant dying suddenly and unexpectedly but we do not know enough to be able to give an individual baby a complete clearance for 'risk'. There is still the occasional infant dying suddenly and unexpectedly in an apparently safe sleep situation and these infants indicate to us that we do not yet have all the answers to solve this particular clinical problem and reason for post-neonatal mortality. We still, however need to ensure that the sleep situation of each infant is as safe as possible.

Why do some parents still not place their child routinely to sleep in the supine position for sleep and in their own bed? For some, there are cultural reasons why bedsharing is preferred. What is often forgotten is that the development of bedsharing in those cultures started at a time when babies slept alongside their parents on a low sleep surface with their own bedding, not in a queen, double or single bed with shared bedding. For others the importance of bedsharing is more about attachment and facilitating breastfeeding.

For others bedsharing sadly occurs because of poverty and overcrowding and is therefore not a truly free choice of the parents. Bedsharing can also occur because of lack of appreciation of risk—'it won't happen to me'. It is not unusual for the final fatal bedsharing event to occur because of a combination of factors that affect parental judgement such as tiredness and alcohol or other drug use.

So in 2015 the message does remain the same and it is pleasing (in this sample at least) that parents and caregivers are heeding the messages about safe sleep for their infants. Avoidance of bedsharing, placement of infants to sleep in the supine sleep position, avoidance of smoking during and after pregnancy, and breast-feeding are still the main messages. Midwives and Plunket nurses are providing good advice to families, and if it is followed, more infant lives will be saved.

**Competing interests:** Nil.

**Author information:** Dawn Elder, Professor and Head of Department, Department of Paediatrics and Child Health, University of Otago, Wellington

**Correspondence:** Professor Dawn Elder, Department of Paediatrics and Child Health, University of Otago – Wellington, PO Box 7343, Wellington, New Zealand. [dawn.elder@otago.ac.nz](mailto:dawn.elder@otago.ac.nz)

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## ORIGINAL ARTICLE

## Infant care practices related to sudden unexpected death in infancy: a 2013 survey

B Lynne Hutchison, John M D Thompson, Edwin A Mitchell

### Abstract

**Aim** This survey aimed to evaluate mothers' knowledge of, and practices related to, risk factors for sudden unexpected death in infancy (SUDI) and to compare results with a similar survey conducted in 2005.

**Method** 400 randomly selected women with infants between the ages of 6 weeks and 4 months were sent a postal questionnaire asking about their knowledge and infant care practices related to SUDI risk factors. Included were questions on sleep position, bed sharing, room sharing, smoking, and breastfeeding. Results were compared with a similar survey conducted in 2005.

**Results** There were 172 (43%) responses. Compared with 2005, more women in this survey cited avoiding bed sharing, keeping the face clear, avoiding soft bedding, and room sharing as SUDI prevention factors. Compared with 2005, more mothers usually used the supine sleep position and shared the parental bedroom, while fewer mothers reported smoking. Eight percent said the infant usually shared a bed, down from 15% in 2005. Of the five main protective factors promoted by New Zealand's Ministry of Health (supine sleep, own bed, room sharing, smoke free, breastfeeding), 43% were implementing all of these practices.

**Conclusion** There has been an increased knowledge of SUDI risk factors. Also evident are an increase in supine positioning and room sharing and a decrease in smoking and bed sharing. These results suggest possible reasons for the falling rate of SUDI in New Zealand.

The leading cause of death in post-neonatal infants in New Zealand and indeed in most affluent countries is Sudden Unexpected Death in Infancy (SUDI). SUDI includes deaths from sudden infant death syndrome (SIDS), unascertained deaths, and deaths where the infant is found deceased in an unsafe sleeping environment.

SUDI rates in New Zealand are among the highest in industrialised countries.<sup>1</sup> However, the latest report from the Child and Youth Mortality Review Committee shows a decrease in SUDI deaths in infants aged 28 days to one year, from 55 in 2008 to 36 in 2012, equating to a drop in the rate from 0.85 to 0.59 per 1000 live births. While the rate of SUDI in Māori is significantly higher than non-Māori, Māori rates have also decreased, with deaths falling from 35 (1.86 per 1000 live Māori births) in 2008 to 21 (1.04 per 1000 live Māori births) in 2012.<sup>2</sup>

Bed sharing, that is an adult (usually the mother) sleeping on the same surface (usually a mattress) with an infant, is emerging as a major risk factor for SUDI now that supine sleeping is predominant.<sup>3</sup> Sixty-four percent of SUDIs in Auckland from 2000–2009 were associated with bed sharing; this increased to 92% in infants aged between 7 and 28 days.<sup>4</sup> A New Zealand coroner has recommended that infants should not bed share in the first 6 months of life.<sup>5</sup> There is no evidence that bed sharing is protective against SIDS.<sup>6,7</sup> Sleeping infants in their own bed in the parents' room is now strongly advised to reduce the risk of SUDI.<sup>7,8</sup>

Current advice from the New Zealand Ministry of Health<sup>8</sup> for reducing the risk of SUDI is: sleep baby on its back, keep the face clear, breastfeed, don't smoke, sleep baby in its own bed, sleep baby in the parental room for the first 6 months, have no soft bedding or toys in the cot, parents to avoid alcohol and drugs, and ensure the cot is safe—i.e. free from cords, gaps, etc.

This survey aimed to evaluate mothers' knowledge of, and practices related to, risk factors for sudden unexpected death in infancy (SUDI) and to compare results with a similar survey conducted in 2005.

## Methods

In August 2013, a postal questionnaire was sent out to 400 randomly selected women who had delivered an infant at National Women's Health (NWH) 6 weeks to 4 months previously. NWH is the largest maternity unit in Auckland, New Zealand, delivering >7500 infants annually. If no response was received within 2 – 3 weeks, a reminder phone call was made to the mother. The questionnaire and methods were similar to those used in a similar survey conducted in 2005 with mainly European mothers from the same hospital.<sup>9</sup> Sampling was performed by using computer generated random numbers, of which the first 400 were selected.

The questionnaire asked the mothers if they knew of any factors that might reduce the risk of SUDI, and about their own infant care practices such as sleep position, room sharing, bed sharing, pacifier use and the use of positioning devices, plus their reasons for using and concerns about these practices.

Return of the filled questionnaire implied consent. The mother's ethnicity was obtained from the hospital record, while the infant's ethnicity was obtained from the mother. Statistical analysis was performed using SAS v9.3 (SAS Institute, Cary, NC). Chi-squared analysis was used for categorical variables, and t-tests for continuous variables. The study was approved by the Health and Disability Ethics Committee and the Auckland District Health Board Research Review Committee.

## Results

Completed questionnaires were received from 172 (43%) women. Their characteristics are shown in Table 1 and compared with the 2005 group.

Other ethnicities comprised predominantly Asian ethnicities. Compared with the 2005 survey, there were fewer Pacific and more Other ethnicity mothers and the mean infant age was slightly lower this time. Otherwise, there were no significant differences in characteristics between the 2005 respondents and the 2013 respondents. There was no information about the non-responders apart from maternal ethnicity.

As in the 2005 survey, European mothers were more likely to respond than Māori, Pacific, and Other mothers. Similarly, compared with the ethnicity of all mothers delivering at NWH in 2013, the ethnicity of our 2013 sample was significantly different ( $p < 0.0001$ ).

### Knowledge of SUDI-protective risk factors

Mothers were asked to list any factors they knew that might help reduce the risk of cot death, or SIDS / SUDI. Significantly more mothers this time cited advice to avoid bed sharing, keep the face clear, use a firm sleep surface, avoid soft bedding, and sleep in the same room as the parent (Table 2).

There was a marked increase in reported sources of this information compared with 2005 (Table 3). Eighty-nine percent of mothers reported receiving a pamphlet about SUDI prevention, up from 71% in 2005 ( $p < 0.0001$ ), although in the following question asking about their sources of information many mothers did not specifically specify pamphlets as their source; rather, they tended to state the person or place from whom they received the pamphlet.

**Table 1. Characteristics of survey respondents**

Variables	2005 Respondents (n=278) n (%) or mean (SD)	2013 Respondents (n=172) n (%) or mean (SD)	Difference $\chi^2$ (p-value)
<b>Infant's ethnicity</b>			
NZ European /other European	175 (63.0)	108 (63.5)	0.95 (0.81)
Māori	29 (10.4)	13 (7.7)	
Pacific	31 (11.2)	8 (4.7)	
Other	43 (15.5)	41 (24.1)	
Not stated		2 (1.0)	
<b>Mother's ethnicity *</b>			
NZ European /other European	168 (60.4)	105 (61.4)	10.12 (0.02)
Māori	12 (4.3)	9 (5.3)	
Pacific	28 (10.1)	6 (3.5)	
Other ethnicities	59 (21.2)	51 (29.8)	
Not stated	11 (4.0)	1 (0.6)	
<b>Parity</b>			
Firstborn	135 (48.6)	82 (47.9)	0.02 (0.90)
Later born	143 (51.4)	89 (52.1)	
<b>Infant's gender</b>			
Male	143 (51.4)	77 (45.0)	1.74 (0.19)
Female	135 (48.6)	94 (55.0)	
<b>Gestation</b>			
<37 weeks	34 (12.2)	18 (10.5)	0.30 (0.58)
≥37 weeks	244 (87.8)	153 (89.5)	
<b>Infant's age (weeks)</b>	11.4 (3.9)	10.6 (3.0)	p=0.02
<b>Maternal age (years)</b>	33.0 (5.1)	33.5 (4.9)	p=0.30
<b>Infant birth weight (gm)</b>	3413 (658.4)	3360.2 (605.4)	p=0.39

\* Ethnic spread of mothers at NWH in 2013 was: NZ European/other European: 46.0%; Māori: 7.4%; Pacific: 12.5%; Other: 34.1%. (From National Womens Annual Clinical Report 2013)

**Table 2. SUDI prevention factors cited**

Variables	2005 Respondents (n=278) n (%)	2013 Respondents (n=172) n (%)	Difference in proportions, 2005–2013: p-value
Sleep baby on back†	234 (84.2)	137 (79.7)	NS‡
Don't smoke during pregnancy or around baby†	202 (72.7)	119 (69.2)	NS‡
Avoid bed sharing during sleep†	128 (46.0)	108 (62.8)	0.0004
Breastfeed†	96 (34.5)	45 (26.2)	NS‡
Keep soft objects and loose bedding out of the crib; keep face clear†	77 (27.7)	80 (46.5)	0.0001
Use a firm sleep surface; avoid soft bedding†	47 (16.9)	51 (29.6)	0.0002
Sleep in same room as parent†	4 (1.4)	40 (23.3)	<0.0001
Avoid alcohol/drugs around baby†	9 (5.3)	15 (8.7)	NS‡
Avoid overheating	74 (26.6)	34 (19.8)	NS‡
Avoid using second-hand crib mattresses	26 (9.4)	9 (5.2)	NS‡
Use a pacifier at nap time and bedtime	10 (3.6)	9 (5.2)	NS‡
Other—e.g. use natural fibres, use clean bedding, aired sleeping space, swaddle baby, etc.	67 (24.1)	66 (38.4)	0.002
Wrong answer, e.g. side or prone sleeping	7 (2.5)	4 (2.3)	NS‡
No risk factors known or listed	24 (8.6)	15 (8.7)	NS‡

†In NZ Ministry of Health guidelines 2013<sup>8</sup>

‡NS: not significant at 5% level

**Table 3. Sources of SUDI prevention information**

Source	2005 Respondents (missing=1) n (%)	2013 Respondents (missing=2) n (%)	Difference in proportions, 2005–2013: p-value
Midwife	149 (53.8)	135 (78.5)	<0.0001
Antenatal class	111 (40.1)	95 (55.2)	0.002
Plunket (community child health nurse)	74 (26.7)	135 (78.5)	<0.0001
Doctor	0 (0.0)	34 (19.8)	<0.0001
Media	54 (19.5)	66 (38.4)	<0.0001
Internet	0 (0.0)	57 (33.1)	<0.0001
Books	42 (15.2)	75 (43.6)	<0.0001
Friend	15 (5.4)	33 (19.2)	<0.0001
Family	15 (5.4)	43 (25.0)	<0.0001
Hospital / Birthcare	8 (2.9)	11 (8.1)	0.03
Pamphlets	10 (3.6)	5 (2.9)	NS‡
Other	4 (1.4)	4 (2.3)	NS‡

‡NS: not significant at 5% level

### SUDI-related infant care practices used

**Sleep position**—While the sleep position used last night did not differ from 2005, the usual sleep position was significantly different, with more mothers using the supine position than previously (Table 4). Again, the main reasons given for choosing the usual sleep position were as follows: back: safety and recommended by health professional; side: baby sleeps better, safety, and concerns about head shape; prone: baby sleeps better and concerns about aspiration and wind; and combination positions: safety, baby sleeps better, and concerns about head shape. Most mothers had no concerns about their choice of sleep position.

**Table 4. Position or positions in which baby placed to sleep**

Variables	2005 Respondents n (%)	2013 Respondents n (%)	Difference 2005–2013: $\chi^2$ (p-value)
<b>Sleep position last night</b>			
Back	201 (72.3)	134 (77.9)	4.7 (0.32)
Side	39 (14.0)	15 (8.7)	
Front	4 (1.4)	5 (2.9)	
Side+back	34 (12.2)	16 (9.3)	
(Back or side) + front	0	2 (1.2)	
<b>Sleep position usually</b>			
Back	180 (64.8)	125 (72.7)	9.88 (0.04)
Side	29 (10.4)	11 (6.4)	
Front	8 (2.9)	4 (2.3)	
Side+back	61 (21.9)	27 (15.7)	
(Back or side) + front	0	5 (2.9)	

Similar to the earlier survey, there were mothers who knew the protective benefit of supine sleeping but yet did not use this position. Of those who had cited supine sleeping as protective, 74% usually slept their infant supine; the remaining 26% usually used a non-supine position, consisting of 4% prone, 7% side, and 16% side and back.

**Room sharing**—Significantly more mothers reported sharing their room with their infants in this survey, and especially that the infant was in its own bed in the parents' room (Table 5). Of the 40 mothers who cited room sharing as protective, 33 (83%) usually slept their infant in their room. The main reasons for the choice of room were, in order: can observe infant, parent and/or baby can sleep

better, safety, and prefer closeness. Most mothers (86%) had no concerns about their choice of room for the baby to sleep in.

**Table 5. What room does baby usually sleep in?**

Room slept in usually†	2005 Respondents n (%)	2013 Respondents n (%)	Difference 2005–2013: $\chi^2$ (p-value)
Own bed, parents' room	110 (39.9)	103 (61.3)	19.3 (<0.0001)
Own bed, own room	123 (44.6)	51 (30.4)	
Shared bed, parents' room	42 (15.3)	14 (8.3)	

† Excludes twins sleeping together

**Bed sharing**—85% of infants had slept in their own bed last night, and 90% slept this way usually (Table 6). When “usual bed,” excluding twins sharing a bed, was dichotomised into own bed only and any shared bed, 8% (15% in 2005) usually shared a bed for some or all of the night ( $\chi^2=4.46$ ,  $p=0.03$ ). Of those bed sharing last night, 29% shared for more than 5 hours (63% in 2005,  $p=0.02$ ). The main reasons given for sharing a bed were for breastfeeding and for short naps or settling baby; safety concerns about this were expressed by 43%.

**Table 6. Bed in which baby slept**

Variables	2005 Respondents n (%)	2013 Respondents n (%)	Difference 2005–2013: $\chi^2$ (p-value)
<b>Bed slept in last night</b>			
Own bed	228 (82.3)	146 (84.9)	6.78 (0.08)
Parental bed	29 (10.5)	8 (4.7)	
Both own and parental bed	18 (6.5)	15 (8.7)	
Both own and another adult's bed		1 (0.6)	
Twins sharing bed	2 (0.7)	2 (1.2)	
<b>Usual bed</b>			
Own bed	233 (84.1)	153 (90.5)	5.06 (0.08)
Parental bed	24 (8.8)	6 (3.6)	
Both own and parental bed	18 (6.5)	8 (4.7)	
Both own and another adult's bed	2 (0.7)	0 (0)	
Twins sharing bed		2 (1.2)	

**Other infant care practices**—Only four mothers (2%) had smoked in pregnancy, down from 8% in 2005 ( $p=0.03$ ). Pacifiers were usually used by 29%, similar to the 31% using them in the earlier survey. Breastfeeding ever was also similar at 96% (97% in 2005), and 91% had breastfed in the last 24 hours (79% in 2005); however, a life survival analysis of breastfeeding in the last 24 hours showed no significant difference between the two studies (result not shown).

Devices to keep the baby positioned were reported by 44%, up from 32% in 2005 ( $p=0.04$ ). Of those using them, the main devices used were a foam wedge (39%), a homemade system such as a rolled towel, blanket or pillow (39%), and a commercially available sleep wrap (34%); 18% used more than one system. Significantly fewer were using wedges and more were using a homemade system this time compared to the last survey (56% and 16% respectively in 2005,  $p=0.04$ ). Significantly fewer reported using plastic mattress wrapping on their infant's mattress (8% in 2013, cf 22% in 2005,  $p\leq 0.0001$ ).

Concerns about their infant's head shape were expressed by 40%, slightly more than the 35% reported in 2005, but this was non-significant. These concerns were reported more by mothers of male infants, firstborn infants, and those who usually sleep supine.

## Ministry of Health prevention advice: what is known and what is practised

Only 9 (5%) mothers cited all of the main factors of back sleeping, breastfeeding, non-smoking, own bed, share parental room, and keep the face clear. The questionnaire did not ask about keeping the face clear, but for the other five practices 43% of mothers performed all of this advice. Those who did so were significantly more likely to be mothers of firstborn infants ( $p=0.01$ ).

## Discussion

There has recently been a decrease in SUDI rates in NZ, such that in 2012 only 36 SUDIs in the post-neonatal age group were reported nationwide, compared with 55 in 2008.<sup>2</sup> This is encouraging, and the findings from this survey point to some areas where there have been changes in knowledge and practices that might have had an influence on this result. It also points to areas in which there is still room for improvement.

Compared with 2005, there has been a significant increase in this survey in cited knowledge of avoiding bed sharing, keeping the face clear and sleeping in the same room as the parent. These issues were highlighted in our 2005 paper when we noted that more education was needed to educate mothers of the benefits of keeping the face clear and of sleeping in the parental bedroom. Eight years later it is gratifying to see the improvement in understanding of these protective behaviours.

For SUDI-related practices we have shown a significant increase especially for room sharing and not smoking. There was also an increase in usually using supine positioning; however, there is still room for improvement in regards to sleep position. One-third of mothers knew the correct sleep position but didn't use it. The reasons for using other sleep positions, as in the earlier survey, were concerns about better sleep, aspiration, and head deformation.

We reiterate our earlier position that these concerns are not warranted. It is well known that babies sometimes have less disturbed sleep on their sides or their fronts, but the frequent arousals experienced when sleeping on their backs may be protective of SUDI.<sup>10</sup> Supine sleeping babies are at higher risk of deformational plagiocephaly, but this is usually only a temporary condition,<sup>11</sup> and infants are not at higher risk of aspiration when sleeping on the back.<sup>12</sup>

Bed sharing has reduced over time, from 15% in 2005 stating that their infant usually shared some or all of the time to 8% usually sharing in 2013. In addition, the length of time shared has reduced. This is in contrast with the National Infant Sleep Position Study (NISP) in the US where usually sharing a bed increased from 6% in 1993 to 13% in 2010.

Bed sharing is a significant risk factor for infants up to 15 weeks of age, even in the absence of smoking, alcohol use, drug use and all other risk factors.<sup>13</sup> Bed sharing is a highly variable practice and thus is difficult to standardise or even to compare between studies. In addition, the risk changes in relation to many different factors, such as the sleeping environment and its associated factors, whether the home is smoke free, how many people are in the bed, the condition of the mother, e.g. whether impaired with fatigue, alcohol or drugs, and the pre-existing risks in the infant, e.g. infants who are very young, premature, low birth weight, male, bottle fed or those whose mother has smoked in pregnancy.<sup>13</sup>

In addition, mothers may interpret questions about bed sharing in different ways and different questions may elicit different answers at different times. It is difficult to quantify as sharing may change over time according to the changing needs of the parent and infant. Maternal perception also plays a part. Perhaps for some mothers briefly falling asleep after breastfeeding would be reported as bed sharing but for others this might be considered not to be sleeping with their infant.

There was a reduction in the use of positioning devices, which is in accordance with advice that these should not be used;<sup>7</sup> however, where used there was an increase in homemade systems such as rolled blankets or pillows, which in itself is a risk for SUDI as it raises the risk for overheating or for airway obstruction if these items end up around the face.

Head shape concerns were at the same level as 2005. Where there was a concern, the baby was more likely to be male, firstborn, and to sleep supine, all factors that have been shown to be risk factors for positional plagiocephaly.<sup>14</sup> However, as it has been shown that most plagiocephaly will spontaneously improve over time mothers need to be reassured that this should not be too much of a concern.<sup>11, 15</sup>

Pacifier use was 29% compared with 31% in the previous study. The Ministry of Health in New Zealand does not recommend the use of pacifiers, but does not advise against their use. This is in contrast to the American Academy of Pediatrics which recommends their use to prevent SIDS.<sup>16</sup>

Although only 5% cited all the main pieces of advice from the Ministry of Health, 43% were practising all this advice. This may indicate that some mothers may not recall that a specific infant care practice is related to SUDI prevention even though they practice it. Although we have shown an increase in knowledge of SUDI risk factors there is still room for improvement.

The main limitation of this study was the low response rate. However, the results are generally in line with what was found in the 2005 survey from the same hospital. The low smoking rate may reflect the types of people who responded to the survey; unfortunately we are unable to know how many non-responders were smokers.

The ethnicity of the responders changed over time and this may have affected the response rate. The ethnicity of our responder sample was significantly different from the NWH 2013 ethnic mix and this is also a major limitation. Results from this survey reflect a mainly European sample and therefore may not be representative of the NZ population. As the highest rates of SUDI are in Māori infants, ideally this survey should be repeated in a Māori and Pacific sample.

## Conclusions

This survey has provided an opportunity to assess maternal knowledge and behaviours related to SUDI risk, particularly as they have changed since the last survey eight years ago. Those involved in educating mothers about safe infant care practices appear to be doing a good job and as a result these mothers generally have a good understanding of risk factors, although for some mothers this does not always transfer into good practice.

We have seen an increase in safe practices such as supine positioning and room sharing, and a decrease in smoking and bed sharing. This is to be celebrated and may indeed provide an indication as to behaviours in the wider NZ community that may have contributed to the lower number of deaths from SUDI in NZ.

**Competing interests:** Nil.

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**Author information:** B Lynne Hutchison, Research Fellow; John M D Thompson, Epidemiologist/Statistician; Edwin A Mitchell, Professor of Child Health Research. Department of Paediatrics: Child and Youth Health, The University of Auckland.

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**Correspondence:** Professor E Mitchell, Department of Paediatrics, Child and Youth Health, University of Auckland, Auckland, New Zealand. [e.mitchell@auckland.ac.nz](mailto:e.mitchell@auckland.ac.nz)

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## ORIGINAL ARTICLE

## Hospital admissions for chronic obstructive pulmonary disease in New Zealand

Richard J Milne, Richard Beasley

### Abstract

**Aim** To determine the number, distribution and cost of hospital admissions for chronic obstructive pulmonary disease (COPD) in New Zealand.

**Methods** National patient-level routine data on admissions with a principal diagnosis of COPD (mostly ICD-10-AN J440 & J441) were obtained for the period July 1st 2008 to June 30th 2013. Admissions with length of stay (LOS)  $\geq$  90 days were excluded.

**Results** There were 61,516 admissions in 5 years. Admission rates and budget impact (in 2012/13 dollar values) were stable but the average length of stay (ALOS) declined from 5.09 to 4.37 days. In FY2012/13 the admission rate was 2.82 per 1000 population, with age standardised rate (ASR) 4.4- and 3.6-fold higher for Māori and Pacific peoples respectively than for European/others. For age  $\geq$  15 years the ASR was 2.55 per 1000. Admission rates were higher for men than women and increased steeply with age and socioeconomic deprivation (NZDep06). The mean age at discharge was lower for Māori and Pacific peoples than for European/Others (63.4, 67.1 and 72.3 years). The mean 30-day readmission rate was 6.7%. The average LOS increased with age and was shorter for Māori (3.6 days) and Pacific peoples (3.5 days) than for European/Others (4.7 days). Admission rates varied widely across District Health Boards, and were higher in rural than urban regions. The estimated cost of admissions in FY2012/13 was \$NZ59.6m.

**Conclusions** Hospital admissions for COPD are costly and are over-represented in high risk groups including rural, elderly, socioeconomically deprived and Māori and Pacific peoples. Effective interventions that are targeted to high risk groups are required to improve equity and reduce the burden of COPD.

Chronic obstructive pulmonary disease (COPD) is an important non-communicable disease in New Zealand with a high prevalence, morbidity and risk of mortality.<sup>1</sup> It was the fourth leading cause of deaths in New Zealand in 2009, responsible for 6% of deaths.<sup>2</sup> COPD is also a common comorbidity of hospitalisation for people admitted for other reasons, adding to the length of stay.<sup>3</sup>

Rates of hospitalisation for Māori are more than double those for non-Māori and it is not known to what extent this represents a greater incidence of COPD amongst Māori, or greater severity of disease, or a different threshold for admission.<sup>4</sup> Evidence-based interventions that improve the quality of life and/or reduce the need for hospital admissions and risk of mortality are a high priority.

Due to its high morbidity and mortality, COPD places a large burden on the healthcare system. The main direct cost to the healthcare system is hospital admissions, largely for exacerbations, which are responsible for around two-thirds of the total cost.<sup>3</sup>

Because hospital admissions are easily identified, they are useful to measure both the trends in the burden of COPD and its associated costs. This is particularly important in New Zealand, which has one of the highest COPD hospital admission rates in the OECD.<sup>5</sup>

The main purpose of this descriptive study was to analyse national hospital admissions for COPD over a 5-year period, in order to estimate the 5-year trends and distribution by age, prioritised ethnicity, socio-economic status, length of stay and district health board (DHB). A secondary purpose was to estimate the impact of these admissions on the public healthcare budget.

## Methods

A nation-wide data set of anonymised publicly funded hospital admissions with a principal clinical diagnosis of COPD ICD-10-AM J40, 439, 440, 441, 448, 449, 410, 411, 42, 432, 438) was obtained from the Ministry of Health, for the period July 1 2008 to June 30 2013 financial years FY2008/09 to 2012/13). Admissions with a length of stay >90 days were excluded in an attempt to avoid biasing the mean costs and the average length of stay (ALOS). An index admission in FY2012/13 was defined as an admission for a patient who had not been admitted for COPD in the previous 4 years. The data included age, sex, prioritised ethnicity, District Health Board (DHB), length of stay (LOS), deprivation index (NZDep06), patient complication and morbidity level (PCCL), Australian Refined Diagnosis Related Group (AR-DRG) version 6.0, case weight and seasonality.

Multiple ethnic groups were prioritised using the following hierarchy: Māori, Pacific, European/Other. Population denominators were obtained from either the 2006 or 2013 census (Statistics NZ) with linear interpolation where required for intermediate years. Day stays were defined as having zero length of stay. The time to a repeat admission for COPD was defined as the number of days from the date of discharge from an index admission to the date of the next admission for COPD, excluding same day readmissions and transfers between hospitals.

Diagnosis Related Groups (AR-DRGs) are a patient classification system used by the NZ Ministry of Health to structure episodes of care into groups that are clinically similar both in terms of patient characteristics and health interventions, and that are therefore anticipated to consume comparable levels of hospital resources.

The 'NZDep' is a small geographical area-based index of socioeconomic deprivation calculated from each 5-yearly census based on the following variables: income, employment, communication, transportation support, educational and other qualifications, home ownership and household crowding. It is arranged in (approximately equal) deciles, with '1' representing the least disadvantaged and '10' representing the most disadvantaged. Individuals were assigned a domicile code based on their home address at the time of admission, which was then mapped to the New Zealand deprivation index (NZDep06).<sup>6</sup>

Admission costs were computed using admission-specific diagnosis related group (DRG) case weights applied to FY2012/13, in which the national price for a hospital admission was \$NZ4614 (NZ Ministry of Health). No attempt was made to obtain numbers of patient presentations or costs for Outpatient Clinic or Emergency Department visits because this information is not specific to the indications under study.

The severity of each hospital admission was estimated using PCCLs which are a measure of the cumulative effect of a patient's complications and comorbidities<sup>7</sup> which were available for FY2009/10 to FY2012/13.

Age adjustment for FY2012/13 was conducted by the direct method using the census 2013 population (Statistics NZ) and the World Health Organization standard population.<sup>8</sup> Analysis of variance was used to test for equality of means and a skewness/kurtosis test for normality. The time to a readmission following discharge from an index admission was analysed using Kaplan-Meier failure analysis, excluding same-day readmissions (LOS=0). In order to capture all readmissions within 12 months of discharge, the period of analysis was July 1, 2011 to June 30, 2012. For a comparison of DHBs, in order to capture all readmissions within 30 days of a discharge the period of analysis was June 1, 2012 to May 31, 2013.

All analyses were conducted using Stata v12.1 software (StataCorp LP, 4905 Lakeway Drive, College Station, Texas 77845-4512, USA).

## Results

**Admissions over 5 years**—There were 62,183 hospital admissions including day stays over the period July 1, 2008 to June 30, 2013 with a principal diagnosis of COPD. Excluding admissions with a length of stay greater than 90 days (1.8%) there were 61,516 admissions, 12% of which were day stays and 2.2% received non-invasive ventilation. The annual admission rate was stable across the 5-year period, with a budget impact in 2012/13 dollars of \$59.6m, while the ALOS declined (Table 1).

**Table 1. Hospital admissions with a principal diagnosis of COPD in the period July 1<sup>st</sup> 2008 to June 30<sup>th</sup>, 2013 and corresponding costs**

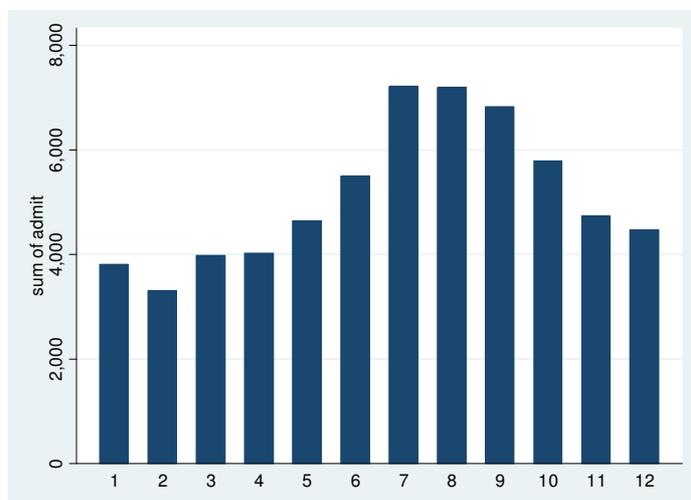
ICD10 AN	2008/9	2009/10	2010/11	2011/12	2012/13	All years
J40	667	589	575	683	622	627
J439	60	69	53	64	67	63
J440	6672	6803	6773	7411	7484	7021
J441	3701	3790	3502	3522	3317	3564
J448	221	188	149	179	188	185
J449	804	845	830	802	687	793
Other <sup>a</sup>	45	56	52	49	53	51
<b>Total</b>	<b>12,170</b>	<b>12,330</b>	<b>11,941</b>	<b>12,657</b>	<b>12,418</b>	<b>61,516</b>
<b>Rate per 1000</b>	<b>2.90</b>	<b>2.91</b>	<b>2.78</b>	<b>2.91</b>	<b>2.82</b>	<b>2.86</b>
<b>Day stays</b>	<b>11.1%</b>	<b>11.7%</b>	<b>11.7%</b>	<b>12.9%</b>	<b>12.6%</b>	<b>12.0%</b>
<b>ALOS (days)</b>	<b>5.09</b>	<b>4.94</b>	<b>4.69</b>	<b>4.49</b>	<b>4.37</b>	<b>4.71</b>
<b>Cost \$(m)<sup>b</sup></b>	<b>\$58.90</b>	<b>\$61.30</b>	<b>\$60.10</b>	<b>\$59.40</b>	<b>\$59.60</b>	<b>\$59.70</b>
<b>Mean cost \$(m)<sup>b</sup></b>	<b>\$4862</b>	<b>\$4968</b>	<b>\$5036</b>	<b>\$4673</b>	<b>\$4799</b>	<b>\$4852</b>

ALOS=average length of stay (P<0.05); admissions with a length of stay >90 days were excluded.

<sup>a</sup> ICD10 J410, 411, 42, 432, 438.

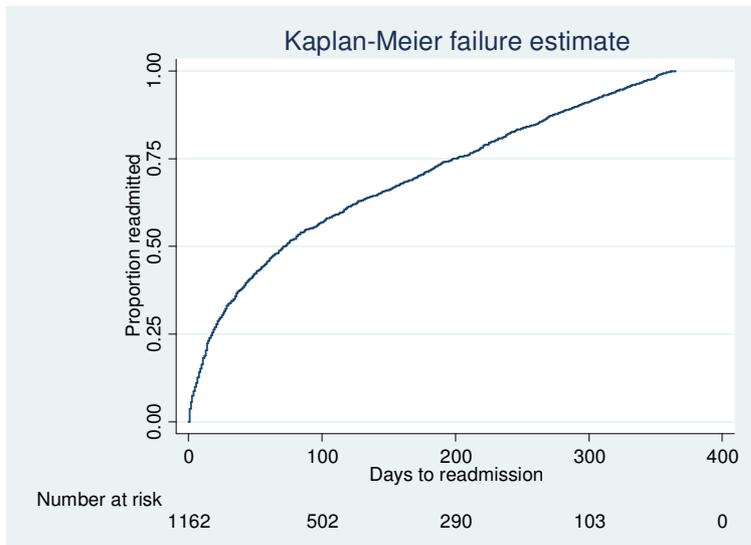
<sup>b</sup> In 2012/13 dollars.

**Seasonality**—Hospital admissions peaked in winter and were lowest in late summer (Figure 1).

**Figure 1. Admissions by month (January=1) in the period July 1, 2008 to June 30, 2013**

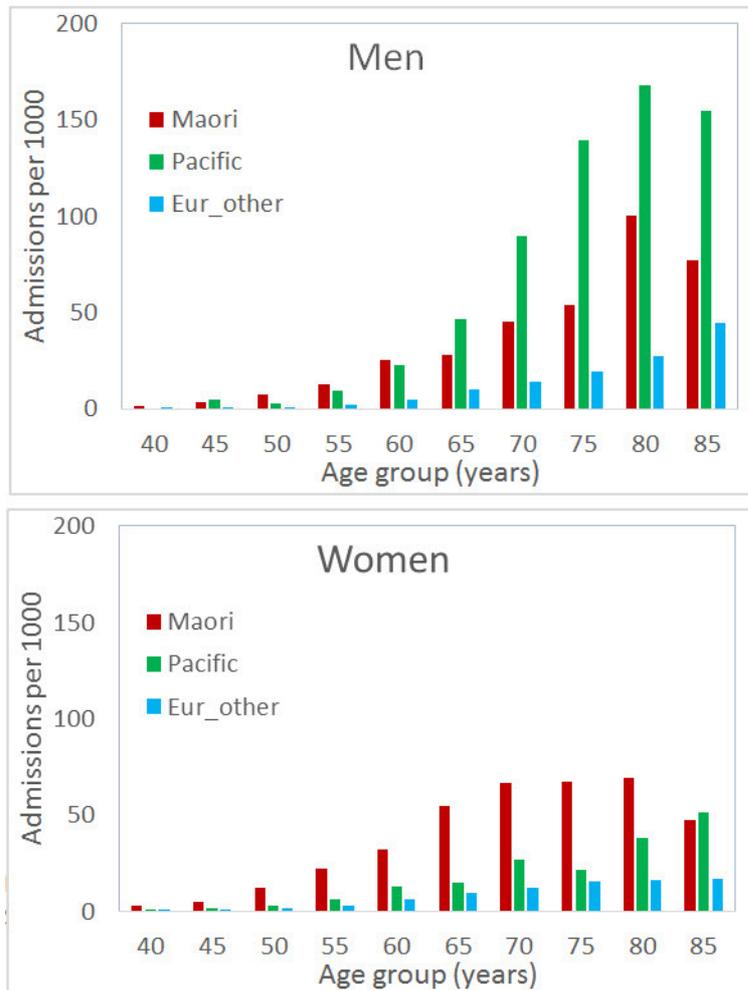
**Repeat admissions**—In order to estimate the probability of repeat admissions within 12 months, a Kaplan-Meier failure analysis was conducted, based on first-ever (index) admissions discharged in the period July 1, 2011 to June 30, 2012. There were 5032 index admissions in this period, 1162 of which (23%) led to a readmission within 12 months of discharge and 385 of these (33%) were readmitted within 30 days of discharge (Figure 2).

**Figure 2. Time to readmission for all new patients who were readmitted within 12 months of discharge**



Regression analysis showed that the time to a first readmission for COPD decreased with age ( $P < 0.01$ ) and the severity of the index admission (PCCL;  $P < 0.05$ ) but did not appear to be directly influenced by ethnicity or deprivation index or the day of discharge (not shown).

Admission rates were higher for men than women and increased steeply with age. They were much higher for Māori and Pacific peoples than European/Others, reaching over 150 per 1000 for elderly Pacific men (Figure 3).

**Figure 3. Admission rates per 1000 population for men and women in FY2012/13**

**Denominator: 2013 Census (Statistics NZ)**—The age-standardised admission rate (ASR) in FY2012/13 was 4.4-fold higher for Māori and 3.6-fold higher for Pacific peoples than for European/other ethnicities; and for individuals with age  $\geq 15$  years (the standard measure for international comparisons) it was 2.55 per 1000 (Table 2).

**Table 2. COPD admission rates by the major ethnic groups in FY 2012/13**

Ethnicity	Admissions	Rate per 1000	ASR <sup>a</sup>	Rate ratio <sup>b</sup>
Māori	2423	4.03	6.14	4.41
Pacific	763	3.15	4.96	3.56
European/Other	9,232	2.59	1.39	1.00
Total	12,418	2.82	1.91	n/a
Age $\geq 15$ years	12,334	3.14	2.55	n/a

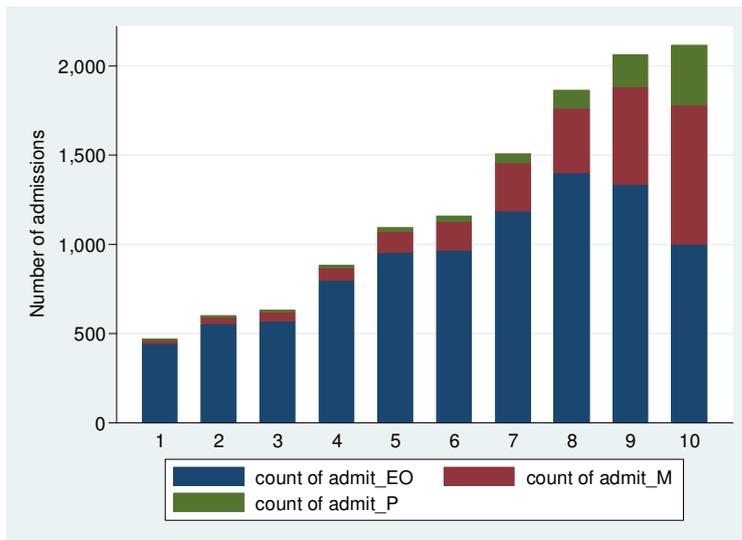
<sup>a</sup> Age standardised to the WHO population.<sup>8</sup>

<sup>b</sup> Relative to European/Other, age standardised.

In FY2012/13, the number of admissions for all three ethnic groups increased steeply with socioeconomic deprivation and the proportions of Māori and Pacific peoples also increased with deprivation.

Admissions for patients in NZDep06 decile 10 (the most deprived group) were more than 4-fold higher than those in decile 1 (Figure 4). There was no clear relationship between socioeconomic deprivation (NZDep06) and 30-day readmission rate ( $p=0.62$ ).

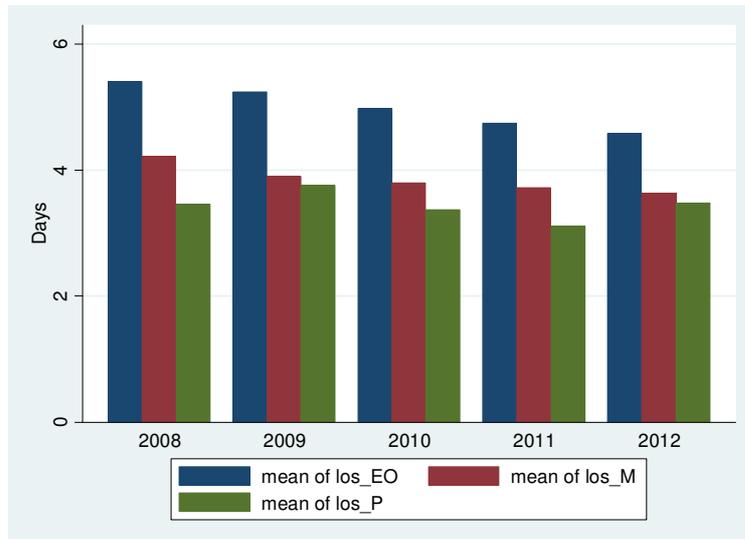
**Figure 4. Admissions by ethnicity and socioeconomic deprivation in FY2012/13**



**Abscissa:** NZDep06 (10=most deprived decile).

**Legend:** admit\_M=Māori; admit\_P=Pacific; admit\_EO=European/Other.

**Length of stay**—Over the 5-year study period, the ALOS was consistently higher for European/Others than for Māori or Pacific peoples ( $p<0.001$ ). It declined for European/Others and Māori but did not change appreciably for Pacific peoples (Figure 5).

**Figure 5. Trends in the average length of stay over 5 years, by ethnic group<sup>a</sup>**

**Abscissa:** financial years 2008/09, 2009/10, 2010/11, 2011/12, 2012/13.

**Legend:** los\_M=Māori; los\_P=Pacific; los\_EO=European/Other.

<sup>a</sup> Includes day stays.

The overall decline was from 5.09 to 4.37 days (difference 0.72 days;  $p < 0.001$ ). In FY 2012/13 the ALOS was shorter for Māori (3.59 days) and Pacific peoples (3.48 days) than for European/Others (4.65 days) [ $p < 0.001$ ].

Regression analysis showed that the LOS increased with age and severity (PCCL) and was higher for women than men ( $\beta > 0$ ;  $P < 0.001$ ), but declined slightly with the level of socioeconomic deprivation ( $\beta < 0$ ,  $P < 0.05$ ; Table 3). There was no significant interaction between ethnicity and deprivation level (not shown).

**Table 3. Regression analysis on length of stay in FY2012/13**

LOS	$\beta^a$	Std. Err.	t	P>t	-95% CI	+95% CI]
Age (years)	0.039	0.004	10.460	0.000	0.032	0.047
PCCL <sup>b</sup>	0.807	0.029	28.200	0.000	0.751	0.864
Ethnicity	0.402	0.064	6.290	0.000	0.276	0.527
Sex (F=1)	0.393	0.095	4.160	0.000	0.208	0.579
NZDep06	-0.039	0.019	-2.090	0.036	-0.076	-0.003
Day of week	0.013	0.024	0.560	0.578	-0.034	0.061

Adjusted  $R^2 = 0.085$ .

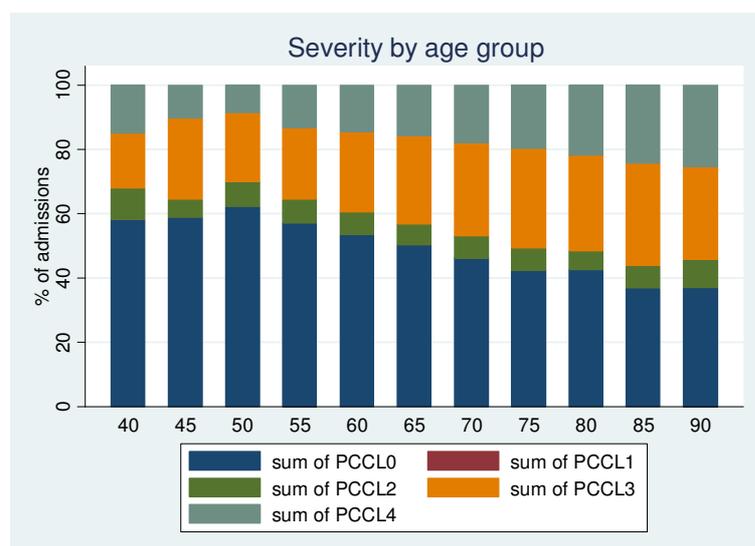
<sup>a</sup> Regression coefficient.

<sup>b</sup> PCCL=Patient complication and morbidity level (0 to 4; see Methods).

**Severity of admission**—Based on ‘patient complication and morbidity levels’ (PCCLs), about half of all admissions in 2012/13 were for the least severe cases (PCCL0) and the distribution of severity showed no substantial change over the 4 years of available data (not shown).

Higher age groups had higher proportions of more severe cases (Figure 6). Māori and European/Others had similar proportions of PCCL0 but Pacific peoples had slightly lower proportions (not shown).

**Figure 6. Distribution of levels of severity (PCCL) by age group in FY2012/13**



**Comparison of District Health Boards**—There was considerable variation in admission rates across the 20 DHBs. Predominantly rural regions including Wairarapa, Whanganui, Lakes District, Northland and West Coast had higher admission rates than urban regions. There was a 2.3-fold difference in admission rates between Wairarapa DHB and Auckland DHB in 2012/13. The ALOS (including day stays) also differed considerably across DHBs, with a range of 3.5 to 6.1.

The proportion of readmissions occurring within 30 days of discharge from an index admission varied from 4.1% in Auckland to 10.7% in Northland. The budget impact of admissions including day stays varied in proportion to the number of admissions, with a national total of \$59.62m (Table 4).

**Table 4. Admissions, admission rates, 30 day readmissions, average length of stay and budget impact by District Health Board (DHB) in FY2012/13**

DHB	Admissions	Patients	Admission rate <sup>a</sup>	ALOS (days)	30-day readmissions <sup>b</sup>	Budget impact (\$M)
Auckland	869	343	2.14	4.85	4.1%	\$4.24
Bay of Plenty	729	320	3.73	4.66	4.4%	\$3.50
Canterbury	1336	436	2.86	5.19	6.9%	\$8.14
Capital & Coast	641	224	2.40	4.22	8.0%	\$2.99
Counties Manukau	1264	451	2.92	3.66	4.4%	\$6.14
Hawke's Bay	547	215	3.68	5.11	10.2%	\$3.16
Hutt Valley	447	167	3.28	3.88	8.4%	\$2.06
Lakes	426	136	4.33	3.88	6.6%	\$1.83
MidCentral	473	176	2.97	4.08	4.5%	\$1.91
Nelson Marlborough	288	130	2.19	4.17	10.0%	\$1.20
Northland	639	271	4.28	3.90	10.7%	\$3.02
South Canterbury	171	58	3.17	6.12	8.6%	\$0.95
Southern	963	352	3.36	4.94	6.0%	\$4.60
Tairāwhiti	135	53	3.04	5.05	7.5%	\$0.67

DHB	Admissions	Patients	Admission rate <sup>a</sup>	ALOS (days)	30-day readmissions <sup>b</sup>	Budget impact (\$M)
Taranaki	378	140	3.62	3.52	5.0%	\$1.50
Waikato	1,193	414	3.51	3.62	6.8%	\$5.21
Wairarapa	189	79	4.89	3.97	7.6%	\$0.81
Waitemata	1,275	488	2.64	4.63	7.8%	\$5.76
West Coast	132	54	4.21	4.02	5.6%	\$0.57
Whanganui	280	102	4.48	3.84	5.9%	\$1.12
Missing	43	29	n/a	8.62	10.3%	\$0.22
<b>Total<sup>c</sup></b>	<b>12,418</b>	<b>4638</b>	<b>3.07</b>	<b>4.37</b>	<b>6.7%</b>	<b>\$59.62</b>

ALOS=average length of stay.

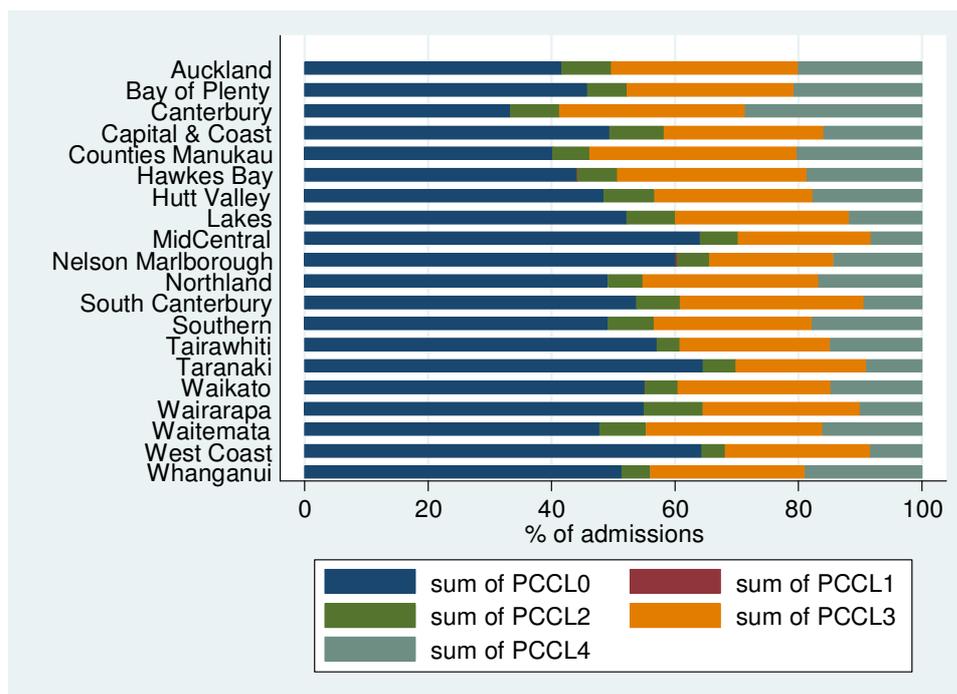
<sup>a</sup> Unadjusted admissions per 1000 population.

<sup>b</sup> Readmission within 30 days of a discharge from an index admission in June 1, 2012 to May 31, 2013.

<sup>c</sup> Excludes 7 admissions with DHB missing and/or patient overseas.

Taranaki, Mid Central, Nelson-Marlborough and West Coast DHBs had the highest proportions of least severe cases (PCCL0) and Canterbury the lowest (Figure 7).

**Figure 7. Distribution of admissions by 'patient complication and morbidity level' (PCCL) across District Health Boards in FY2012/13**



PCCL0=least severe; PCCL4=most severe.

## Discussion

This study has demonstrated that COPD is a major public health problem in New Zealand, with a substantive burden due to hospital admissions. In FY2012/13 there were 12,418 admissions with a principal diagnosis of COPD and a length of stay less than 90 days. This is approximately 1.2% of all publicly funded admissions in NZ.<sup>9</sup> The burden is disproportionate for Māori and Pacific peoples and for men and women with lower socioeconomic status and the elderly and rural populations.

The age standardised admission rate for European/Others is lower than the unadjusted rate because of the preponderance of relatively elderly people compared to the WHO standard population.<sup>8</sup> However, the reverse is true for Māori and Pacific peoples because of their relatively high mortality. The ASR for patients  $\geq 15$  years of age in FY2012/13 (2.55 per 1000) is third only to Hungary (3.64 per 1000) and Ireland (3.10 per 1000) for the same age group in 2011 OECD statistics.<sup>5</sup>

The mean age at discharge in 2012/13 was lower for Māori and Pacific peoples than for European/Others (63.4, 67.1 and 72.3 years respectively,  $p < 0.001$ ), although the magnitude of the difference was not as great as that reported from a study from Waikato Hospital in 2004 (Māori versus non Maori, 57 and 72 years, respectively). These findings suggest that the disease progresses more rapidly in the Māori and Pacific populations, possibly due to greater exposure to risk factors for COPD including but not limited to tobacco and marijuana smoking, occupational exposures, childhood respiratory illnesses and asthma, which are likely to play a role.<sup>1,4,11</sup> These risk factors are also likely to contribute to the higher prevalence of COPD for Māori and Pacific peoples. Mortality from COPD is 70% higher for Māori than for others,<sup>12</sup> consistent with the much higher hospital admission rates observed in our study.

Recent policy in the United States is to use 30-day readmission rates following an index hospitalisation for a COPD admission as an accountability measure on which funding is based.<sup>13</sup> Recent international studies have reported 30-day readmission rates ranging from 8% to 18% in different settings.<sup>14-16</sup> The mean rate of 6.7% for NZ in 2012/13 is low by comparison. While hospital quality of care is only one of several factors associated with 30-day readmission rates, these New Zealand figures suggest internationally favourable hospital management.

Over the 5-year study period the average length of stay declined by 0.72 days, due largely to a decline for European/Others. This appears to represent a real clinical gain rather than a gradual fall in the threshold for admissions, because the distribution of severity was stable. It is unclear why this gain was not achieved for Pacific peoples. The average length of stay varied considerably across DHBs but it is an imperfect measure of relative performance because of differing admission thresholds and age/ethnicity/ deprivation case mix.

The duration of a hospital stay for COPD can depend partly on the day of the week on which the patient was admitted,<sup>17</sup> but this was not evident when our analysis was adjusted for other variables. The average length of stay (ALOS) was shorter for Māori and Pacific peoples than for European/Other ethnic groups, partly because of a higher proportion of day stays.

It is possible that, because of economic disadvantage, Māori and Pacific peoples have a greater tendency to present directly to the Emergency Department than to a general practitioner for mild exacerbations of COPD. Also, these groups have relatively low proportions of elderly men and women, who have a longer ALOS. Another possible contributor to the lower length of stay for some disadvantaged groups could be a lower severity threshold for admissions. However this seems unlikely for Māori and Pacific peoples, because they had similar distributions of severity as European/Others.

There was a strong socioeconomic gradient in hospital admissions for all 3 main ethnic groups. Overseas studies suggest that most of such differences can be explained by the associations with tobacco smoking or exposure to environmental tobacco smoke.<sup>18,19</sup>

The NZ healthcare environment, where patients pay to access primary health care but not Emergency Department attendance or hospital admission, may provide an unintended incentive to increasing attendance to hospital, which then leads to an admission. Likewise, ethnic disparities in hospitalisation rates reflect not only prevalence /severity of COPD but also differences in access to primary care, and difference in perception of the care delivered in different healthcare settings. Higher admission rates in rural based DHBs could reflect poorer access to out-of-hours primary care, or a lower threshold for referral to hospital due to concerns about remoteness.

The distinct seasonal pattern of COPD admissions that has also been reported by researchers abroad<sup>20</sup> suggests that environmental interventions could reduce admissions and reduce hospital expenditure. Respiratory viruses, which are more active in winter, could contribute to exacerbations of COPD.<sup>21</sup> Work is now being undertaken in New Zealand on the effects of home heating<sup>22</sup> and the impact of air pollution on respiratory admissions.<sup>23</sup>

COPD is the most common ambulatory sensitive (preventable) hospitalisation in adults. Some admissions for exacerbations of COPD are potentially preventable by improved access to primary care; although admission rates for a basket of chronic conditions including COPD were stable in the period 2001 to 2009, during which a capitated funding model improved access.<sup>24</sup>

Further interpretation of hospital admission data is dependent on the accuracy of coding. This is likely to have been similar across the time period studied, although the identification of admissions for a small minority of patients less than 30 years of age does raise the issue of the validity of COPD as the primary cause of admission in this group.

COPD is a costly respiratory disease, with at least 12,418 hospital admissions attributed directly to COPD in FY2012/13, costing the DHBs \$59.9M (mean cost per admission \$NZ4799). Researchers in the United States have reported a mean cost of \$US2928 (\$NZ3501) for a 'standard' hospital admission for COPD in 2010 and \$US33,440 for admissions requiring intensive care.<sup>25</sup> Admissions with other principal diagnoses that could have been complicated and/or prolonged by COPD comorbidity were excluded from the analysis because this would lead to double counting (especially of cardiovascular admissions) and their contribution to hospital costs cannot be determined; therefore the total budget impact of COPD is likely to have been underestimated. It has been reported that COPD and cardiovascular disease are the most common comorbidities that complicate hospital admissions in NZ.<sup>3</sup>

In addition, our estimate of the budget impact of COPD is conservative because it is based on DRG case weights and it excludes outpatient appointments, emergency care, and admissions with a length of stay greater than 90 days, which will contribute disproportionately to the cost. Additional direct medical costs to DHBs including GP consultations, community pharmaceuticals and disability care were also outside the scope of this study.

A study in the United States reported that individuals with COPD consumed over 3-fold more healthcare resource than a matched control group.<sup>26</sup> Medical costs to the community include caregiver support, which can be substantial, and loss of earnings by patients and their families. Community interventions that reduce the risk of COPD admissions and the acuity of other admissions could have an important impact on the healthcare budget.

An international model showed that treatments that reduce the risk or severity of exacerbations are likely to be cost effective among those patients who have frequent exacerbations and hospitalisations.<sup>27</sup> Our findings suggest that in addition to patients with multiple hospital admissions, Māori and Pacific peoples and those of low socioeconomic status represent important priority groups for such interventions. These may include both established community interventions such as smoking cessation and pulmonary rehabilitation programmes<sup>28,29</sup> and cost effective novel interventions such as long term high flow nasal humidification therapy.<sup>30,31</sup>

In conclusion, hospital admissions for COPD are costly, and are over-represented in high risk groups including rural, elderly, socioeconomically deprived and Māori and Pacific peoples. Effective community interventions that are targeted to high risk individuals have the potential to improve equity and reduce the humanistic and economic burden of COPD.

**Competing interests:** Nil.

**Author information:** Richard J Milne, Associate Professor, University of Auckland & Principal, Health Outcomes Associates Ltd, Auckland; Richard Beasley, Physician, Medical Research Institute of New Zealand, Wellington

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**Correspondence:** Dr Richard Milne, Principal, Health Outcomes Associates Ltd, PO Box 25005, St Heliers, Auckland 1740, New Zealand. [richard.milne@hoa.co.nz](mailto:richard.milne@hoa.co.nz)

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## ORIGINAL ARTICLE

## Is HealthPathways effective? An online survey of hospital clinicians, general practitioners and practice nurses

Graham McGeoch, Peter McGeoch, Brett Shand

### Abstract

**Aim** An online survey was used to determine the perceptions of healthcare professionals in Canterbury on HealthPathways, a website that provides clinical and referral information for general practice teams, relevant to locally available health services and resources.

**Method** The survey questionnaire included questions on the effectiveness and ease-of-use of the website, computer literacy and use of online clinical guidance systems. Differences in the responses between work groups were analysed using the Mann-Whitney test.

**Results** 249/480 (52%) of general practitioners, 72/156 (46%) of practice nurses, and 43/66 (65%) of hospital clinicians completed the questionnaire. Approximately 90–95% of general practice teams considered the website was easy to use and had contributed to both an increase and improvement of care in the community, with about 50% stating that it had improved their relationships with patients and hospital clinicians. Minor concerns included the website's increasing size and prescriptive nature and that it increased the duration of a patient consultation. Approximately 60% of hospital clinicians reported improvements in referral quality and triage and working relationships with general practices since the introduction of HealthPathways.

**Conclusion** HealthPathways has achieved a high level of acceptance in both primary and secondary care, and has therefore acted as a valuable change management tool increasing healthcare integration in Canterbury.

HealthPathways is a password-protected website that provides easy-to-follow localised “best practice” guidance for general practice teams.<sup>1</sup> The website was developed in the Canterbury region of New Zealand and is now used routinely by the majority of general practitioners in the area.

A report on the development and characteristics of HealthPathways and its role in contributing to healthcare integration is available on the Canterbury Initiative website.<sup>2</sup> That report shows HealthPathways has continued to grow steadily with an increase in the number of visits and pages viewed each month. Localised versions of the website are currently used in 7 other district health boards in New Zealand and 14 local health districts in Australia.

Given this widespread and increasing use of HealthPathways we decided to obtain information on perceptions of the website from healthcare professionals. This paper describes the findings of an online survey of general practitioners, hospital clinicians and practice nurses in Canterbury on the clinical usefulness and ease of use of HealthPathways.

### Methods

**Survey details**—The survey named, ‘Looking to the Future. A Survey of HealthPathways Users’ was carried out between 9 December 2013 and 9 January 2014 as part of ongoing assessment and development of the website by the Canterbury Initiative.<sup>2</sup> Ethical approval for the survey was therefore not sought. The questionnaire was formatted and distributed using the online tool, Survey Monkey® (Survey Monkey, CA, USA). A repeat invitation was sent to non-responders midway through the survey period. The questionnaire was not anonymous, while an incentive for participation was offered in the form of a draw for a gift voucher. A copy of the questionnaire is available on the Canterbury Initiative website.<sup>2</sup>

The survey questionnaire was based on the technology acceptance model which suggests that when an individual is presented with new technology, a number of factors influence how and when they will use it.<sup>3</sup>

Two of the most important factors are perceived usefulness and ease-of-use.<sup>4</sup> Other surveys on acceptance of technology by medical professionals were used as a guide when constructing the questionnaire.<sup>5-9</sup>

General practitioners and practice nurses were sent a questionnaire that included 8 questions on demographics, computer literacy and use of other online clinical websites, 7 questions on the use of HealthPathways, 9 on the clinical usefulness and effectiveness of the website (7 for practice nurses), 3 on ease-of-use of the website, 2 on personal experiences, and 2 on preferences for online clinical guidance.

The questionnaire included 3 graded questions on the influence HealthPathways has had on professional working relationships and 3 open-ended questions (qualified or unqualified comment to a colleague from another region regarding the website; concerns regarding the development and maintenance of the website; and any other general comment).

Hospital clinicians were sent a different questionnaire that contained 10 questions on their experience and opinions of HealthPathways in regard to referral quality and the triage process and the same 3 open-ended questions described above. The responses to the questions were graded used a seven-point scale: 7 (totally agree), 6 (agree), 5 (slightly agree), 4 (neutral), 3 (slightly disagree), 2 (disagree), and 1 (totally disagree).

**Data analysis**—Responses to the questions were expressed as percentage frequency for each grade and mean score ( $\pm$ SD). The nonparametric Mann-Whitney test was used to compare differences in the distribution of the graded responses to questions between the general practitioners and practice nurses and between subgroups of general practitioners stratified according to gender, age (<40 yr vs. >40 yr), and location of practice (urban vs. rural), and 2) differences in demographic categorical variables between the study groups. *P* values <0.05 were considered statistically significant. The internal consistency of the graded responses of each professional group to theoretically related constructs in the questionnaire was assessed by calculating Cronbach's alpha. For qualitative analysis of the open-ended questions, the comments were grouped into broad themes and the percentage frequency of each theme calculated.

## Results

### General practitioners

**Response rates**—An invitation to participate in the survey was sent to the majority of general practitioners in Canterbury (n=480).. A total of 249 questionnaires were returned (response rate, 52%).

**Demographics, computer literacy and use of HealthPathways**—About two-thirds of the general practitioners were female (Table 1). Approximately three-quarters of the respondents had practiced for longer than 10 years. Nearly all of the general practitioners (93%) were confident users of computer technology and considered they had better than basic skills.

The website was visited regularly (6–15 times/wk) by approximately 50% of the general practitioners, with 33% accessing the website on a more frequent basis. The respondents visited the site mainly to obtain guidance on the assessment and management of clinical conditions. Since the introduction of HealthPathways, the use of other online medical resources had decreased in 69% of respondents.

**Graded responses on the effectiveness and ease of use of HealthPathways**—The responses to the graded questions in the questionnaire are summarised in Table 2. With the exception of the two questions on preferences for online guidance the Cronbach alpha values for related constructs were between 0.70–0.80, indicating the responses had good internal consistency.

The role of the website in contributing to the increase in community-based health care services was acknowledged by the majority of general practitioners (88%). Overall, the response to the questions showed that the website was regarded favourably as it provided locally relevant clinical and referral information that was easily accessible during a patient consultation. 90% of respondents thought the website had improved the care they provided to their patients. However, 53% of the general practitioners considered using the website increased the duration of a patient consultation.

The majority of general practitioners considered the website made the referral process more transparent by identifying patients who required specialist care from those who could be managed in general practice. One-half of the respondents disagreed with the question on whether or not the

website should be altered to provide structured decision support, with only 17% considering this would be a positive change. In this regard, 58% of respondents preferred to make decisions based on their knowledge of patients rather than obtaining advice from structured decision support. Ninety percent of respondents thought the website had improved the care they had provided to their patients.

**Table 1. Demographics and use of HealthPathways and other clinical websites of the general practitioners (n=249)**

<b>Males/females</b>	106/143
<b>Age (yr)</b>	
20–30	4%
31–40	19%
41–50	28%
51–60	36%
>60	13%
<b>Years in clinical practice</b>	
1–10	21%
11–20	25%
21–30	36%
31–40	15%
>40	3%
<b>Computer literacy</b>	
Poor	0%
Basic	7%
Confident	67%
Very confident	24%
Expert	2%
<b>Use of website (times/wk)</b>	
0	1%
1–5	19%
6–15	47%
16–25	22%
26–35	7%
>35 times	4%
<b>Access website for information on:</b>	
Clinical condition	50%
Referral	25%
Community-based service	17%
Resource or patient information	8%
<b>HealthPathways has changed my use of other online clinical websites?</b>	
Increased	7%
Decreased	69%
No change	24%

The questions on personal experiences showed that approximately one-third of general practitioners considered their relationship with patients had improved since using HealthPathways. Similarly, more than one-half of the respondents considered their working relationship with hospital clinicians had improved since the introduction of HealthPathways.

Subgroup analysis of the general practitioner data showed that female respondents had a more positive response in 16 of the 20 questions than male respondents. In particular, female doctors considered the website increased their ability to provide information resources for patients [mean score: female, 5.2 (1.3) vs. male, 4.7 (1.5);  $P < 0.01$ ], and disagreed to a greater extent than male

doctors that the website should be altered to provide structured decision support (mean score: female, 3.1 (1.4) vs. male, 3.6 (1.5);  $P<0.01$ ).

**Table 2. Response of the general practitioners to the graded questions**

Clinical effectiveness	Agree	Neutral	Disagree	Mean score (± SD)	Cronbach's alpha
<b>HealthPathways has:</b>					
Assisted in provision of more healthcare in the community?	88%	10%	2%	5.9 (1.1)	0.75
Improved the care I provide to my patients?	90%	6%	4%	5.9 (1.1)	
Increased the time spent with each patient?	53%	25%	22%	4.5 (1.5)	
Supported my diagnostic process?	89%	8%	3%	5.9 (1.1)	
Enabled me to manage patients I would have previously referred?	86%	7%	7%	5.6 (1.2)	
Encouraged me to refer patients I would previously have managed myself?	33%	26%	41%	3.8 (1.5)	
Encouraged me to offer private referral options?	24%	41%	35%	3.7 (1.4)	
Increased the number of information leaflets I provide to my patients?	71%	16%	13%	5.0 (1.4)	
Knowing the criteria for the availability of publically-funded patient care is helpful?	96%	2%	2%	6.2 (0.9)	
<b>Ease-of-use</b>					
HealthPathways is easy to use in clinical practice?	94%	2%	4%	6.1 (1.0)	0.70
HealthPathways has made my job easier?	90%	5%	5%	6.0 (1.2)	
The search function on HealthPathways is effective?	81%	6%	13%	5.4 (1.4)	
<b>Personal experience</b>					
<b>HealthPathways has:</b>					
Improved my relationship with my patients?	31%	49%	20%	4.1 (1.3)	0.80
Improved my relationship with hospital clinicians?	57%	29%	14%	4.7 (1.4)	
<b>Preferences for online clinical guidance</b>					
I prefer to make decisions based on my knowledge of the patient rather than advice from structured decision support?	58%	24%	18%	4.8 (1.4)	0.44
HealthPathways should be altered to provide structured decision support?	17%	34%	49%	3.3 (1.4)	

Analysis of the data stratified according to age (<40 yr vs. >40 yr) showed younger doctors had a more positive opinion of HealthPathways than older doctors with a higher mean score in 18 of the 20 questions. Not surprisingly, younger doctors found the website easier to use than older doctors [mean score: young, 6.4 (0.6) vs. old, 6.0 (1.1);  $P<0.01$ ], with a smaller proportion considering the website increased the duration of a patient consultation [mean score: young, 4.1 (1.4) vs. old, 4.6 (1.5);  $P<0.01$ ].

Comparison of rural and urban general practitioners showed that of the 20 questions, rural doctors had more positive responses in 17, with the information on private referral options being regarded as particularly useful [mean score: rural, 4.4 (1.1) vs. urban, 3.6 (1.4);  $P<0.001$ ].

**Written comments on experience with HealthPathways**—The majority of general practitioners (77%) considered HealthPathways was a service worthy of an unqualified recommendation to a colleague in another area, with only 2% expressing an overtly negative comment.

Regarding concerns on the development and maintenance of the website, approximately one-quarter of the respondents identified minor issues, mainly the increasing size of the website, the inflexibility of the clinical pathways, and the requirement to adequately reference and continually update the information. A small proportion of respondents (4%) considered that since the introduction of the

website that more services were being carried out in the primary sector without a compensatory rise in funding. A similar proportion (3%) considered HealthPathways had removed clinical judgment from general practice and represented “tick-box medicine”.

## Practice nurses

**Response rates**—A limitation of the survey for this group was the unavailability of a complete list of email addresses for practice nurses in the Canterbury region. Of the 82 invitations to participate in the survey 38 were returned (response rate, 46%). An additional 34 questionnaires were returned from practice nurses who heard about the survey from a colleague in the same practice during the survey period, making a total of 72 completed forms.

**Demographics, computer literacy and use of HealthPathways**—As shown in Table 3, all but one of the practice nurses were female, with two-thirds having practiced for longer than 10-yr and all considering they were confident users of computer technology. The website was visited regularly (6-15 times/wk) by the majority of respondents (94%). Practice nurses used the site in a more general manner than general practitioners and accessed the site mainly to obtain patient information or linkage to other clinical resources. Since the introduction of HealthPathways, the use of other online medical resources had decreased in 65% of practice nurses, although about one-fifth (19%) stated that it had increased their access of other websites.

**Graded responses on the effectiveness and ease of use of HealthPathways**—The responses to the graded questions in the questionnaire are summarised in Table 4. With the exception of the two questions on preferences for online guidance, the Cronbach alpha values for related constructs ranged between 0.61–0.76, indicating the responses had acceptable internal consistency.

The majority of practice nurses considered the website was easy to use, had contributed to an increase in community-based health care, and had improved the care they were able to provide to their patients by distinguishing between those they could manage themselves from those who required to be seen by a general practitioner.

Similar to the responses of the general practitioners, about one-half (40%) of the practice nurses considered using the website had increased the duration of a patient consultation. The questions on working relationships showed that a significantly greater proportion of practice nurses than general practitioners considered their relationship with patients had improved since using HealthPathways (nurses 60% vs. general practitioners 31%;  $p<0.001$ ), while a similar proportion stated their working relationship with hospital clinicians had improved since introduction of the website (nurses, 51% vs. general practitioners, 57%;  $p=0.12$ ).

In contrast to the response of the general practitioners, about one-third of the practice nurses stated a preference for the website to be altered to provide structured decision support (nurses, 35% vs. general practitioners, 17%;  $p<0.001$ ). This was reflected by a greater proportion of general practitioners preferring to make clinical decisions based on their knowledge of patients rather than obtaining advice from structured decision support (nurses, 43% vs. general practitioners, 58%;  $p<0.01$ ).

**Table 3. Demographics and use of HealthPathways and other clinical websites of the practice nurses (n=72).**

<b>Males/females</b>	1/71
<b>Age (yr)</b>	
20–30	4%
31–40	8%
41–50	32%
51–60	50%
>60	6%
<b>Years in clinical practice</b>	
1–10	34%
11–20	20%
21–30	26%
31–40	19%
>40	1%
<b>Computer literacy</b>	
Poor	0%
Basic	0%
Confident	61%
Very confident	32%
Expert	7%
<b>Use of website (times/wk)</b>	
0	1%
1–5	45%
6–15	48%
16–25	6%
26–35	0%
>35 times	0%
<b>Access website for information on:</b>	
Clinical condition	26%
Referral	18%
Community-based service	25%
Resource or patient information	31%
<b>HealthPathways has changed my use of other online clinical websites?</b>	
Increased	19%
Decreased	65%
No change	16%

**Written comments on experience with HealthPathways**—The majority of practice nurses (82%) considered HealthPathways was a service worthy of an unqualified recommendation to a colleague in another area, with no respondent expressing an overtly negative comment. Only a small number of respondents had minor concerns regarding the development and maintenance of the website, with the majority of these being navigational issues in specific clinical pathways.

**Table 4. Response of the practice nurses to the graded questions**

Clinical effectiveness	Agree	Neutral	Disagree	Mean score (± SD)	Cronbach's alpha
<b>HealthPathways has:</b>					
Assisted in provision of more healthcare in the community?	91%	9%	0%	6.1 (0.9)	0.61
Improved the care I provide to my patients?	97%	3%	0%	6.2 (0.7)	
Increased the time spent with each patient?	38%	35%	27%	4.2 (1.4)	
Enabled me to manage patients I would have previously referred to a general practitioner?	84%	12%	4%	5.6 (1.1)	
Encouraged me to refer patients I would previously have managed myself?	57%	33%	10%	4.8 (1.3)	
Increased the number of information leaflets I provide to my patients?	85%	12%	3%	5.9 (1.1)	
Knowing the criteria for the availability of publically-funded patient care is helpful?	93%	7%	0%	6.0 (0.8)	
<b>Ease-of-use</b>					
HealthPathways is easy to use in clinical practice?	96%	1%	3%	6.2 (1.0)	0.70
HealthPathways has made my job easier?	96%	4%	0%	6.4 (0.8)	
The search function on HealthPathways is effective?	85%	4%	11%	5.4 (1.3)	
<b>Personal experience</b>					
<b>HealthPathways has:</b>					
Improved my relationship with my patients?	60%	30%	10%	4.7 (1.4)	0.76
Improved my relationship with hospital clinicians?	51%	40%	9%	4.4 (1.2)	
<b>Preferences for online clinical guidance</b>					
I prefer to make decisions based on my knowledge of the patient rather than advice from structured decision support?	43%	26%	31%	4.3 (1.3)	0.46
HealthPathways should be altered to provide structured decision support?	35%	52%	13%	4.3 (1.1)	

## Hospital clinicians

**Response rates and demographics**—The hospital clinicians sent the survey questionnaire were either the clinical director of their department or had been involved in the work groups that contributed to the development of the pathways. A summary of the demographics of the hospital clinicians is shown in Table 5. The response rate to the survey was 65% (43 returned vs. 66 sent).

**Graded responses on the effectiveness of HealthPathways**—The Cronbach alpha values of the two related constructs showed the responses had relatively high internal consistency. As shown in Table 5, the majority of hospital clinicians (87%) considered the website had contributed to better patient management in primary care and had improved all stages of referral and follow-up of patients. A common response was that referrals now contained more explicit and relevant information in a standardized format, with 36% of respondents considering that the acuity of the referred patients had increased. These improvements were seen as assisting in the triage process and reducing the rejection rate of referrals. Approximately 60% of the clinicians agreed that involvement with development and maintenance of the website had improved their department's working relationships with general practices. However, a greater proportion (75%) indicated that this involvement required significant time and effort by staff members.

**Written comments on HealthPathways**—More than half (58%) of hospital clinicians gave an unqualified recommendation to HealthPathways with common themes being the value of the website as a resource for general practice and its positive effect on the quality of referrals. The time required to develop and maintain the clinical pathways was repeated by 16% of the respondents. Other mildly expressed concerns included the increasing size and overly prescriptive nature of the website.

**Table 5. Demographics and response to the graded questions of the hospital clinicians**

<b>Demographics</b>					
n	43				
Males/females	26/17				
Age (yr)					
20-30	0%				
31-40	19%				
41-50	44%				
51-60	35%				
>60	2%				
<b>Clinical effectiveness</b>					
HealthPathways has:	Agree	Neutral	Disagree	Mean score (± SD)	Cronbach's alpha
Resulted in improved care of patients in the community?	87%	10%	3%	6.0 (1.0)	0.83
Improved general practice management prior to referral?	71%	21%	8%	5.1 (1.2)	
Increased the proportion of appropriate referrals?	55%	40%	5%	4.8 (1.3)	
Improved the overall quality of referrals?	69%	26%	5%	5.2 (1.2)	
Increased the acuity of referred patients?	36%	51%	13%	4.4 (1.3)	
Provided more explicit information to help triage of referrals?	71%	24%	5%	5.3 (1.2)	
Enabled me to get advice out to general practice?	77%	13%	10%	5.3 (1.3)	
Reduced the number of patients I need to follow-up?	34%	31%	33%	4.0 (1.5)	
<b>Ease of use</b>					
The development and maintenance of HealthPathways has required a lot of effort from myself and/or my department?	75%	18%	7%	5.4 (1.4)	—
<b>Personal experience</b>					
HealthPathways has:					
Improved the relationship between my department and general practice?	63%	32%	5%	5.2 (1.3)	0.80
Been a positive experience for myself and/or my department?	78%	15%	7%	5.5 (1.3)	

## Discussion

The respondents in this survey generally expressed positive opinions on the role of HealthPathways in their day-to-day practices. The clinical information on the website and the local criteria for secondary care referral was considered useful by most general practitioners and practice nurses. This information appeared to make the referral process more transparent and help general practitioners identify patients who required referral from those who they could manage themselves, or in the case of practice nurses, patients who needed to be seen by a doctor.

The majority of hospital clinicians responded that the referral and triage process for secondary care had improved since the introduction of HealthPathways. A further encouraging finding of the survey was that the involvement of healthcare professionals in the development and continuing review of the clinical pathways had contributed to better working relationships in the region. The small proportion of negative comments or opinions of the website included concerns on its increasing size and overly

prescriptive nature and its effect of increasing the workload of both primary and secondary care clinicians.

At the time HealthPathways was developed it was generally acknowledged that clinical guidelines<sup>10-12</sup> and structured decision support systems<sup>13</sup> were not achieving their goals of improving treatment and clinical outcomes of patients. Numerous barriers to the effective use of guidelines were identified that included the prior knowledge and beliefs of health professionals,<sup>14</sup> and the prescriptive nature of guidelines often making it difficult and time consuming to fit them easily into a patient consultation.<sup>15,16</sup> Another common barrier was the perception that guidelines were developed by experts who did not understand general practice.<sup>17</sup>

To overcome these barriers it was recognised that guidelines needed to be applicable to usual practice<sup>11,12</sup> and be presented in a consistent and brief format that was easy to follow.<sup>14,16</sup> The need for unbiased sources of evidence,<sup>11</sup> local opinion leaders, educational seminars,<sup>18</sup> and structured audit and feedback processes<sup>15</sup> were other important factors for successful integration of online guidelines.

HealthPathways was designed to incorporate all these requirements by providing relevant localised information written by local clinicians, that conformed to 'best practice' guidelines and was backed-up by continual feedback, two-yearly reviews, and where necessary clinical audit. Our survey indicates that HealthPathways has overcome many of the barriers encountered by other online clinical resources, with the collaboration between local healthcare professionals in its development being a major factor in breaking down historical barriers. The relevance of the information to the local health community was another important factor.

The main barrier to use of online clinical information systems is time.<sup>11,15,19</sup> Despite being easy to use about 50% of the general practitioners and practice nurses in our survey thought HealthPathways had increased the duration of a patient consultation. This could be due to either time spent on the site or empowerment of nurses and doctors to do more for their patients.

Another relatively common comment was that the website was becoming too big. To avoid this impacting adversely on a patient consultation represents a challenge facing HealthPathways in the future.

The lack of interest for decision support to be more integrated with the patient record and based on computer algorithms has relevance to the current investment in such systems in other parts of New Zealand. Further study is warranted to determine whether or not simpler systems including HealthPathways are sufficient and preferred by clinical teams.

Subgroup analysis of the general practitioner data provided some interesting findings. Female general practitioners, younger doctors and rural practitioners had an overall more positive opinion of the website.

This tendency for female general practitioners to use online clinical guidance to a greater extent than their male counterparts has been described by several earlier studies.<sup>11,21</sup> Our finding that younger doctors found the website easier to use than older doctors was not unexpected and has been reported previously.<sup>11,20-22</sup> The more positive general opinion of rural practitioners on online clinical resources was also not unexpected given their remote locations and relative isolation, with the survey showing information on private referral options was especially useful.

This survey had several limitations. The response rate of the general practitioners and practice nurses did not reach 60%, the rate considered to signify that a representative proportion of the study population has been surveyed. The possibility that individuals with a more positive perception of HealthPathways responded to the survey may therefore be a potential source of bias. The survey was carried out over a relatively short period, immediately preceding the summer holiday period, which was likely to have influenced the response rate. The practice nurses were a select group with known email addresses, while the hospital clinicians were those who were willing to assist in the development of the clinical pathways.

In conclusion, this survey shows that HealthPathways has achieved its objectives of providing easily accessible best practice guidance for general practice teams that is relevant to local services and resources.

The survey shows that HealthPathways has contributed to fostering better working relationships between the primary and secondary healthcare sectors in Canterbury and as such has acted both as an online clinical resource and a tool for promoting integration of health care delivery.

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**Author information:** Graham McGeoch, General Practitioner; Peter McGeoch, Medical Student; Brett Shand, Clinical Writer and Analyst. The Canterbury Initiative, Canterbury District Health Board, Christchurch

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**Correspondence:** Dr Graham McGeoch, The Canterbury Initiative, 4<sup>th</sup> floor, The Princes Margaret Hospital, Christchurch, New Zealand. [mcgeochg@gmail.com](mailto:mcgeochg@gmail.com)

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## ORIGINAL ARTICLE

## Regional differences in echocardiography provision in New Zealand—results from the 2013 SCANZ Workforce Survey

Belinda A Buckley, Katrina Poppe, Mark J Farnworth, Gillian Whalley

### Abstract

**Aim** Healthcare may be unevenly distributed based on geographic location. This study aimed to identify whether regional differences in echocardiography provision exist and, if so, to explore key causes.

**Method** In March 2013, 18 public hospitals with a sonographer-led echocardiography service were surveyed, all of which provided data. Questions related to characteristics of the sonographer workforce, echocardiogram volumes and workflows. Information on District Health Board (DHB) population was obtained from public access websites. Multivariable linear regression was performed using the following variables: ethnicity, age, socioeconomic status, type of centre, sonographer full-time equivalent (FTE) and number/proportion of trainees to determine their potential contribution to echocardiogram volume.

**Results** 1748 echocardiograms were performed per 100,000 population (mean) with significant differences seen amongst DHBs but not between tertiary surgical and regional centres (surgical median 1802, regional median 1658,  $p=0.18$ ). Regional disparity in the population-based cardiac sonographer workforce size was observed and the number of scans performed per sonographer was higher in larger centres. In multivariable modelling, the DHB population-based scan volume was predicted by: socioeconomic status (top two quintiles of deprivation status increased scans by 75 per 100,000 population,  $p=0.02$ ) and age (age 20 to 65 years increased scans by 131 per 100,000 population,  $p=0.06$ ).

**Conclusion** Regional differences in echocardiography services in New Zealand exist as evidenced by marked regional disparity in both population-based echo volumes and cardiac sonographer workforce size.

Regional variation in healthcare provision occurs when differences in the access to or the availability of healthcare are dependent on geographic location and unrelated to need.<sup>1</sup>

Echocardiography is a common diagnostic imaging test that plays a crucial role in the provision of patient care for cardiovascular conditions,<sup>2</sup> yet studies in the United States of America (USA), the United Kingdom (UK) and Canada have demonstrated regional disparity in provision of this essential service.

Significant variation in the use of echocardiography has been demonstrated in the Veterans' Administration (VA) healthcare system<sup>3</sup> that was unrelated to population size or differences in healthcare or funding. In the UK significant differences across the four nations (England, Wales, Scotland, and Northern Ireland) has been observed.<sup>4,5</sup> And lastly, large variability in echocardiography provision throughout Canada has also been described.<sup>2</sup>

Similar regional differences in echocardiography services were described in New Zealand (NZ) in 2005 using a national audit over a 1-week period—Survey of Clinical echocardiography Around New Zealand (SCANZ).<sup>6</sup> That study assessed the entire public DHB echocardiography service at the time and reported “significant regional disparity exists in terms of the rate of utilisation of echocardiography across district health boards (DHBs) on a population basis”.<sup>6</sup> The utilisation of echocardiography for risk assessment in Acute Coronary syndrome (ACS) patients has also been investigated within NZ (in 2002 and 2007) and regional disparity was demonstrated comparing centres with or without interventional facilities.<sup>7,8</sup>

One suggested cause of the regional differences in echocardiography services is the size of the cardiac sonographer workforce. In the UK a strong correlation has been observed between the numbers of echocardiograms performed within each nation per capita and the number of sonographers per country,<sup>4</sup> suggesting that the availability of sonographers may be a causal factor in the volume of echocardiograms performed.

In Canada, it was reported that the shortage of sonographers represented a resource barrier and that “the dearth of sonographers is generally expected to be one of the main limitations to the access of echocardiographic services”.<sup>2</sup> In NZ the size of the cardiac sonographer workforce was investigated for the first time in 2010<sup>9</sup> and reported a “scarcity of personnel” as a possible factor in the regional differences seen in the 2005 SCANZ audit.<sup>6</sup> However the relationship between sonographer resource and echo utilisation has not been reported.

Therefore, the aim of this study was to determine whether the regional disparity in public echocardiography services in New Zealand previously described<sup>6</sup> still exists and to identify DHB population predictors of the echocardiogram volumes. Additionally the relationship between the cardiac sonographer workforce size, demographics of the regional population and echocardiography utilisation will be investigated since this relationship has not been previously described in New Zealand.

## Method

### Data sources

In March 2013 surveys were distributed by e-mail to the team leaders of echocardiography at 18 public hospitals. Participants were identified through networks and included all providers of echocardiography using a sonographer-led service. Two hospitals previously surveyed in 2010 were excluded from distribution as they no longer employed sonographers and provided a physician-only echo service. Survey questions related to the cardiac sonographer workforce characteristics, reported echocardiogram volumes and scan duration and were answered by a single respondent.

### Data analysis

Surveys were returned over the period March to July 2013. Return rate was 100%; by e-mail or post from 15 hospitals, 3 hospitals by telephone interview using a single interviewer. Survey responses for the cardiac sonography workforce were entered as both the total number of sonographers and the full time equivalent (FTE) of the echocardiography provision component of the role (based on a 40-hour working week). Annual (2012) echocardiography volumes (actual number of echocardiograms performed per centre) and workflow for each procedure type were entered separated by centre; centres were identified as either surgical (tertiary providers of cardiac surgery) or regional. Entered data were coded and checked for accuracy. Information on DHB population was obtained from the Statistics New Zealand and Ministry of Health public access websites.<sup>10,11</sup>

The median number of scans performed were compared using the Wilcoxon rank sum test. Multivariable linear regression was performed to estimate the associations between DHB population-based scan volume and available population descriptors, which were: age group (represented as percentage aged <20 years compared to ≥20 years and percentage aged +20–65 years compared to <20 or >65 years), percentage of Māori/Pacific ethnicity (compared to non-Māori/Pacific), and percentage in quintile 4 and 5 (most deprived) of the deprivation index compared to quintiles 1–3 (least/less deprived). The number of variables that can be included in the model is limited by the small sample size (16 DHBs) and these age groups were selected as being relevant to the major indications for echocardiography.

Two multivariable linear regression models were developed to investigate how factors associated with the cardiac sonographer workforce influenced the number of echocardiograms performed per sonographer FTE. Model 1 represented the workforce as the proportion of trainee FTEs, whereas Model 2 represented the workforce as total FTEs, irrespective of whether qualified or trainee. Both models included centre type and median scan time. The co-efficient predicted the increase or decrease in the total number of echocardiograms performed for each variable. R statistical software (v3.0.0) was used for all analyses.<sup>12</sup>

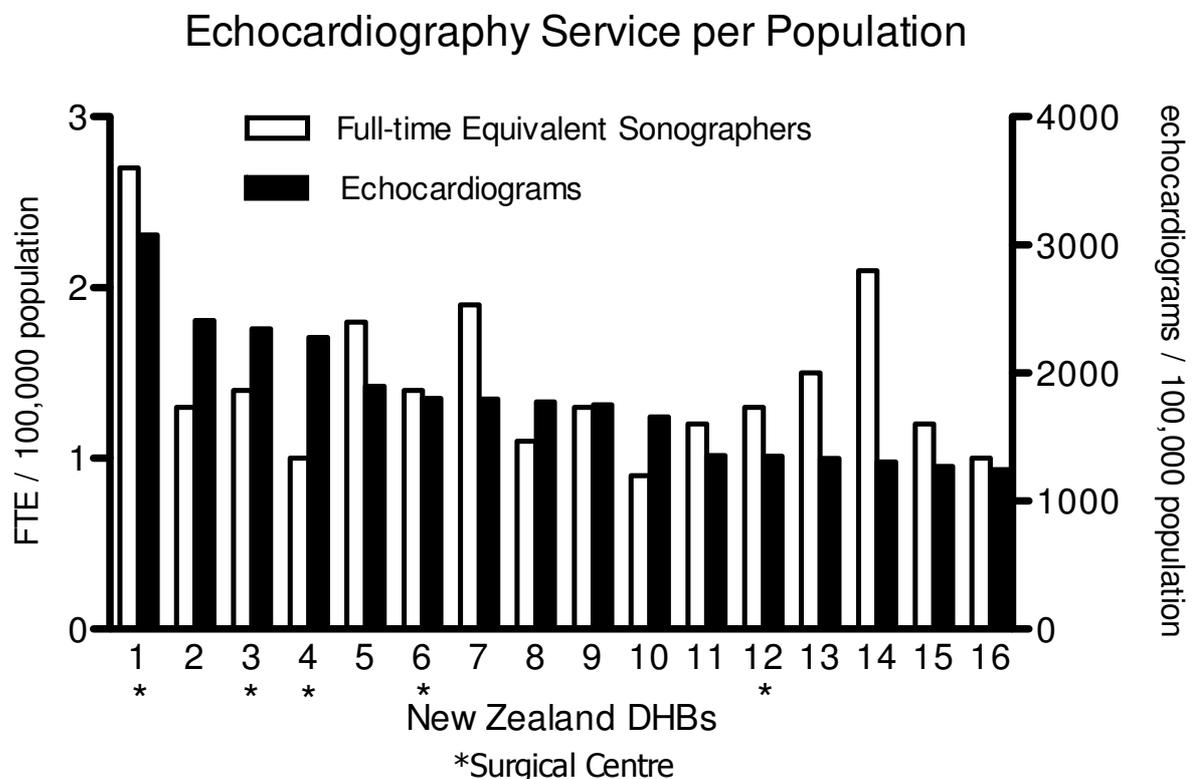
## Results

### Population-based District Health Board (DHB) echocardiogram volumes

A total of 78,900 echocardiograms were performed in public hospitals in 2012; 36,414 echocardiograms (46.2%) were provided by the five hospitals that perform cardiothoracic surgery. An average of 1790 echocardiograms per 100,000 population per annum were performed, with no significant differences seen between tertiary surgical and regional centres (surgical median 1802, range 1352–3077; regional median 1658, range 1246–2409,  $p=0.18$ ).

The average sonographer FTE per 100,000 population is 1.4 with wide differences within centre types and within individual DHBs (surgical median 1.4, range 1.0–2.7; regional median 1.3, range 0.9–2.1).

**Figure 1. Regional echocardiogram service provision by full-time equivalent (FTE) sonographers and echocardiogram scan numbers per 100,000 DHB population**



### DHB population characteristics

A multivariable linear regression model was developed to investigate how factors that describe the DHB population influence the number of echocardiograms performed annually per 100,000 head of population (independent variable).

Every percent increase in the number of people aged 20–65 years in the DHB results in, on average, 131 more echocardiograms performed per 100,000 population per annum. In contrast, 79 fewer echoes are performed per 100,000 people for every 1% increase in those aged <20 years.

Low socioeconomic status (Q4 and Q5) was associated with an increase in the number of echoes performed, which was statistically significant ( $p=0.02$ ).

The proportion of people of Māori and Pacific ethnicity within a DHB population was a negative predictor of echocardiogram volume (35 fewer echocardiograms for each 1% increase in Māori/Pacific population), although this effect was not statistically significant. There was no significant interaction between ethnicity and the different age bands suggesting that the relationship between age and the number of echocardiograms performed is not different for people of Māori/Pacific ethnicity.

**Table 1. Population characteristics by DHB**

District Health Board (DHB)	Total population, N	Age, years (%)			Ethnicity Māori/Pacific (%)	Deprivation status Quintile 4 and 5 (%)
		<20	20–65	>65		
Northland	159795	31	55	16	34.3	56
Waitemata	562970	29	60	11	17.1	26
Auckland*	469400	26	54	20	18.8	39
Counties Manukau	516050	34	57	9	39.4	52
Waikato	373220	30	57	13	24.5	46
Lakes	103170	32	56	12	37.4	51
Bay of Plenty	214910	29	55	16	26.3	45
Tairāwhiti	46753	34	54	12	50.7	65
Taranaki	110258	29	56	15	18.6	41
Hawke's Bay	156490	30	56	14	28.9	47
Mid central	170200	29	57	14	21.7	46
Hutt	145215	30	59	11	26.1	42
Capital and Coast	299720	27	62	11	18.5	28
Nelson Marlborough	141933	26	59	15	10.9	32
Canterbury	509860	27	60	13	10.7	29
Southern*	309028	27	59	14	10.6	32

\* Denotes DHBs who have more than one hospital centre within the catchment.

**Table 2. Model of DHB demographics versus the number of echocardiograms performed per 100,000 population per annum**

Intercept		Coefficient	Standard error	P-value
		<b>-5828</b>	<b>6761</b>	<b>0.41</b>
Age	<20 years	-79	134	0.57
Age	20–65 years	131	62	0.06
Ethnicity	Māori /Pacific	-35	40	0.39
Deprivation status	Quintile 4 and 5	75	29	0.02

Data were entered into the model as binary variables; adjusted  $R^2 = 40.5\%$

### Workforce size and demographics

There were 84 cardiac sonographers in NZ, 14 (17%) of which were trainee sonographers; the total workforce FTE is 70.4, with 13.5 of the FTE being trainees and 37% of the total workforce were employed in surgical centres.

The FTE provided nationally to the echocardiographer role is 61.9. The vacant FTE of 3.2 is 4.5% of the total workforce size. Eighteen (25.7%) of 70 qualified cardiac sonographers and three (21.4%) of 14 trainee cardiac sonographers perform cardiac technical duties in addition to performing

echocardiography. Seventy seven % of cardiac sonographers in surgical centres have more than 5 years of experience with 42% having more than 15 years of experience (21% in regional centres).

The average number of echocardiograms performed per cardiac sonographer FTE was 1323 per annum. Sonographers in surgical centres performed on average more scans per FTE than regional centres (1465 versus 1258) but there was wide disparity within DHBs and centre types (surgical median 1319, range 1039–2193; regional median 1218, range 631–1938).

**Table 3. Model 1 – trainee versus qualified workforce**

	Coefficient	Standard error	P-value
<b>Intercept</b>	1885	636	0.01
% of workforce trainees	-9.0	636	0.37
Surgical centre	712	9.6	0.04
Median scan time (minutes)	-11	15	0.48

Adjusted R<sup>2</sup> = 25.5%.

Model 1 demonstrates that, even after adjusting for centre type and median scan time, an increased percentage of trainees in the workforce will negatively impact on the numbers of echocardiograms per FTE.

**Table 4. Model 2 –Total workforce size by FTE**

	Coefficient	Standard error	P-value
<b>Intercept</b>	<b>2131</b>	<b>677</b>	<b>0.008</b>
Total FTE	50	77	0.52
Surgical Centre	561	413	0.20
Median scan time (minutes)	-22	17	0.20

Adjusted R<sup>2</sup> = 42.8%.

Model 2 demonstrates that increasing centre size (measured by total workforce FTE) will positively impact on the number of echocardiograms per FTE.

Both models showed that, independent of other factors, surgical centres performed more echocardiograms per FTE than regional centres and that increasing scan length reduced the number of echocardiograms performed per cardiac sonographer FTE.

## Discussion

General—This study demonstrates that there is marked regional disparity in echocardiogram volumes throughout New Zealand DHBs and although this study and prior studies<sup>6</sup> reported echocardiogram volumes differently the same disparity first identified in 2005 still exists.

This study builds on the earlier work by demonstrating that both the population-based echocardiogram volumes and the cardiac sonographer workforce size (measured by sonographer FTE) are widely different between DHBs and within centre types.

Multivariable regression analysis showed that deprivation, ethnicity, sonographer FTE and centre type affect echocardiogram volumes and that these volumes are not directly related to increasing age in the DHB population, since the age group which had the most influence on increasing volume was the 20 to 65 years age group.

Not surprisingly DHBs with an increased population of those aged less than 20 years were associated with fewer echocardiograms and may reflect the complexity of the caseload. This effect was not

statistically significant however and should not be over interpreted due to the relatively low number of paediatric echocardiograms performed nationally.

Although not statistically significant, the decrease in volume of echocardiograms for DHBs with higher populations of Māori and Pacific suggests the potential for a need versus access imbalance described by the inverse care law<sup>13</sup> since Māori and Pacific are known to have higher prevalence of cardiac disease,<sup>14</sup> much higher prevalence of cardiac risk factors<sup>14</sup> and are therefore more likely to require an echo. Additionally all four of the DHBs with the highest proportion of Māori and Pacific population (greater than 30% of total population) showed median (at one centre) or lower than median (at three centres) population based cardiac sonographer FTE. This suggests that one possibility for the reduced volume for centres with increased Māori/Pacific population is the unequal distribution of cardiac sonographer FTE.

Furthermore, it is interesting that low socioeconomic status was a predictor of increased scan volumes. Since proportionally higher deprivation is known to exist in Māori and Pacific populations,<sup>15</sup> it may be expected that both ethnicity and socioeconomic status would show a reduction in volumes, or perhaps the interaction of the two. This difference is likely multifactorial but may relate to the inclusion of ethnicity in the reported DHB deprivation population characteristics. This warrants further investigation.

There are likely other factors which may impact on differences in the echocardiogram volumes seen that are not included in this study. This level of data is complicated by several factors: surgical centres take patient referrals from outside their geographic catchment area; there are different rural/urban mixes across the DHBs; some DHBs offer outreach services through mobile clinics and travelling clinics.

A further consideration is differing wait list volumes since the number of echocardiograms performed may not equate to demand—*anecdotal evidence suggests wait list volumes vary widely throughout the country and this may account for some of regional volume differences seen. Finally, disease prevalence within the DHB populations may account for some of the regional differences seen.*

Both the wait list and the number of echocardiograms performed could relate to the cardiac sonographer workforce size, as has been suggested in a previous UK study.<sup>4</sup> Although there is regional disparity in cardiac sonographer workforce size (measured by sonographer FTE) and regional variability in the annual number of echocardiograms performed, there does not seem to be a relationship between the two. Possible reasons for this were explored by multivariable analysis, which predicted that both the proportion of trainee to qualified FTE in a DHB and overall workforce size may account for some of the DHB differences seen, but not other factors.

The results show that increasing the proportion of trainees in a workforce will reduce the volume of echoes performed. This is not surprising as training of sonographers is time intensive and requires one on one direct supervision.<sup>16</sup> In NZ, cardiac sonographers are usually trained in an employed (rather than supernumerary) capacity and it is known that this model of training impacts on productivity.<sup>17</sup> More regional than surgical centres have trainees in the workforce (64% versus 36%) and this may reflect the ability for larger centres to recruit qualified and experienced staff from other centres or overseas.

Both workforce models consistently show that the type of centre impacts on the echo volume produced. Surgical centres perform more scans per sonographer FTE, independent of all other factors. This increased echo volume capacity of surgical centres may relate to the experience of the sonographers working in surgical centres.

The overall size of the cardiac workforce at a DHB may also affect the echocardiogram volume; increased efficiencies at large centres and infrastructure differences such as clerical support for bookings or patient transport services may be helpful.

Scan time is also demonstrated as an important predictor of volume of echoes per DHB with each minute increase in median scan time reducing the volume of echoes able to be performed.

From these data, it appears that the sonographer workforce in New Zealand is small, and is likely to be contributing the low overall number of echocardiograms performed. In New Zealand, the population average per year is 1.6 cardiac sonographer FTE per 100,000 population compared to 3.1 in Australia.<sup>18</sup> What these data also show is that there remains important disparity both in terms of population based FTE and number of echocardiograms at the different DHBs in New Zealand.

**Limitations**—This study forms a complete national sample of echocardiography services provided by publically funded DHBs but is not representative of all echocardiography provision nationally since private providers were excluded. Furthermore only public hospitals with echocardiograms performed by cardiac sonographers were included—two public hospitals were excluded from survey distribution for this reason. However, this is unlikely to have major impact since most comprehensive diagnostic echocardiography in New Zealand is performed by sonographers. The study also excludes point-of-care and limited scope echocardiography performed by other physicians.

The multivariable analysis in this study is limited by the small sample size with only 18 participating public hospitals—although a complete national sample was collected. The sample was further reduced to 16 for DHB analysis (as two DHBs were represented by two hospitals each) and the small sample size limited the number of variables which could be included in the models. Since the variables included were predictive in other studies it is unlikely that important predictors were excluded from the analysis but this study does not investigate all possible variables. Furthermore the use of composite measures for ethnicity and deprivation in the reported DHB population characteristics may result in compounding as these variables were not modelled independently. For DHBs with more than one hospital the combined workforce and volumes may not accurately reflect the complexity and differences of each hospital within the DHB.

Although this survey was performed over a 3-month period it reflects an accurate point in time representation of the cardiac sonographer workforce and echocardiography service within each DHB. The DHB age and quintile demographic information used was from the 2006 census but was the most recent available. However information on DHB total population was from the most recent (2013/2014) estimates to enable a closer time match with survey information.

**Conclusion**—This study demonstrates that regional disparity in public echocardiography in New Zealand exists today – potentially disadvantaging populations with the greatest need. This is demonstrated by the unequal geographic distribution of echo services. The reasons for this are multifactorial, but are likely contributed to by DHB demographic differences in age, ethnicity, and socioeconomic deprivation status as well as the size and demographics of the cardiac sonographer workforce.

Although there is acknowledgement and commitment to minimise and potentially close inequality gaps in all areas of cardiac healthcare<sup>13</sup> and the regional disparity in echocardiography volume has been noted previously,<sup>6</sup> there have been no previous studies relating cardiac sonographers' workforce distribution to regional echo service provision.

**Competing interests:** Nil.

**Author information:** Belinda A Buckley, Cardiac Sonographer, Cardiac Investigation Unit, Counties Manukau Health, Otahuhu, Auckland; Katrina Poppe, Research Fellow, Department of Medicine, University of Auckland; Mark J Farnworth, Senior Lecturer, Natural Sciences, Unitec Institute of Technology, Auckland; Gillian Whalley, Professor/Associate Dean, Social and Health Sciences Research, Unitec Institute of Technology, Auckland

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**Correspondence:** Mrs Belinda Buckley, Cardiac Investigation Unit, Counties Manukau Health, Private Bag 93311, Otahuhu, Auckland 1640, New Zealand. [belinda.buckley@middlemore.co.nz](mailto:belinda.buckley@middlemore.co.nz)

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## ORIGINAL ARTICLE

## A comparison of laparoscopic adjustable gastric band and laparoscopic sleeve gastrectomy: a single surgeon's experience

Richard Flint

### Abstract

**Aim** Laparoscopic adjustable gastric band (LAGB) has been a popular form of surgical weight loss in New Zealand but is now being neglected in preference of the laparoscopic sleeve gastrectomy (LSG). Arguments for each operation have focused on differences in weight loss and complication rates. The aim of this study is to compare the results of these two techniques from a single surgeon's practise.

**Method** A non-randomised, observational study comparing patients undergoing either LAGB or LSG by a single surgeon.

**Results** There were 228 patients who had either a LAGB (94 patients, mean age 45.1±11.9 years, mean BMI 42.2±7.1 kg/m<sup>2</sup>) or a LSG (134 patients, mean age 44.8±9.11 years, mean BMI 50.2±9.0 kg/m<sup>2</sup>) between October 2009 and April 2014. The 2-year mean percent excess body weight loss for the LAGB group was 46.1±27.8% compared to 72.1±20.9% for the LSG group (P<0.0001). There were 19 patients (20%) that required 29 reoperations following LAGB, most commonly for gastric prolapse (mean 22.8±13.8 months postop). In contrast, there were 4 patients (3%) that required reoperation following LSG (2 haemorrhage, 1 staple-line leak and 1 check laparoscopy) and 2 patients (1%) that required gastroscopy for sleeve spasm. Reoperation rate was significantly greater for LAGB than LSG (p<0.0001).

**Conclusion** In this current series there was a significantly reduced level of weight loss but higher complication rate following LAGB when compared to LSG. Despite the limitations of this study, the results may explain why LSG has gained preference over LAGB in recent years.

Obesity affects at least a quarter of New Zealand adults and is a leading cause of preventable death.<sup>1</sup> Despite a variety of strategies to tackle obesity, only weight-loss surgery has been proven to induce the type of weight loss required to improve survival.<sup>2</sup> Unfortunately the ideal operation has yet to be determined. One of the most popular operations has been the laparoscopic adjustable gastric band (LAGB) that limits the size of the stomach by placing an adjustable silicone collar just below the gastroesophageal junction. Proponents for this operation have focused on its favourable perioperative safety profile and weight-loss results.<sup>3</sup>

In recent times there has been a groundswell away from LAGB in favour of the laparoscopic sleeve gastrectomy (LSG).<sup>4</sup> In this operation the stomach is reduced to a narrow tube by stapling and removing most of the fundus. Initial accounts suggest a greater weight loss than the LAGB but at an increased perioperative risk. Few have attempted to compare these techniques and currently there has only been one randomised controlled study conducted. Unfortunately this was a study of low power (n=80) that was completed at a time when the sleeve gastrectomy was still being developed but its findings were consistent with these initial reports.<sup>5</sup>

In this present study the results of a consecutive series of patients who had either LAGB or LSG from a single local surgeon are compared. The aim of this non-randomised observational study is to demonstrate any differences in weight loss and complications between the two techniques so the knowledge of the merits of each operation can be enhanced within the New Zealand environment.

## Methods

All patients undergoing either LSG or LAGB weight loss surgery by the author between October 2009 and April 2014 were sourced from a prospective database. Patient demographics (age, gender, weight, and body mass index (BMI)) were sourced from the database, with missing data being recovered from a retrospective chart review. Patient follow-up was also accessed from the database and when required, patients were either called back to clinic or contacted by telephone.

All patients had a comprehensive preoperative workup that involved consults with the author as operating surgeon, a psychologist, a dietician and an exercise specialist. A preoperative very low calorie diet (up to 800 kcal/day, OptiFast, Nestle New Zealand) was commenced at least 2 weeks before surgery. Laparoscopic adjustable gastric bands (LapBand AP system, Allergan, Irvine CA) were placed by the pars flaccida approach. Postoperative band adjustments were scheduled to start 6 weeks after surgery and monthly thereafter until the optimal volume was reached.

Laparoscopic sleeve gastrectomy was performed using a 36F bougie starting 3cm from the antrum. The staple line was not oversewn nor were tissue-reinforced staples used, but fibrin sealant (Tisseel, Baxter International Inc.) was used routinely until 2014, after which it was used selectively. Dietician and exercise specialist follow-up was continued for at least a year after all operations, and postoperative psychologist consults were scheduled on an as-needed basis.

All descriptive data is expressed as mean  $\pm$  standard deviation. Weight loss is expressed as percentage of excess body weight lost, with the ideal body weight being calculated by the Deitel & Greenstein formula, indirectly based on Metropolitan Life tables.<sup>6</sup> All statistical analysis was performed by InStat version 6.0 software (GraphPad Software Inc., San Diego, USA). Student's two-tailed t-test (non-paired) was used to analyse all nonparametric data and Fisher's exact test for all parametric data.

This study was conducted in accordance with the directions of the New Zealand Health and Disability Commissioner Ethics Committee. Formal review was not required.

## Results

There were 228 patients who had either a LAGB (94 patients, mean age 45.1 $\pm$ 11.9 years) or a LSG (134 patients, mean age 44.8 $\pm$ 9.11 years) during the study period (Table 1). Patients having LAGB were significantly smaller than LSG (mean BMI 42.2 $\pm$ 7.1 kg/m<sup>2</sup> versus mean BMI 50.2 $\pm$ 9.0 kg/m<sup>2</sup>; p=0.02). All patients were accounted for during the study period but weight loss data was incomplete for 9 (10%) LAGB and 21 (16%) LSG patients. The average duration of follow-up was greater after LAGB (Table 1).

The 2-year mean percent excess body weight loss for the LAGB group was 46.1 $\pm$ 27.8% compared to 72.1 $\pm$ 20.9% for the LSG group (P<0.0001) (Figure 1). There were two deaths during the study period. One patient had a non-survivable cerebrovascular accident in the second week following LSG. The second death occurred 9 months after LAGB from an unrecognised acute gastric prolapse whilst out of town.

During the study period a total of 19 patients with a LAGB required a total of 29 reoperations. The author performed all but two of these reoperations. Two of these were for re-siting of the LAGB subcutaneous reservoir due to malposition that had rendered it inaccessible. The remaining 17 patients required a repeat laparoscopy.

The commonest indication for repeat laparoscopy was for gastric prolapse (nine patients). This occurred at an average 22.8 $\pm$ 13.8 months from the initial operation. Two of these nine patients insisted their LAGB was removed after the prolapse and had no further surgery. The remaining seven had laparoscopic repositioning of their AGB, of whom two had further prolapse and subsequent removal of their AGB. The next most common indication for further surgery was band erosion (two patients) that required removal of the AGB at 17 and 30 months from initial surgery.

Gastric perforations at time of initial operation occurred in two patients and were both successfully managed with laparoscopic removal of the AGB. Band intolerance occurred in two patients and

required replacement with a larger band (one patient) or removal the AGB (one patient). The other indications for reoperation following LAGB was an infected AGB (one patient) and spontaneous unbuckling of the AGB (one patient).

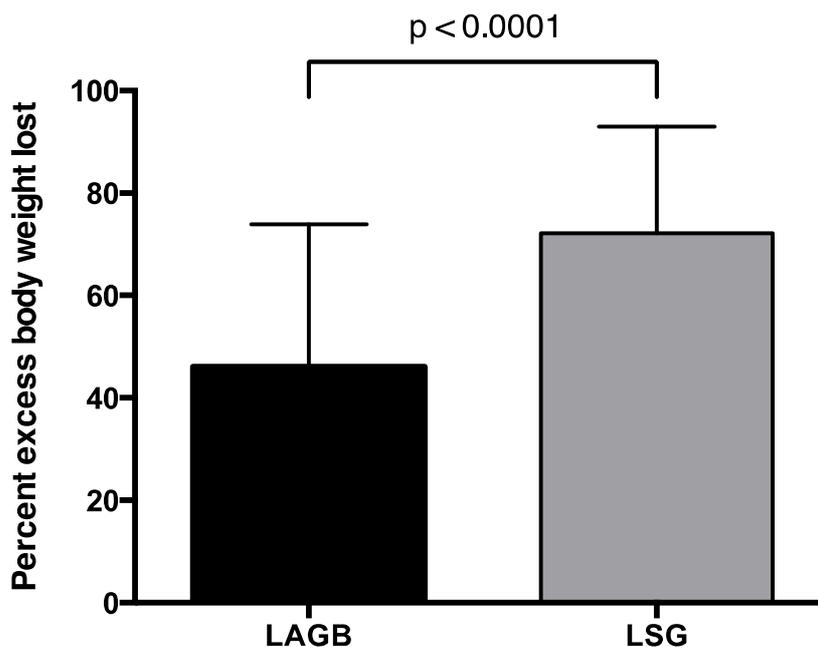
Of the 94 patients who had LAGB, 10 required removal of the AGB. Four of these had a conversion to another weight loss surgery (two gastric bypasses and two sleeve gastrectomies) whilst the remaining six patients had no further surgery.

**Table 1. A comparison of laparoscopic adjustable gastric band (LAGB) and laparoscopic sleeve gastrectomy (LSG) describing patient demographics, weight loss, reinterventions and complications**

Variables	LAGB	LSG	p
Number	94	134	
Age (years)	45.1±11.9	44.8±9.11	NS
BMI (kg/m <sup>2</sup> )	42.2±7.1	50.2±9.0	0.02
%EBWL at 2 years	46.1±27.8%	72.1%±20.9%	<0.0001
Average follow-up (months)	33.7±12.6	24.0±14.7	<0.0001
Reoperation	19	4	<0.0001
Endoscopy	0	2	NS
Prolapse	9		
Erosion	2		
Haemorrhage	0	2	NS
Staple line leak		1	
Stricture		0	

%EBWL = percent excess body weight loss.

**Figure 1. Graph comparing percent excess body weight lost at 2 years after laparoscopic adjustable gastric band (LAGB) and laparoscopic sleeve gastrectomy (LSG)**



Following LSG, two patients had a postoperative bleed and required an urgent laparoscopy to control hemostasis. One patient had a staple-line leak on postoperative day 5 and was successfully treated with laparoscopic placement of drains and endoscopic stenting. The remaining patient had a diagnostic laparoscopy on postoperative day 1 after an anomaly on routine postoperative gastrografin swallow suggested a leak. No leak had occurred in this case and the patient continued to recover without incident. There were no gastric strictures in this series but two patients required gastroscopy in the first month due to sleeve spasm. One patient developed a spontaneous portal vein thrombosis that resolved with anticoagulation alone.

## Discussion

This report describes a single surgeon's experience of LAGB and LSG that shows a significantly greater weight loss following LSG with a reduced reoperation rate during the study period.

The sleeve gastrectomy is a recent weight-loss procedure that was developed as the first stage of a two-stage procedure for high-risk patients. The aim was to reduce weight in the extremely obese so that a bypass could be safely performed at a later date.<sup>7</sup> Since then the popularity of LSG as a standalone operation has surged as people have become attracted to its perceived technical simplicity, feasibility, and good outcomes.

Local surgeons have recognised that patients' demand for LSG have come at the expense of the LAGB, a procedure that used to be extremely popular amongst those seeking weight-loss surgery. This phenomenon has been mimicked internationally with demand for the LSG in North America rising dramatically over the last decade.<sup>4</sup> However there has been little comparison between the two procedures with only one low-powered randomised controlled trial describing a greater weight loss following LSG, with less reoperations but more severe complications.<sup>5</sup>

This current study's findings of a 20% reoperation rate following LAGB may seem at odds with other units' claims of a 1% perioperative complication rate.<sup>8</sup> Indeed it is these reported low rates that had led many to prefer the LAGB over other surgeries such as the gastric bypass that have a five-fold greater perioperative risk.<sup>9</sup>

This current study differs from these earlier reports by including events beyond the 30-day perioperative window. The results presented in this paper suggest that problems with the LAGB can occur beyond the initial postoperative period and should be considered when comparing different types of weight-loss operations.

Indeed, this implication is now being supported by recent long-term follow-up studies that describe a similar reoperation rate to that presented here. Gero et al describe a 50% reoperation rate in their 10-year follow-up of a randomised controlled trial of two different types of LAGB.<sup>10</sup> O'Brien et al describe a similar reoperation rate of 56% during the 15-year follow-up of a series of 3227 bands.<sup>11</sup> In addition, Himpens et al had to reoperate on 22% of their LAGB during their 3-year follow-up of a randomised trial of LAGB versus sleeve gastrectomy<sup>5</sup> whilst Steffen et al report a 23% long-term complication rate in their 5-year follow-up of 824 LAGB.<sup>12</sup>

As in this current study the most common indication for reoperation was gastric prolapse; a condition where the stomach herniates up through the band and becomes impacted. The rate of documented prolapse varies up to 20% and its true cause is still conjectural.<sup>13</sup> It is the author's opinion that much of the variation in the incidence can be attributed to the duration of follow-up as many of the cases in this series occurred long after the band had been adequately adjusted.

The suspicion that gastric prolapse is an ongoing risk that accumulates over time, is supported in larger studies of longer duration that describe prolapse occurring approximately 2 years after its placement.<sup>12,14</sup> A similar argument can be made for gastric erosion which also occurs several months after placement of the band.<sup>15</sup> Therefore it seems reasonable to assume the number of patients that

have extremely satisfactory weight loss with no adverse effects following their LAGB will get progressively smaller as problems with the LAGB accumulate overtime. Furthermore it is impossible to predict preoperatively who will remain in this successful group.<sup>10</sup>

Although greater weight loss with a lower chance of reoperation makes a convincing argument against the LAGB in preference of the LSG; it must be noted that all of the LAGB complications in this study could be salvaged laparoscopically, usually in a non-urgent basis, and none of the patients suffered long-term sequelae. Complications after the LSG may be less common, but the consequences are much more serious. For example the most feared complication of a leak in the staple line is very uncommon (reported to be 2-6%<sup>16</sup> and in this series 0.7%). However, when it does occur it takes an average of 40 days to heal, will require a total gastrectomy in 10% and is the leading cause of death accounting for 30% of mortalities after LSG.<sup>16,17</sup> Therefore the true advantage of the LAGB over LSG may be in its reversibility if problems were to occur.

Although this study describes significant differences between the LAGB and LSG the results need to be interpreted in view of some limitations. This was a non-randomised, non-blinded study so direct comparisons between the groups may be susceptible to bias and confounding. Indeed the group who had LSG had a greater initial BMI and it is accepted that those with a greater excess weight will have a larger excess weight loss following their operation. Furthermore the follow-up is still relatively short and it is possible that long-term problems with the LSG are yet to become apparent, which will alter the comparisons. Another limitation is based on the use of one LAGB amongst a variety of different types of adjustable gastric bands on the market

In conclusion, this report of a single surgeon's experience of LAGB and LSG in the New Zealand environment describes a greater weight loss and lower complication rate following LSG. Experiences like this may explain the growing popularity of the LSG over LAGB.

**Competing interests:** Nil.

**Author information:** Richard Flint, Senior Lecturer, Academic Department of Surgery, University of Otago – Christchurch, Christchurch

**Correspondence:** Richard Flint, Academic Department of Surgery, University of Otago Christchurch, PO Box 4710, Christchurch, New Zealand. [Richard.Flint@otago.ac.nz](mailto:Richard.Flint@otago.ac.nz)

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## ORIGINAL ARTICLE

## Use of an Accelerated Diagnostic Pathway allows rapid and safe discharge of 70% of chest pain patients from the Emergency Department

Andrew R Munro, Tom Jerram, Tom Morton, Suzanne Hamilton

### Abstract

**Introduction** The majority of patients who present to the Emergency Department (ED) with chest pain, do not have Acute Coronary Syndrome (ACS). Rapid, safe discharge home for this large group is hampered by clinical uncertainty. A pragmatic Accelerated Diagnostic Pathway (ADP) used in our ED achieves this goal.

**Aim** To demonstrate the safety and utility of a locally developed ADP. The primary outcome for patients who were identified as non-high risk by our ADP was death or acute myocardial infarction (AMI) at 30 days. Secondary outcomes were ED length of stay, discharge rates, provocative testing and revascularisation rates.

**Method** This is a prospective observational convenience cohort study of chest pain patients presenting to a regional ED excluding ST-elevation myocardial infarction (STEMI). Using a locally derived ADP, patients were classified as high risk or non-high risk for 30-day death or AMI. Patients could be classified as high risk on the basis of ECG change, troponin elevation, or senior clinician “gestalt” irrespective of negative serial ECGs and troponins. All others were classified non-high risk and were followed up at 30 days.

**Results** There were 452 patient events with the ADP identifying 75% as non-high-risk (93% of these patients were actually discharged). All patients were successfully followed up for 30-day outcomes. The sensitivity and negative predictive value of the ADP was 100% (95% CI: 99–100%). Specificity was 83% (95% CI: 79–87%). The average ED length of stay was 4 hours 5 minutes. There were low rates of revascularisation (1.5%) and provocative testing (6.2%) in the non-high risk group.

**Conclusion** This ED ADP for chest pain rapidly and safely identified patients who were not at high risk of a short-term AMI or death.

New Zealand Emergency Departments currently receive around 50,000 chest pain patients annually. Ultimately 70 to 80% of chest pain patients without STEMI, do not have a final high-risk diagnosis. Rapid, yet safe rule-out for this large group is complicated by the knowledge that 1 to 5% of the group clinically evaluated as low risk may mask life-threatening disease.<sup>1-3</sup>

Striving for a zero percent miss rate for AMI is associated with significant cost and probable harm. With this in mind, the ‘acceptable’ miss rate appears to be around 1%.<sup>4-8</sup>

International consensus guidelines recommend provocative testing within 72 hours of index ED presentation for all undifferentiated chest pain patients who are not clearly at very low risk.<sup>9-11</sup> Unfortunately stress testing in this population is associated with a very low positive rate (1.7%), one third of who will be false positive, exposing low risk patients to potential harm through invasive testing and revascularisation for stable coronary artery disease.<sup>4,12-17</sup>

Several recent studies from Australasia show the utility of an ED ADP using Thrombolysis In Myocardial Injury (TIMI) scoring and early use of troponin to identify patients as low, intermediate or high risk of major adverse cardiac event. Unfortunately, rates of potential early ED discharge in these trials are low.<sup>18-20</sup>

Many patients who do not meet low risk criteria in these and other ADPs or guidelines may in fact be safely discharged. In an effort to reflect this we designed an ADP to specifically identify chest pain patients as either “high-risk” or “non-high risk.”

Our hospital uses the 5<sup>th</sup>-generation high-sensitivity cardiac troponin-T (hs-cTnT) (Roche®); enabling earlier detection of cardiac injury. Mild elevation in troponin is common in patients without AMI (cardiac failure, cardiomyopathy, diabetes, and renal impairment).

There is evidence that delta change (up or down) in hs-cTnT levels in conjunction with an absolute cutoff value for MI (of >52 ng/L) may increase specificity without a significant reduction in sensitivity with the current literature supporting the use of absolute delta values as opposed to relative change.<sup>21-26</sup>

This ADP, in addition to standard early ECG interpretation, uses very early serial troponins (applying absolute and delta cutoffs) and the “safety-net” of senior doctor gestalt (that is, the presence significant clinical concern for an acute coronary syndrome despite normal investigations).

Our aim was to show that a locally developed and applied ADP can rapidly and safely identify a cohort of chest pain patients who are not at high risk of death or MI within 30 days of ED presentation.

This study was conducted in a regional New Zealand ED (Nelson Hospital). Five percent of our 26,000 annual ED attendances are for chest pain, 18% of which ultimately have an ACS diagnosis.

The ED physician group consists of five specialists with postgraduate qualification (Fellow of the Australasian College for Emergency Medicine) and three without.

Our hospital has a cardiology service with in-hours access to emergent coronary intervention. An outpatient chest pain clinic provides provocative testing for non-high risk patients and can only be accessed via primary care.

The recruitment period was from August 2013 to April 2014. Recruitment was by convenience sampling as there is no specialist emergency physician directly available in our department from 0000–0800.

## Methods

This is a single-centre prospective observational study of a convenience cohort of ED chest pain patients subjected to a local ADP stratifying for risk of AMI or death at 30 days.

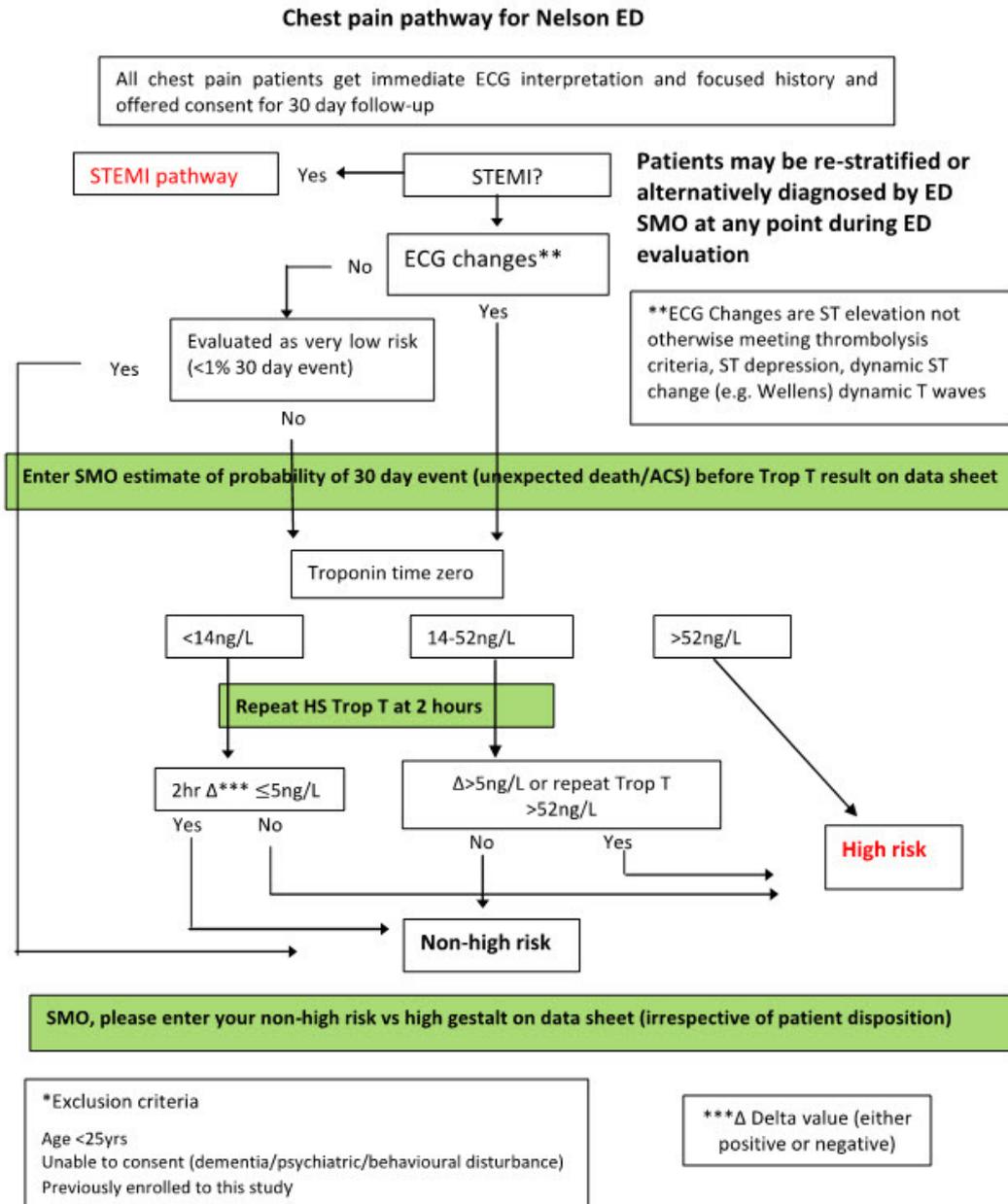
Northern B Health and Disability Committee ethics approval was obtained (reference number 13/NTB/72) in June 2013 and was registered with the Australia New Zealand Registry of Clinical Trials ACTRN12614000417684.

We powered the study to show a primary outcome rate of <1% at the 95% confidence interval. Our calculations used data from two recent studies and calculation methods for diagnostic testing, published by Jones et al.<sup>26-28</sup> We determined a minimum number of between 373 and 400.

All patients with a presenting complaint of chest pain being assessed by an ED doctor were eligible for the study. Patients exited the study if given a clear non-cardiac diagnosis during ED workup. This included pulmonary embolism, pneumonia, pericarditis, but specifically excluded musculoskeletal chest pain and gastroesophageal reflux; both of these are well-documented misdiagnoses resulting in missed ACS cases.

Written consent for 30-day follow-up was obtained from eligible patients prior to the availability of troponin result. Those patients not seen by an ED physician primarily were managed under the supervision of an ED physician, including ECG interpretation and final risk assessment/gestalt. Patients with STEMI were followed up, although not included in the study.

Figure1. ADP pathway



Patients could be stratified as high risk by one of three ways:

- Ischaemic ECG at any stage during ED admission (irrespective of troponin result).
- Initial troponin >52 ng/L or a 2-hour delta (change up or down) troponin of >5 ng/L.
- If despite these being negative the ED physician had significant clinical concern for ACS at the end of the evaluation. This was included as a “safety net” as there is a well-documented rate of unstable angina with negative ECG/biomarkers.

Patients not meeting any of these criteria were stratified as non-high risk.

We derived our absolute troponin and delta troponin cutoff values from recent work by Reichlin et al.<sup>26</sup> This group used 1-hour delta troponin values. As there were some members of our group not comfortable discharging patients based on 1-hour delta troponins, we elected to conservatively extrapolate the available data to a 2-hour hs-cTnT delta of 5 ng/L. The same paper provided an absolute cutoff off for high risk of 52 ng/L.<sup>26</sup>

A ‘time zero’ hs-cTnT was obtained as close to time of ED triage as possible with a second troponin sample taken (if required) approximately 2 hours later. Patients with duration of pain greater than 6 hours and initial troponin <14 ng/L, were not required to have a second troponin, and were considered troponin negative. Patients felt by the clinician to have a very low risk of ACS (arbitrarily <1%) were not required by the ADP to have biomarker testing.

All non-consented patients were identified by review of daily departmental presenting complaint. This included patients referred directly from general practitioners to the cardiology service, but seen in our department. These patients had their records reviewed at 30 days for evidence of death or MI, but were not included in the study.

The ECG was considered ischemic if there was new or presumed new ST elevation or significant ST depression (>1 mm) or T wave inversion at *any* stage during ED assessment.

All consented patients were followed up with structured telephone or email interview no sooner than 30 days from their index presentation. Primary outcome events were recorded by one of two investigators. Independent adjudication in unclear cases of AMI was by consultant cardiologists.

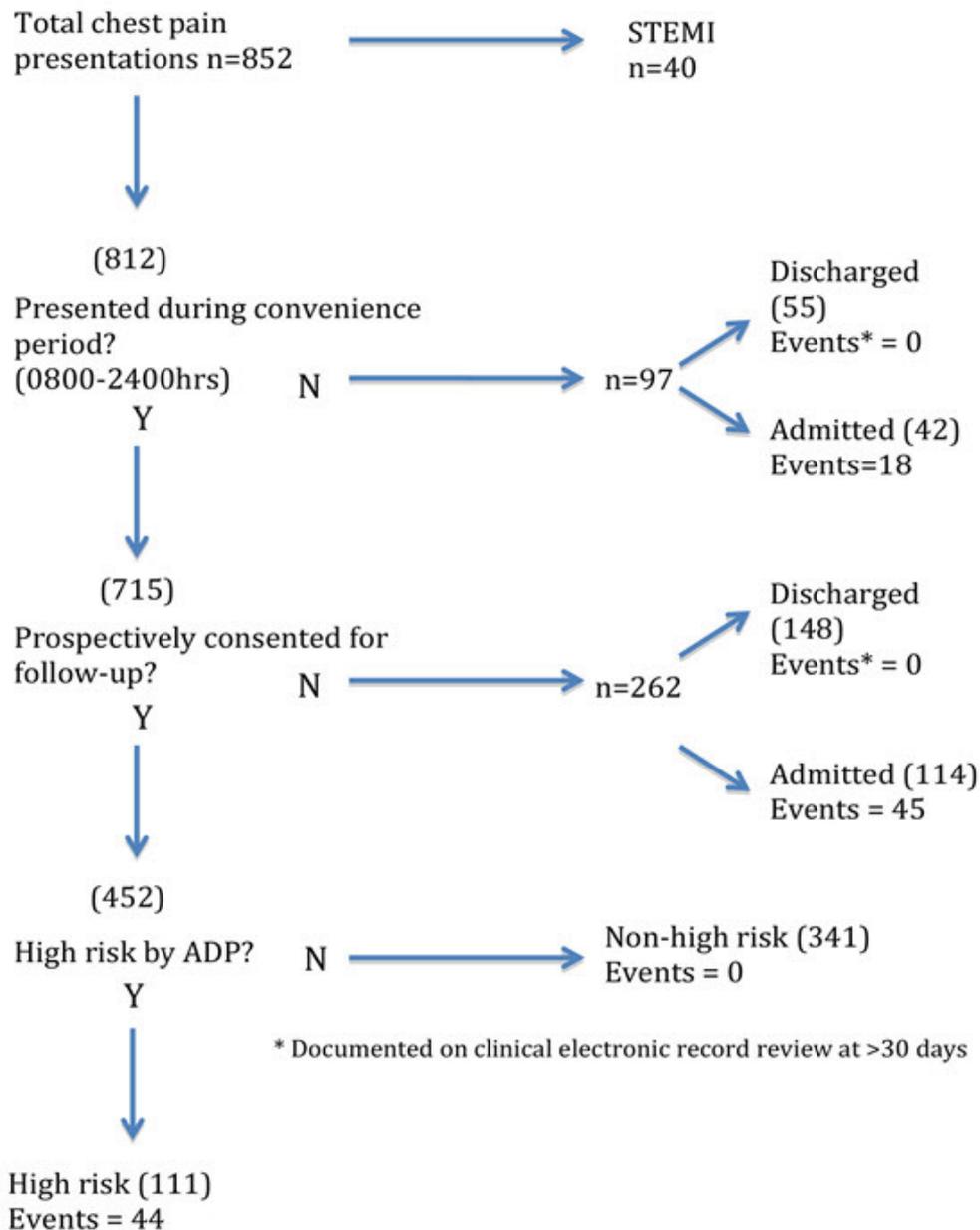
Data was collected on a standardised data sheet and entered into Microsoft Excel spreadsheet and statistical analysis was web-based using [http://www.medcalc.org/calc/diagnostic\\_test.php](http://www.medcalc.org/calc/diagnostic_test.php)

## Results

We recorded 852 ED encounters for 726 patients with chest pain potentially consistent with ACS. There were 40 STEMIs; a rate of 4.7% of all chest-pain patients.

Our study cohort consisted of 436 chest pain patients who presented 452 occasions. 60% were male. The mean age was 63±14.5 years (1SD). All consented patients were successfully followed-up.

341 patients were stratified as non-high risk by this ADP, none of who had a 30-day event.

**Figure 2. Patient groups and 30-day 'events'**

Twelve percent (n=40) of the non-high risk group underwent provocative evaluation (exercise tolerance testing or stress ECHO). Only seven occurred within 72 hours of discharge.

It is worth noting that none of the 131 chest pain patients with a time zero hs-cTnT of 5 ng/L or less experienced a 30-day event. This was 38% of the non-high risk group.

Additionally 29% of the non-high risk group had a documented history of IHD.

Of the 111-chest pain patients who were considered high risk (HR) by the ADP 44 (40%) had a 30-day primary event (see Table 1).

**Table 1. Characteristics of the high-risk group by ADP with 30-day event rates**

Sub-group	n, (%)	30-day event n=44 (% of sub-group)
Ischemic ECG	36 (32%)	17 (47%)
hs-cTnT $\geq$ 52 ng/L	23 (21%)	15 (65%)
$\Delta$ hs-cTnT $\geq$ 5 ng/L	22 (26%)	10 (46%)
Clinical concern	30 (27%)	2 (7%)

113 patients did not have a 2-hour troponin. This was made up of patients with an initial diagnostic troponin (n=23), as well as those with pain onset of more than 6 hours in who had a hs-cTnT <14 (n=90).

Four patients in the non-high risk group had revascularisation (1.2%). Two had recent AMIs prior to their index ED presentation, one of who was already scheduled for a staged LAD stent following a STEMI, one who was a direct referral to Cardiology (opportunistically enrolled to the study) and was thought to have progressive disease requiring stenting.

Of the remaining two, one received semi-elective coronary artery grafts within the 30-day period suffering a perioperative stroke followed by a NSTEMI during rehabilitation. The other had been a electively stented 1 month prior to index ED presentation and went on to have a delayed stent-related coronary artery dissection (29 days following consent for the study), requiring further stenting. By comparison, 23% of the high-risk group underwent revascularisation.

Both sensitivity and negative predictive value for the ADP was 100% (95%CI: 98.9–100% and 92–100% respectively). Specificity and positive predictive values were 83% and 39% respectively.

Overall average ED length of stay was 4 hours 5 minutes. There were 262 patients who presented within the study hours but who were not consented for follow-up. Most of these were either direct referral to the cardiology service, therefore not seen by ED medical staff, or referred from primary care with a known troponin result, and therefore unable to enter the study. Four patients declined consent and three who were initially consented were removed due to presence of exclusion criteria (<25 years old, dementia and previous enrolment within 30 days of index presentation). 148 of these 262 patients were discharged, with no evidence of any 30-day adverse event on review of patient records. Of those admitted there were 45 primary events (39%). None of these events were included in our study cohort.

## Discussion

This was a study of a locally developed ADP that rapidly identified a large group of ED chest pain patients as safe for discharge within in a mean ED LOS of 4 hours 5 minutes. To our knowledge this is the first prospective study that has safely discharged home 70% of all ED chest pain presentations. Unlike recently published ADP, we did not use a formal scoring tool such as TIMI or GRACE.<sup>29–34</sup> This enabled a greater proportion of patients to be classified as non-high risk for 30-day events, without affecting safety.

It is noteworthy that there were a higher proportion of patients with documented IHD in the non-high risk group than the high-risk group. This reinforces the idea that high TIMI or GRACE score does not necessarily translate to short-term risk.

We stratified the groups as high risk and non-high risk in an attempt to remove the uncertainty associated with “intermediate risk” patients, simplifying what has become a very complex decision process. Our ADP asks the simple question—“is this patient at high risk of a major adverse cardiac event in the next 30 days?” If not, patients were discharged home. This did not mean they didn’t have cardiac disease but simply that they were safe to have any further investigations organised by their primary care doctor as an outpatient.

Despite a recent call for a “requiem on unstable angina” there is an incidence of unstable coronary plaque/high grade occlusion with negative biomarkers.<sup>35</sup> We used senior clinician assessment/gestalt to provide an important “safety net” for the group of patients with unstable coronary artery disease and negative biomarkers/ECG. All patients felt to be high risk by this criteria were admitted, two (7%) of who ultimately had a diagnosis of NSTEMI.

Previous studies have typically used a triple composite endpoint of death, AMI and revascularisation. There is however a lack evidence showing benefit for revascularisation in stable coronary artery disease.<sup>13,16</sup> For this reason we specifically chose patient oriented rather than procedurally oriented outcomes.

We identified the following limitations:

- *Convenience sampling was due to the availability of ED SMO presence for clinical risk assessment.* Patients who presented outside of this period (n=97) were electronically followed-up. Using admission and discharge, as surrogates for high and non-high risk respectively, to the best of our knowledge none who was discharged had an adverse event.
- *Missed recruits.* This was due to a number of factors, but was predominantly made up of patients referred directly by general practitioners to the cardiology service rather than an Emergency Physician. There was higher rate of ACS in this group (17% vs 10% in our cohort), likely due to this referral bias. Discharged patients who were missed for recruitment had their electronic record for local and national events reviewed at 30-days. To the best of our knowledge the primary outcome rate for this group was zero. Although not studied, these patients were likely to have had a similar risk stratification process to the ADP, as use and interpretation of 0 and 2 hour troponins was standard practice in our ED at the time.
- *Validity.* The study was performed at a single secondary hospital, with a relatively small group of emergency physicians in a community with strong primary care follow-up. Our ADP requires external validation in other ED settings.
- *The optimum test characteristics of serial hs-cTnT are yet to be defined.* We used an algorithm based on what we believe to be the best available evidence on this topic. Further studies on hs-cTnT in clinical practice are likely to further refine risk stratification using this test.
- *Dependence of the ADP on the senior ED physician’s unstructured judgment.* This was designed as a safety net for the small number of patients with negative hs-cTnT and ECG but who may nonetheless be clinically very concerning. This was a critical safety feature and is a strength of this ADP.

## Conclusion

We have demonstrated that an Emergency Department Accelerated Diagnostic Protocol allows rapid and safe discharge of the majority (70%) of chest pain patients, with no significant adverse events at 30 days

This approach is likely to result in significantly shorter ED stays, lower costs, fewer admissions and subsequent risks of unnecessary workup for patients. Multi-centre prospective studies would further demonstrate the safety of this approach.

**Competing interests:** Nil.

**Author information:** Andrew R Munro, Emergency Physician, Emergency Department, Nelson Hospital, Nelson; Tom Morton, Emergency Physician Emergency Department, Nelson Hospital, Nelson; Tom Jerram, Emergency Physician Emergency Department, Nelson Hospital, Nelson; Suzanne Hamilton, Advanced Trainee for Emergency Medicine, Emergency Department, Nelson Hospital, Nelson

**Correspondence:** Dr Andrew Munro, Emergency Department, Nelson Hospital, Tipahi Street, Nelson 7010, New Zealand. [andrewmu@xtra.co.nz](mailto:andrewmu@xtra.co.nz)

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## ORIGINAL ARTICLE

## Projected costs of colorectal cancer treatment in New Zealand in the absence of population screening

Ian Sheerin, Terri Green, Diana Sarfati, Brian Cox

### Abstract

**Aim** To estimate volumes and costs of health services required for new cases of colorectal cancers in New Zealand from 2014 to 2026 in the absence of population screening.

**Method** Annual incidence of colorectal cancer, by stage, location and age was estimated for 2006-2026 based on NZ cancer registry data for 2001-2005. Treatment protocols were determined based on current best practice. An economics forecasting model was developed to estimate annual volumes and costs of health services to treat new cases of colorectal cancer expected to present each year from 2014 to 2026. Survival rates and other model parameters were drawn from the literature. Costs are presented at 2011 prices.

**Results** Annual health service costs of new colorectal cancer presentations in New Zealand are estimated to increase from approximately \$83.6 million in 2014 to \$100.2 million by 2026, if no systematic screening programme is introduced. The majority of these costs will be for surgery and colonoscopies.

**Conclusion** These results provide a baseline against which to compare the level of resources required if a population screening programme is introduced. Planning is necessary to manage costs and services for colorectal cancer, even without a systematic population screening programme.

New Zealand and Australia have the highest rates of colorectal cancer (CRC) incidence and mortality in the world.

International evidence shows that mortality rates from CRC can be reduced in the context of population-based screening, and screening programmes exist in many parts of the world.<sup>1-3</sup> A pilot CRC screening programme was established in New Zealand in 2011 to assess the practical implications, acceptability and cost-effectiveness of immunohistochemical faecal occult blood testing (FOBT) screening in New Zealand.

The decision whether or not to extend the programme nationally will be made after evaluation of the pilot. Part of the debate concerns capacity issues and whether there will be sufficient capacity to provide the necessary diagnostic, treatment and follow-up services without unacceptable delays both to those with positive screening tests, and to those requiring these services for non-screening diagnostic or surveillance purposes.<sup>3-5</sup> These capacity issues will impact on the feasibility of systematic population screening for CRC in New Zealand.

Diagnosis and treatment of CRC is currently taking place largely in the absence of screening, as cases present to the health services. This paper estimates and projects both volumes and costs of services for CRC, based on the current situation—i.e. without a population-based CRC screening programme. This provides a baseline against which to compare resource provision should a population screening programme be introduced.

### Method

Annual incidence of CRC in New Zealand was estimated by cancer stage, age, ethnicity and site for each year from 2006 to 2026. NZ Cancer Registry data were obtained for the years 2001–2005,<sup>6</sup> which was the most up to date information available at the commencement of this study. A simple linear progression was assumed for future age-specific rates of CRC (which are generally declining) combined with population projections of New Zealand that assume medium migration to obtain projected annual numbers of cases of CRC.

Because CRC incidence increases considerably with increasing age, separate age-banded regression models were fitted for men and women for incident cases by year, assuming a linear path from 2006 to 2026, projecting

from the numbers of incident cases per year from 2001–2005. Stage distributions for CRC were assumed to follow the same pattern as that recorded by the Cancer Registry 2001–2005. Assumptions include declining CRC incidence for non-Māori.

Because recommended treatments are influenced by both location and stage, two anatomical locations were modelled separately: colon including the rectosigmoid junction, and rectum. Levels of spread in this model were: localised, regional by direct invasion, regional to lymph nodes, distant, or not known.

In order to model the increasing CRC incidence in Māori, estimates for Māori were calculated by applying relative risk (RR) for Māori compared with non-Māori of 0.4 in 2006, increasing by a linear rate of 0.04 per year to a maximum of 1.2 by 2026.<sup>7</sup> This gives an estimated RR for Māori of 0.72 for 2014. More recent data indicates that this may be a low estimate of RR for Māori, but the impact of this is considered to be minimal on the overall estimated costs of CRC for the whole New Zealand population for the period covered by this study. We assume that the recent increase seen in RR for Māori will slow or stop, thus the assumption that RR will not increase beyond 1.2.

An economics forecasting model was developed from these projections of CRC annual incidence. The economics model estimated annual volumes and health service costs of services required to investigate, treat and follow-up cases of CRC from 2010 to 2026, by stage and location. The model aimed to capture “current best practice” i.e. that all suspected cases of CRC would be investigated, treated and followed up in accordance with current practice used in a recognised tertiary centre, in New Zealand.

Key informants from Canterbury District Health Board and from University of Otago were interviewed to obtain advice on current diagnostic, treatment and follow-up services and protocols by cancer site and stage. Detailed advice on aspects of CRC care was also obtained from key informants in Auckland to include wider representation of tertiary centre practice in New Zealand. Costs were estimated in NZ 2010/11 dollar values.

Detailed assumptions for the economics model are summarised in Tables 1 and 2. Model parameters were based on published New Zealand research, augmented by information from the key informants. Where possible, separate parameters were used for colon and rectal cancer, and for the different cancer stages. Some studies reported only combined results and therefore the same parameter had to be used for both colon and rectal cancer, and in some cases for several cancer stages. Proportions of surgical patients with complications were taken from data relating to colon cancers.<sup>8</sup> For rectal cancer patients, it was assumed that proportions with complications following surgery would be similar, as reported by Robinson et al<sup>9</sup> for a Christchurch series, which included rectal cancers.

Parameter values were assumed for patient flow rates for diagnostic, treatment and follow-up procedures, using the percentages receiving services summarised in Tables 1 and 2. This included an initial diagnostic colonoscopy, surgery, radiotherapy, chemotherapy, outpatient and colonoscopy follow-up. Values for complications, cancer recurrence and survival rates were also sourced. It was assumed that diagnostic and treatment services for the first presentation would take place within 12 months. Colonoscopy follow-up was at 3 years, then every 5 years thereafter up to age 74. Full compliance was assumed. The model was amended and run again with colonoscopy follow-up until death.

Proportions presenting to hospital emergency departments and the timing of health services were as advised by Frizelle (personal communication, 2010). Percent of CRC patients presenting to emergency departments were assumed to be 12%, 30%, 33% and 33% for cancer stages 1, 2, 3 and 4 respectively. Services for patients presenting as emergencies were slightly different. For patients unable to receive a colonoscopy at the time of emergency presentation, the model assumed that they would receive one within 12 months.

Recurrence rates for those with stage 2 (invasive) cancers were taken from studies by Simpson et al<sup>10</sup> and for Stage 3 (regional) from Gibbs et al.<sup>11</sup> Recurrence was defined as tumours or metastatic disease detected at follow-up. The model assumed there was no relapse for patients with stage 1 cancer.

Estimates of survival were obtained by taking age, sex and ethnic specific all-cause mortality rates from the NZ life tables,<sup>12</sup> then adjusting for cancer-specific mortality, using the assumptions in Tables 1 and 2.

Survival by stage was taken from Keating et al<sup>13</sup> and Figueredo et al<sup>14</sup> who documented similar survival for Stage 2 patients in a systematic review. It was assumed that all patients with stage 4 (palliative) would die within 12 months.<sup>13</sup>

**Table 1. Model parameter values – colon cancer [services received and survival rates]**

Variables	Cancer Stage				References
	1	2	3	4	
Receive surgery (%)	90 <sup>(i)</sup>	97 <sup>(ii)</sup>	95 <sup>(ii)</sup>	17 <sup>(iii)</sup>	15,10
Complications (%)	0	23	23	N/A <sup>(iv)</sup>	8,9
Re-operation (% of those with complications)	0	6.4	6.4	N/A <sup>(iv)</sup>	
Chemotherapy (% overall)	0	Stage 2b only <sup>(v)</sup>		43	11,13
Chemotherapy by age (%)		Stage 2b only			
25–54	0	98	98	29	15
55–64	0	87	87	66	
65–74	0	72	72	56	
75+ years	0	30	30	35	
Stoma (%)	5 <sup>(vi)</sup>	5 <sup>(vi)</sup>	5 <sup>(vi)</sup>	20 <sup>(vii)</sup>	Frizelle (pers. comm, 2010) Bissett (pers. comm, 2010)
Colonoscopy follow-up	100 <sup>(viii)</sup>	100 <sup>(viii)</sup>	100 <sup>(viii)</sup>	N/A	McFarlane (pers. comm, 2008)
Nurse Outpatient follow-up	100 <sup>(ix)</sup>	100 <sup>(ix)</sup>	100 <sup>(ix)</sup>	To palliative <sup>(x)</sup>	McFarlane (pers. comm, 2008)
5-year survival cancer-specific (%)	100	92	65	0 <sup>(xi)</sup>	13
Recurrence (% of those who had surgery)	10 [<15months]	20 [71% <2 years; 19% in year 3]	31 <sup>(xii)</sup> [<1 year]	N/A	16  10,15,17
Referral further surgery (% of those who relapse)	100	100 <sup>(xii)</sup>	17		11
Uptake (%)	100	72	72		15

**Notes:**

- i) The other 10% of cancers are removed at colonoscopy (Bissett, personal communication, 2010).
- ii) A small percentage do not receive surgery due to comorbidities.
- iii) This is palliative surgery.
- iv) We assume no further surgery. Patients receive palliative non-surgical care.
- v) The other 79% have stage 2a cancer and do not receive chemotherapy.
- vi) These are temporary, with a reversal after 2 years.
- vii) These are permanent stomas.
- viii) Colonoscopy after 3 years, then every 5 years until age 74.
- ix) Patients are seen at 3 months then every 6 months for the first 2 years post-surgery, then yearly until 5 years when referred back to the GP.
- x) 66% receive palliative care, 33% receive hospice care, and 100% receive GP care for pain relief (Robinson B, Personal Communication, 2008). It is assumed that all die within 1 year.
- xi) It is assumed that all die within 1 year.
- xii) 21% are referred for curative surgery (with 5 year survival of 30%); the other 79% go to palliative care.
- xiii) We assume relapse to metastatic disease.

**Table 2. Model parameter values – rectal cancer [services received and survival rates]**

Variables	Cancer Stage				References
	1	2	3	4	
Radiotherapy (%)	0	95 <sup>(i)</sup>	95 <sup>(i)</sup>	0	Frizelle (pers. comm, 2010)
Receive surgery (%)	90 <sup>(ii)</sup>	97 <sup>(iii)</sup>	95 <sup>(iii)</sup>	17 <sup>(iv)</sup>	15,10, Frizelle pers. comm, 2010) Bissett (pers. comm, 2010)
Complications (%)	0	23	23	N/A <sup>(v)</sup>	9
Re-operation (% of those with complications)		6.4	6.4	N/A <sup>(v)</sup>	8
Chemo-radiotherapy (% overall)	0	21 Stage 2b only <sup>(vi)</sup>	75	43 <sup>(vii)</sup>	11,13
Chemo-radiotherapy by age (%)		Stage 2b only		<sup>(vii)</sup>	
25–54	0	98	98	95	13,15 Frizelle (pers. comm, 2010)
55–64	0	95	95	95	
65–74	0	95	95	95	
75+ years	0	30	30	35	
Stoma (%)					
Temporary	60 <sup>(viii)</sup>	60 <sup>(viii)</sup>	60 <sup>(viii)</sup>	75	Frizelle (pers. comm, 2010) Bissett (pers. comm, 2010)
Permanent	30	30	30	25	
Colonoscopy follow-up	100 <sup>(ix)</sup>	100 <sup>(ix)</sup>	100 <sup>(ix)</sup>	N/A	McFarlane (pers.comm,2008)
Outpatient Nurse follow-up	100 <sup>(x)</sup>	100 <sup>(x)</sup>	100 <sup>(x)</sup>	To palliative <sup>(xi)</sup>	McFarlane (pers.comm,2008)
5-year survival Cancer-specific (%)	100	92	65	0 <sup>(xii)</sup>	13
Recurrence (% of those who had surgery)	10 < 15 months	20 [71% < 2 years; 19% in year 3]	31 <sup>(xiv)</sup> <3 years	N/A	10 15
Referral further surgery (% of those who relapse)	100	100 <sup>(xiii)</sup>	17%		
Uptake (%)	100	100	100		

**Notes:**

- i) This is normally done prior to surgery.
- ii) The other 10% of cancers are removed at colonoscopy (Bissett, personal communication, 2010)
- iii) A small percentage do not receive surgery due to co-morbidities
- iv) This is palliative surgery.
- v) We assume no further surgery. Patients receive palliative non-surgical care.
- vi) The other 79% have stage 2a cancer and do not receive chemotherapy
- vii) For distant rectal cancers, it was assumed patients would receive chemotherapy only (no radiotherapy).
- viii) A stoma reversal is assumed after 2 years for these patients, but not for patients with stage 4 cancer
- ix) Colonoscopy after 3 years, then every 5 years until age 74
- x) Patients are seen at 3 months then every 6 months for the first 2 years post-surgery, then yearly until 5 years when referred back to the GP
- xi) 66% receive palliative care, 33% receive hospice care, and 100% receive GP care for pain relief (Robinson B, personal communication,2010) It is assumed that all die within 1 year.
- xii) It is assumed all die within 12 months.
- xiii) 21% are referred for curative surgery (with 5 year survival of 30%); the other 79% go to palliative care.
- xiv) We assume relapse to metastatic disease

Estimates of costs of colonoscopies, hospital admissions, surgical, and chemo-radio services were based on New Zealand cost weights (WEISNZ11, Costweight schedule AR-DRGv6.0) for appropriate diagnostic-related groups (DRGs).

DRGs were developed by researchers in other countries<sup>18</sup> to provide broad estimates of costs of hospital procedures, and specific costing systems have been developed for New Zealand, based originally on the Victoria, Australia costweight system. An additional hospital cost for each ED presentation was included, which was estimated as an average cost using DRG G65B because suspected gastro-intestinal obstruction is a common reason for an ED presentation. Ambulance costs for emergency presentations were not included.

Costs of palliative care, stoma nursing and community follow-up were estimated from information supplied by Nurse Maude District Nursing Association (personal communication, 2011). Calculated costs of domiciliary follow-up included allowance for cancer stage, age, ethnicity, gender and expected survival as estimated from Keating et al<sup>13</sup> and New Zealand Life Tables.<sup>12</sup>

Costs of stomas includes procedures for both insertion and removal of temporary stomas, as well as allowance for stoma nursing, which was estimated as an average cost per patient, adjusted for age, cancer stage and survival. Percentages of patients receiving stomas were as estimated by Bisset (personal communication, 2010) and by Frizelle (personal communication, 2010).

The economics forecasting model assumed a “cost of health services” perspective, so it excluded non-health services costs to patients and families such as lost earnings from time off work, travel costs, or cost of help with household tasks. The model does include costs for home care funded by District Health Boards, and it also includes patient fees and government subsidy costs of GP visits for palliative patients.

Patient out-of-pocket costs of GP co-payments assumed an average consultation fee of \$40 (in 2011\$NZ) which was estimated from a sample of general practices in Canterbury. Capitation payments were those paid by the government in 2011 for people aged 65 and over. The model excludes any patient out of pocket costs that may have been paid for GP consultations or medication *prior* to presentation to secondary care.

Our estimates include those who may be treated in private hospitals, assuming that all private sector patients with cancer are reported in the NZ Cancer Registry. Their diagnosis and treatment has been costed ‘as if’ they had been treated in the public sector.

The economics model estimated costs of services from the volumes and mix of services required to diagnose, treat and manage cases of CRC in different stages. Volumes of required services were multiplied by costs, then summed in order to estimate total annual CRC costs. Costs for each year are presented as 2011 prices, and were not discounted. This captures the growth in resource provision required over time. Cost comparisons were made between 2026 and 2014. The model was run for new cases of cancer from 2005 to 2026. This allowed for a running in period, to include follow-up services building up from earlier cases.

## Results

Patients presenting to health services in New Zealand with diagnosed colorectal cancer (CRC) are estimated to increase from 3,060 in 2014 to 3,851 by 2026, an increase of 25.8% (Table 3). Figure 1 illustrates the expected increase in cases of CRC from 2006 to 2026, showing that most of the increase was likely to be from colon cancers (rather than rectal cancers). This projected increase in total volumes incorporated allowance for the declining incidence of CRC in some younger age groups.

Table 3 also shows the estimated demands for diagnostic, treatment and follow-up services for CRC to meet current best practice. The demand for colonoscopies (for both incident cases and follow-ups) was estimated to increase from 5,668 per annum in 2014 to 6,886 in 2026 – an increase of 21%. The model predicted that the largest component of demand for colonoscopies would be for follow-up

investigations, assuming the recommended colonoscopy follow-up period of three years after initial presentation, then every 5 years thereafter, up to age 74. As the model input was limited to cases from 2005 onwards, these colonoscopy totals do not capture all colonoscopy follow-up from earlier cases. The underestimate was greater for 2014, compared to 2026.

The demand for surgery for CRC was estimated to increase from 2,658 cases in 2014 to 3314 cases in 2026, including both incident cases and estimated recurrences (Table 3). This is an estimated increase in surgical volumes of 25% from 2014 to 2026.

The demand for chemotherapy is expected to grow at a slower rate—i.e., an increase from 1287 cases in 2014 to 1322 in 2026. The demand for chemotherapy was driven by the incidence of Stage 2b and Stage 3 cancers, as most of these patients receive chemotherapy. However, uptake was inversely proportional to age, with approximately 30% of people aged 75 years and over receiving chemotherapy, compared with 98% of 25 to 54 year-olds.<sup>8</sup>

The demand for domiciliary follow-up was forecast to grow from 3,056 cases in 2014 to 3,812 in 2026, an increase of 25%. Although Table 3 shows lower volumes of patients needing stomas and palliative care, these services entail considerable costs. Table 3 shows the estimated number of people with CRC who were expected to present to hospital emergency departments (EDs). These may be a small part of the overall workload for EDs, but EDs have to provide appropriate referral and diagnostic services for such patients.

**Table 3. Projected annual incident cases of colorectal cancer and services required in New Zealand annually 2010–2026, to meet current best practice**

Cases of colorectal cancer*		2010	2014	2017	2020	2026
	N	2851	3060	3242	3415	3851
Colonoscopies, including follow-up	N	4903	5668	5950	6446	6886
Expected ED presentations**	N	766	823	873	917	1035
Patients requiring surgery	N	2473	2658	2825	2976	3314
Cases requiring chemotherapy***	N	1223	1287	1337	1364	1322
Patients requiring palliative care	N	887	946	1000	1044	1027
Patients requiring stomas	N	941	1005	1059	1103	1228
Cases on domiciliary follow-up	N	2835	3056	3224	3389	3812

**Notes:** \*Derived from Ministry of Health forecasts and includes colon and rectal cancers; \*\*ED presentations are also included in the total cases of CRC in the first line of this table; \*\*\* Includes chemo-radiotherapy.

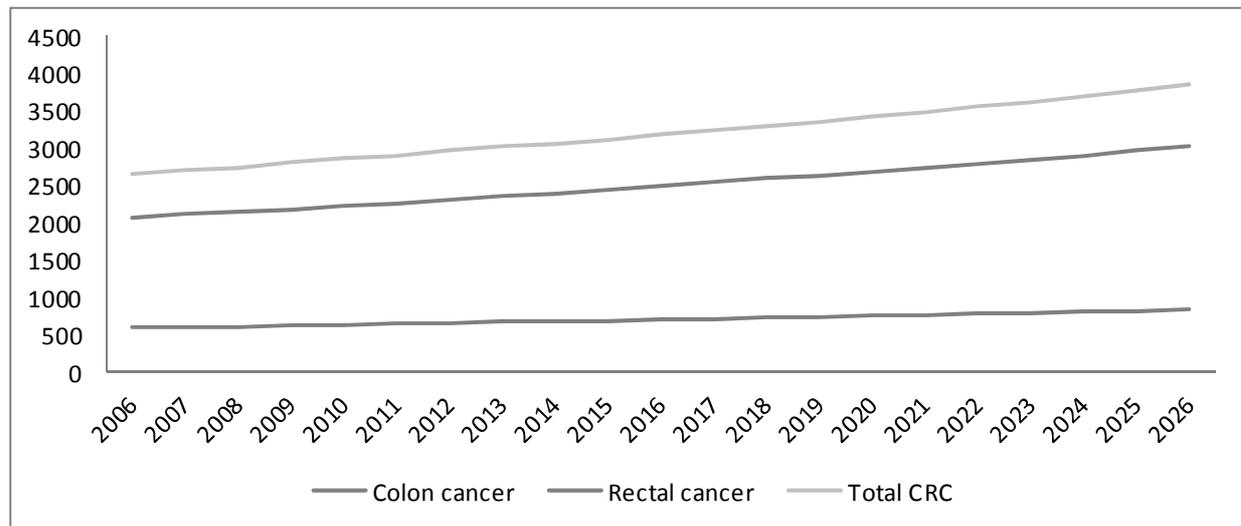
**Figure 1. Projected annual incident cases of colon, rectal and all CRC from 2006–2026**

Table 4 shows forecasted annual costs of health services for patients presenting with CRC in New Zealand. From 2014 to 2026, total health service costs of CRC services to meet current best practice were estimated to increase from \$ 83.6 million to approximately \$100.2 million.

The largest component was the cost of surgery, followed by the cost of colonoscopies. From 2014 to 2026 surgical costs were expected to increase from \$ 41.3 million to approximately \$51.3 million (a 24% increase). Annual costs of colonoscopies were projected to increase from \$21 million to \$25.6 million over that same period (a 21.5% increase).

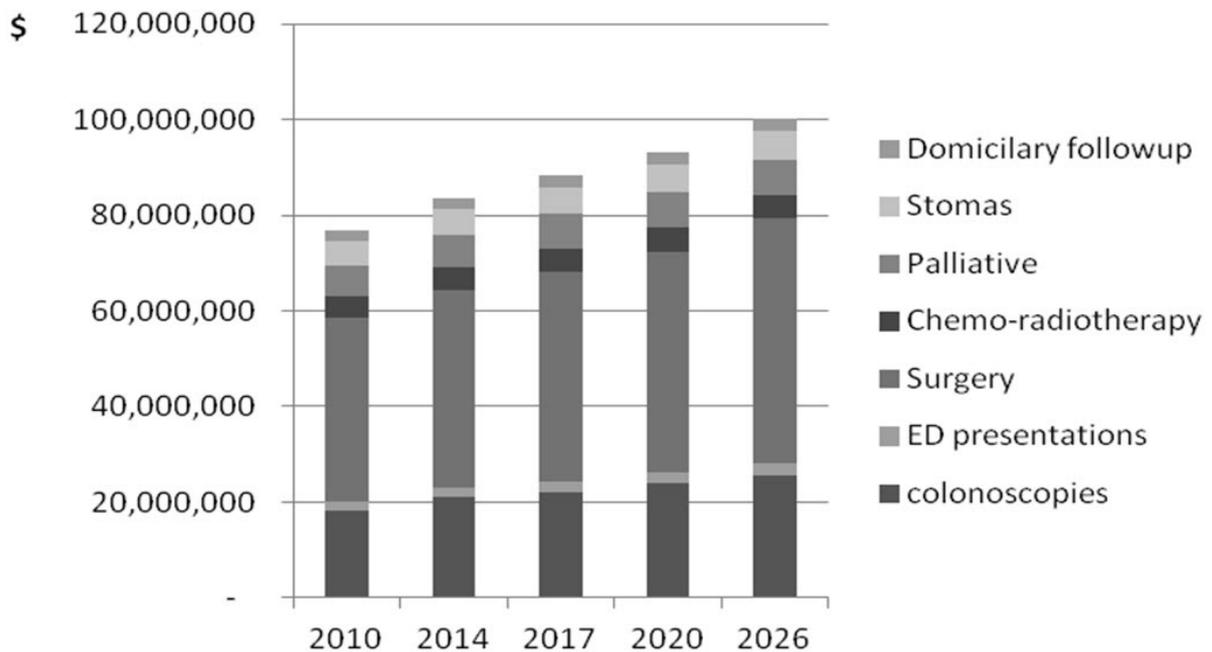
**Table 4. Projected annual costs of health services required to treat colorectal cancer in NZ according to current best practice (2011 \$NZ)**

Variables	2010	2014	2017	2020	2026
Colonoscopies	18,226,407	21,069,148	22,116,838	23,961,338	25,597,661
ED presentations**	1,864,095	2,003,010	2,125,345	2,232,488	2,519,154
Surgery	38,440,500	41,333,952	43,861,995	46,200,627	51,304,380
Chemotherapy***	4,576,099	4,805,831	4,984,247	5,065,961	4,769,876
Palliative care	6,313,812	6,741,716	7,126,093	7,439,707	7,315,110
Stomas	5,030,102	5,305,866	5,550,914	5,725,424	6,265,721
Domiciliary follow-up	2,256,561	2,377,344	2,608,808	2,597,327	2,467,047
<b>Total costs of Colorectal Cancer****</b>	<b>76,707,576</b>	<b>83,636,866</b>	<b>88,374,241</b>	<b>93,222,873</b>	<b>100,238,950</b>

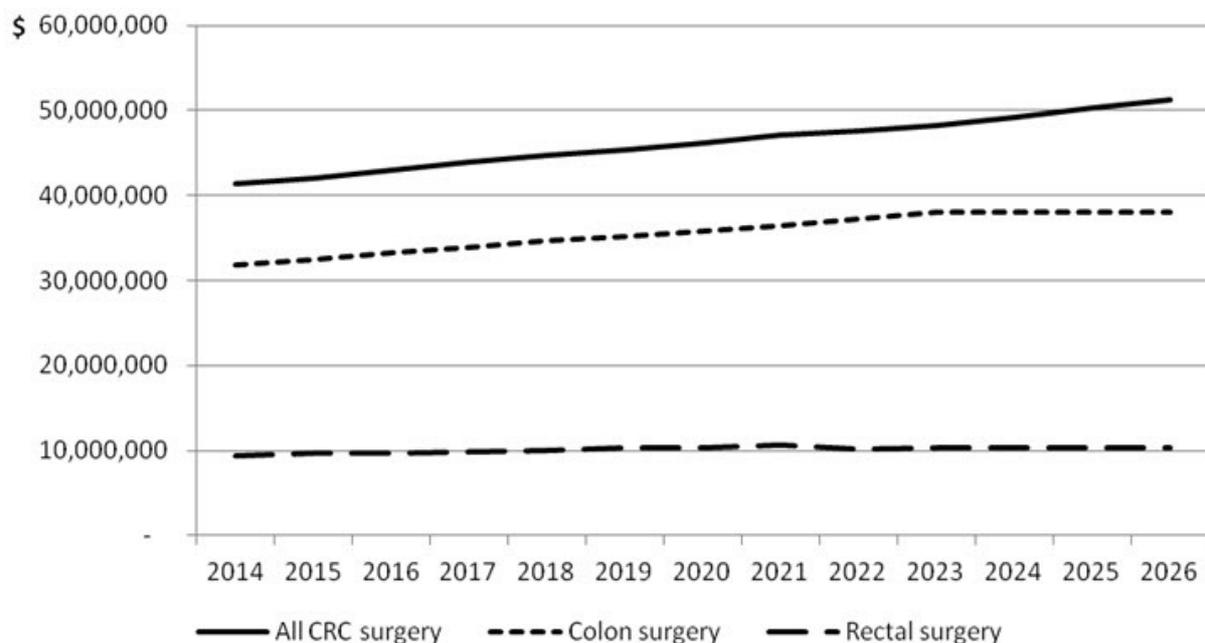
Notes: \*Derived from Ministry of Health forecasts and includes colon and rectal cancers; \*\* This is the cost of observation for gastrointestinal obstruction, based on DRG 65B, and is an additional cost for ED presentations, which were estimated using proportions presenting to EDs as advised by Frizelle (personal communication, 2010); \*\*\* Includes chemo-therapy and adjuvant radiotherapy; \*\*\*\* Costs of health services costs only – excludes lost income and other costs to patients and families

Figure 2 illustrates the relative sizes of the costs of specific CRC services from 2014 to 2026. In particular, it shows that the largest share of costs is likely to be for surgical services (approximately 50% of all CRC costs). The second largest health service cost was for colonoscopies, approximately 25% of total costs. The next largest source of costs was palliative care (8%), closely followed by stomas (6.3% in 2014).

Although chemotherapy and radiotherapy are currently important components of CRC treatment, they comprised only a small portion of costs of health services for CRC (5.7% in 2014).

**Figure 2. Annual costs of colorectal cancer services required 2010–2026**

The model suggested that colon rather than rectal cancer will drive the increasing costs of surgery for CRC in New Zealand (Figure 3) and comprise 77% and 74% of estimated surgical costs in 2014 and 2026, respectively.

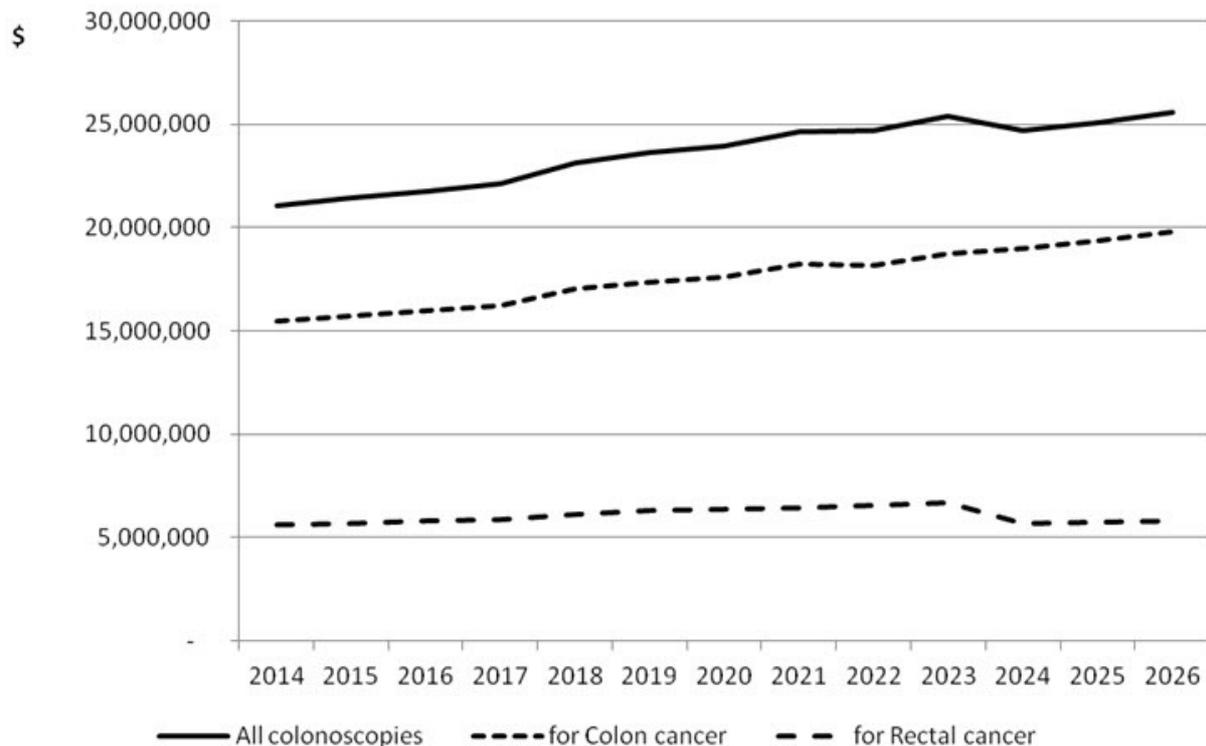
**Figure 3. Projected costs of surgery for colon and rectal cancer 2014–2026**

Similarly colonoscopy costs for colon cancer comprised approximately 73% of colonoscopy costs in 2014 and 77% in 2026. Increases in health service costs of colonoscopy (Figure 4) were mainly for follow-up investigations. These figures were based on current practice which is for 5-year colonoscopy follow-up until age 74 years. However, with many people living longer and healthier lives and the complication rate of the procedure in decline, we included an analysis to estimate the extra services and costs that could be required if colonoscopy follow-up was extended beyond age 74 years.

Table 5 shows that by 2020, volumes and costs of colonoscopy services would be approximately 20% greater if follow-up protocols were to be extended to life-long follow-up. By 2026 the total costs with life-long follow-up were estimated to be \$32.1 million compared with a cost of \$25.6 million if follow-up ceased at 75 years of age (Table 5).

The model did not capture follow-up in cases diagnosed prior to 2005, with the shortfall being greater for 2014 compared to 2026. These shortfalls would be higher for the life-long colonoscopy follow-up scenario, compared to the 'colonoscopy until age 75' scenario.

**Figure 4. Projected costs of colonoscopies for colon and rectal cancer in NZ: 2014–2026**



**Table 5. Estimated numbers and costs of colonoscopies required with current follow-up protocols, compared with life-long colonoscopy follow-up**

Variables		2014	2017	2020	2026
Colonoscopies (Follow-up to age 74)	N	5668	5950	6446	6886
Colonoscopies (If Life-long follow-up)	N	6375	6678	7713	8637
Cost (Follow-up to age 74)	\$	21,069,148	22,116,838	23,961,338	25,597,661
Cost (If life-long follow-up)	\$	23,697,718	24,826,408	28,671,118	32,107,850

## Discussion

This project has estimated volumes and costs of health services for CRC from 2014 to 2026, assuming as far as was possible, current best practice diagnostic and treatment services for CRC, but without systematic CRC screening. The total annual costs of health services for CRC in New Zealand were estimated to increase from approximately \$83.6 million in 2014 to \$100.2 million by 2026 (at 2010/11 prices). In 2014, an estimated 50% of these costs were for surgery, with another 25% of annual costs attributed to colonoscopies for both new and follow-up cases.

The majority of these services would be for cancers located in the colon (including recto-sigmoid junction). Colonoscopy services were estimated to require an increasing investment as demand for colonoscopies was estimated to increase by 21% by 2026. A large driver was the demand for follow-up colonoscopies, with current protocols indicating routine follow-up at three years following the first presentation, then every 5 years thereafter. Our estimates of the growth required may be conservative, first because the estimates were based as far as possible on current best practice, which not all centres are currently offering. Thus the increase from *actual provision* in 2014 to that required in 2026 may be higher than we estimated. Second, higher risk patients may receive more intensive follow-up.<sup>19</sup>

In Table 5, we presented the results with the life-long colonoscopy follow-up scenario which showed that both volumes of colonoscopies and their costs would be considerably greater than under current protocols. It must be acknowledged however that although many people are healthy enough to receive follow-up beyond 75 years of age and may benefit from it, full compliance would be unlikely to be achieved, therefore the health service costs and volumes required may not be as high as estimated.

The model did not capture all follow-up colonoscopy, and the shortfall was greater for 2014 than for 2026. For the base scenario (current protocols) the 2026 estimate did capture all follow-up for cases diagnosed at age 65 or over, which are the majority, thus the 2026 figures are probably reasonable targets. The 2014 estimates are underestimated more (they are low estimates of what should be provided) but this may mean they are nearer to current actual provision.

The impact of the model shortfall in estimating colonoscopy requirements for the life-long colonoscopy follow-up scenario is greater than for the base scenario but possible lower compliance with age may offset this to some extent.

It must be noted that there will be additional demand for CRC services from people who present with possible CRC symptoms, but who are found not to have CRC. Our estimates are only for those who have cancer, based on projections from the NZ Cancer Register 2001-05. Costs of false positives would be additional to our estimates which should be regarded as conservative.

The estimated costs were only for health services. They did not include other costs that may be incurred by patients and their families, e.g. travel. Ambulance costs were also not included.

The estimates were based as far as possible on 'current best practice' consistent with what would be provided in a tertiary centre in 2011/12. We have not attempted to estimate the growth in services and costs which might be required due to possible local variations from this practice in smaller centres. Furthermore, we were unable to account for possible changes in routine practice over time. However, it is expected that there may be reductions in variation in practice and a higher proportion of "best practice" occurring throughout by 2026 due to national initiatives such as the bowel cancer tumour standards work.<sup>20</sup>

All surgery, colonoscopy, radiotherapy and chemotherapy were costed 'as if' it had been provided in the public sector. In practice some will be provided in the private sector. But total provision will need to expand to meet the demand. The future burden on the public health sector will depend on growth in the private sector.

The ageing population will continue to cause an increasing cancer burden and Figure 1 predicts that an increasing number of CRC patients will present to health services by 2026. CRC largely affects people aged 65 and over.<sup>6</sup> This trend of increasing presentations associated with an ageing population, despite a falling incidence rate was also noted in Ministry of Health cancer projections.<sup>6</sup>

It is noted that there is some indication that CRC risk in NZ may reduce after approximately 2020, including in older age groups.<sup>21</sup> The results in this study present volumes of services and costs forecast using current CRC projection methods used by the Ministry of Health which incorporate estimates of declining CRC incidence over time. It is possible that alternative methods of estimating future CRC incidence would result in different projections of costs and volumes of services required.

The lengthy debate over CRC screening in New Zealand has included whether the country can resource the diagnostic and treatment services necessary for it to be effective. Recent estimates of colonoscopy requirements have been produced by some members of our team.<sup>20</sup> The research presented here illustrates the relative importance, particularly of both surgical and colonoscopy services, indicating that forward planning, investment and training is required. These services will be in heavy demand even if CRC screening is not introduced. For example, Yeoman and Parry<sup>23</sup> reported large numbers of people waiting for more than six months for a colonoscopy in New Zealand.

This research was part of a larger HRC-funded project which is developing a micro-simulation model for CRC in New Zealand, which could be potentially valuable for evaluating possible screening options, such as differing age eligibility criteria. The economics model presented here could be used to assess the costs and resource requirements of such screening options, comparing them with projections based on no screening. Total costs of each option would be estimated over a specified time horizon by summing the discounted annual costs. Each annual cost would need to be discounted to take account of the differential timings.

The results presented here are limited by the lack of published research to source parameter values for the modelling. These sources were supplemented by unpublished data, but disaggregated values were not available for all cancer categories. Thus in some cases the same parameter values were used for more than one cancer stage, and for both sites. The model can be refined as further information becomes available.

Although the aim was to model current best practice, some of the parameters were sourced from national data which would have included local variations.

It was not possible to incorporate potential technological changes, particularly with diagnostic investigations, such as CT colonography, which if introduced widely, could change the mix of services and costs. This research aimed to model "current best practice" in 2010/11—e.g. that all patients with CRC will receive colonoscopies for initial investigations and routine follow-up. If diagnostic, treatment and follow-up protocols were to change at some point, our cost projections would need to be amended accordingly, as a result of different unit costs and levels of service.

Similarly new technologies and protocols could lead to improved survival and this may impact on total costs.

In addition, we have used estimates of average costs of health services (colonoscopies, surgical and chemo or radiotherapy), based on DRGs. These provide a broad estimate of costs in New Zealand, which may not reflect local variations. We have not attempted to model possible variations in costs that may be associated with general surgeons versus specialist colorectal surgeons. Also, costs of palliative care and domiciliary follow-up were estimated from protocols used in Canterbury, New Zealand, which may differ from those used in other centres.

The results are subject to the accuracy of population projections. CRC incidence is highest in older age groups, for example in 2006, the Cancer Register reports age specific rates of registrations for colon cancer per 100,000 of 22.4 for all registrations aged 50-55 years, compared with 251.9 for all those aged 70-74 years.<sup>24</sup> By 2026, the 65 and over population is estimated to comprise 19.9% of the total population, up from 13.5% in 2011.<sup>25</sup> This will be an increase from an estimated 580,600 people aged 65 and over in 2011, to 941,400 in 2026 (a 62% increase in numbers).

We have restricted our estimated costs to the period to 2026, and have not undertaken sensitivity analyses on alternative population projections, because Statistics NZ state that projections of the 65+ population can be made with confidence, as such projections are largely not affected by migration or fertility.<sup>26</sup> Clearly, this large projected increase in the older population will have a considerable impact on projections of new CRC cases.

Our estimates are based on CRC incidence projected from cancer registrations on the Cancer Register from 2001-2005 which was the most up-to-date information available at the commencement of this study. There was a reasonable degree of stability of these registrations in this time period. For males, the annual age standardised rate (ASR) per 100,000 ranged from 50.8 to 56.2 (median 55.2), while that for females ranged from 42.5 to 45.0 (median 44.1).<sup>27</sup> We have not undertaken sensitivity analysis of the effects of varying these annual rates, because they appear to vary over a limited range. The overall trend is for a gradual decline in annual incidence rates, but an increase in numbers of CRC registrations, because of population ageing.<sup>27</sup>

If a systematic national CRC screening programme was fully implemented throughout New Zealand, it can be expected that more cancers will be detected at an earlier stage, so that over time, there will be a stage shift with a relatively lower proportion of cancers in advanced stages.<sup>28,29</sup> However, initially screening can be expected to greatly increase health services costs both from CRC detected and other diseases and conditions discovered.

Even without a systematic screening programme, CRC in New Zealand puts major demands on health services and involves substantial costs. Demand for colonoscopy services is a particular concern. Population screening for CRC offers the potential for health gains, but will also require considerable investment which should be carefully planned so that high quality services can be organised with trained staff. There is a risk that shortfalls in diagnostic or surgical services could present significant barriers to the implementation of screening services.

Planning for the demand for CRC services could help to avert such barriers and to schedule necessary health investments in a co-ordinated manner.

**Competing interests:** Nil.

**Author information:** Ian Sheerin, Health Economist and Senior Lecturer, Department of Population Health, University of Otago, Christchurch; Terri Green, Health Economist, University of Canterbury; Diana Sarfati, Epidemiologist, Department of Public Health, University of Otago, Wellington; Brian Cox, Epidemiologist, Hugh Adam Cancer Epidemiology Unit, Department of Preventive and Social Medicine, University of Otago, Dunedin

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**Correspondence:** Dr Ian Sheerin, Department of Population Health, University of Otago, Christchurch, PO Box 4345, Christchurch, New Zealand. [ian.sheerin@otago.ac.nz](mailto:ian.sheerin@otago.ac.nz)

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## VIEWPOINT

## Consensus pathways: evidence into practice

Graham McGeoch, Ian Anderson, Juanita Gibson, Carolyn Gullery, David Kerr, Brett Shand

### Abstract

HealthPathways is a website that provides general practice teams with guidance on clinical assessment and management of medical conditions, relevant to local services and resources. The website evolved in 2008 as part of changes towards an integrated healthcare system in the Canterbury region of New Zealand. The website differs from other clinical guidance websites as the clinical pathways are formulated by local healthcare professionals, health managers, and technical writers. This process is facilitated by a proactive group called the Canterbury Initiative. The website now contains over 570 clinical pathways, with access increasing seven-fold since 2009 (visits/mth; 1053 in 2009 vs. 7729 in 2014).

HealthPathways has contributed to the delivery of more care in the community (e.g. primary care spirometry; 1443 measurements in 2014 representing one-quarter of the total number). Introduction of the website has been associated with an improvement in referral quality, more equitable referral triage, and more transparent management of demand for secondary care.

Because the website provides relevant localised clinical information required during a patient consultation in an easy-to-use standardised format, it has overcome many of the barriers encountered by other online clinical guidance systems. The website has also acted as a change management tool by disseminating information required for successful integration of health services.

### The evolution of HealthPathways

Major changes in healthcare delivery began in Canterbury around 2007.<sup>1</sup> HealthPathways<sup>2</sup> evolved as a consequence of a move towards an integrated healthcare system and acted as a platform to disseminate the key principles required to achieve this objective. These principles included developing primary and community services that supported people to take greater responsibility for their health and ensured patients were treated by the correct person, thereby reducing demand on secondary and specialist resources. To implement these changes partnerships were formed across the full spectrum of healthcare similar to the Health Network approach of Briggs et al.<sup>3</sup>

The interface between general practices and hospital services was recognised as a major area requiring redesign and key to the development of an integrated health system. This led to local general practitioners and hospital clinicians taking part in meetings to discuss possible improvements. With the assistance of senior health system managers, funders, and a facilitator, a plan was prepared that proposed changes in pre-referral and post-referral patient management. Following acceptance and implementation of the plan, this project became known as the Canterbury Initiative.<sup>4</sup>

Work groups in specific medical areas all identified that general practice teams did not have easy access to referral criteria and had poor awareness of available community services. General practitioners consistently stated that best practice advice would encourage optimal management prior to referral and that agreed access criteria and waiting times needed to be defined and collated into a single repository. Hospital clinicians were also often poorly informed about available skills and capacity in general practice and the community.

Using a Canterbury District Health Board (DHB) Innovation Grant, a clinical pathway for management of chronic obstructive pulmonary disease was drafted. To disseminate the information, a website containing the clinical pathway was constructed by a local technical writing company, Streamliners Ltd. The e-web content was structured so that information would be easy to access

during a patient consultation. Following the development of 10 other clinical pathways, using a standardised format, the website went live in October 2008 under the name, HealthPathways.<sup>2</sup>

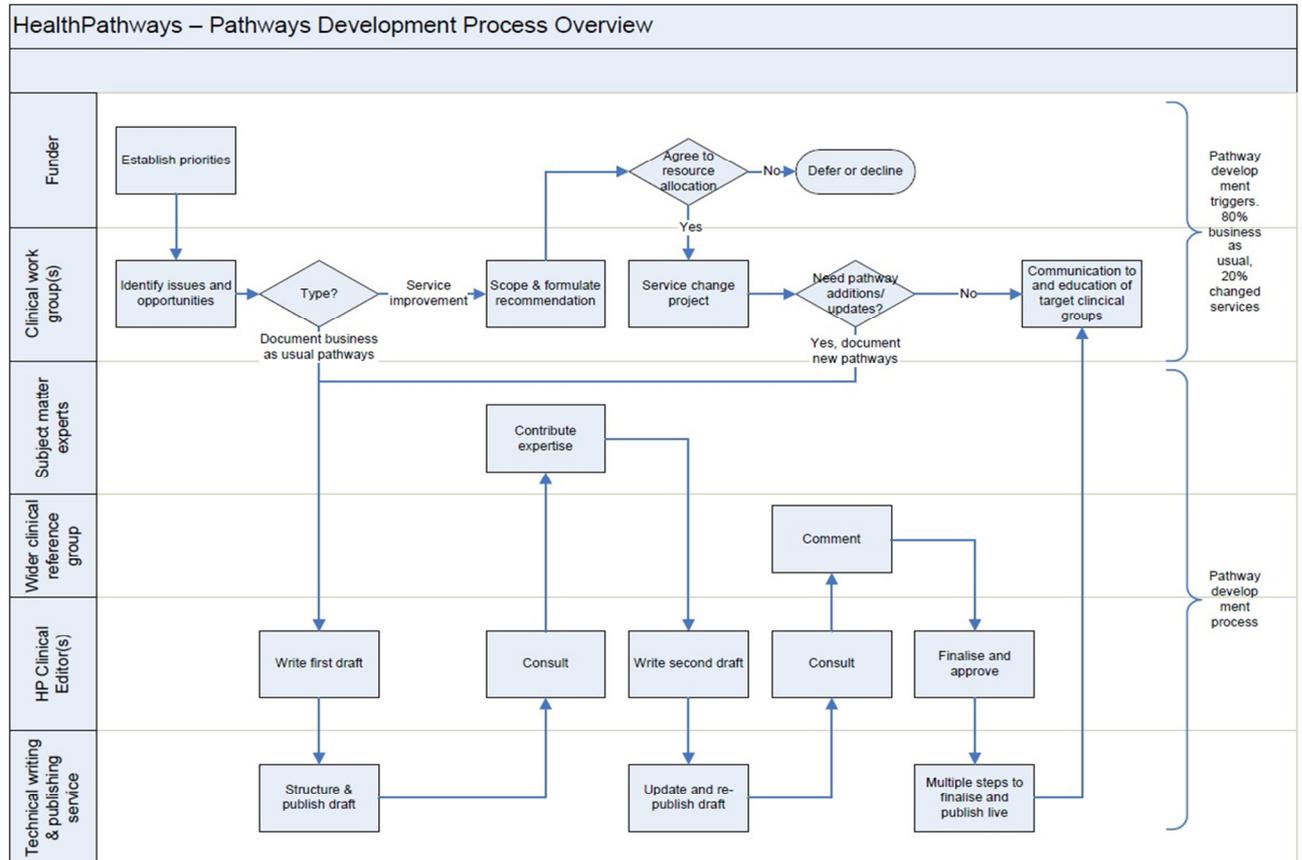
### The process used to develop a clinical pathway on HealthPathways

At the time of its inception, HealthPathways represented a unique step-forward from other online clinical guidance systems, such as the New Zealand-based sites Best Practice,<sup>5</sup> Web Health,<sup>6</sup> USA-based sites Intermountain HealthCare<sup>7</sup> and Geisinger,<sup>8</sup> and UK-based sites Map of Medicine<sup>9</sup> and Clinical Evidence.<sup>10</sup> The main points of difference were that the clinical pathways on HealthPathways provided locally relevant information and were established by an iterative and collaborative process between healthcare professionals, management, funders, clinical editors, and technical writers.

The steps for developing a clinical pathway are shown in Figure 1 and the personnel involved and their role described in Table 1. Consensus, transparency, and equity were key values used during this process with the main focus being on what is best for patients.<sup>11</sup> The pathways reflect evidence-based best practice while incorporating local expert usual practice.

Where best practice guidelines could not be met, the pathways included the reasons and advice on possible alternatives. The evidence sources are provided in a resource section. Patients are not directly involved in the development of the majority of clinical pathways, although the Canterbury DHB consumer council has been consulted. Funders are integrally involved during pathway development where changes are planned in the site, situation, or clinician delivering care. Many pathways have required changes to diagnostic tests and procedures, whereas other pathways simply describe usual care.

**Figure 1. The process used to develop a clinical pathway on HealthPathways**



**Table 1. Personnel involved in the development of a clinical pathway**

<b>Members of work group</b>	<b>Roles</b>
<b>Medical personnel</b> <b>Clinical editor</b>  <b>General practitioner liaison</b>  <b>Clinical leader</b>  <b>Clinician content facilitator</b>  <b>Clinical director of hospital dept</b> <b>4 to 6 general practitioners</b> <b>2 to 5 hospital clinicians</b> <b>Number of nurses and allied health professionals.</b> <b>Subject matter experts</b>	<p>General practitioner who writes much of the content, and ensures that it is relevant to the local situation and conforms to international best practice guidelines.</p> <p>Assists with triage of referrals, organises education sessions, and oversees updates to website and referral forms.</p> <p>Promotes acceptance and dissemination of the new processes and clinical pathway.</p> <p>Gathers clinical information with the content required based on the level of expertise of local primary care.</p> <p>Signs off the pathways with the clinical editor.</p> <p>Provides knowledge and experience of primary care.</p> <p>Provides knowledge and experience of secondary care.</p> <p>Provides knowledge and experience on the medical area in the clinical pathway.</p> <p>Often secondary care clinicians who write and review pathways with the clinical editor.</p>
<b>Administration personnel</b> <b>Work-group facilitator</b>  <b>HealthPathways coordinator</b>	<p>Acts independently of the local clinical community involved in the discussions.</p> <p>Collection of non-clinical information, monitoring feedback and liaison with other centres using HealthPathways.</p>
<b>Technical development personnel</b> <b>Technical writing company</b> <b>Technical writers and editors</b> <b>Website developers</b> <b>Information technology experts</b>	<p>Streamliners Ltd, Christchurch. Technical writing, content development and maintenance of the website.</p>

## Information provided on a clinical pathway

The primary objective of HealthPathways is to provide concise information required for a patient consultation and to overcome the difficulty general practices may experience when organising multiple sources of information. The clinical pathways include information on all areas of referral for secondary care, but not tertiary care. It is not intended as an automated or structured decision support tool or to describe the management of a condition within the hospital.

The website provides information on investigations, differential diagnosis, acute and conservative management, and patient education. Important information on possible severe adverse events is highlighted by a 'red flag'. The pathway may include links to resources on background clinical information, aetiology, supporting international guidelines, or the details of educational sessions. Pathways that have been audited contain a link to a summary of the major findings and planned improvements.

The majority of pathways include a link to HealthInfo,<sup>12</sup> a website that provides health information for patients, consistent with that described in the clinical pathways. The clinical pathway for colorectal symptoms is shown in Figure 2.

Figure 2. Example of a clinical pathway

**HealthPathways** CANTERBURY

Back < > Print Send Feedback

### Colorectal Symptoms

**Note:** This pathway is for symptomatic patients only (unless anaemic). For asymptomatic patients, see [Bowel Cancer Screening](#).

#### Red Flags

- Weight loss
- Abdominal mass
- Iron deficient anaemia
- Blood mixed with stool
- Palpable or visible rectal mass

#### Assessment

**Practice Point!**  
Performing a PR examination is best practice for all patients presenting with colorectal symptoms.

- History:
  - Rectal bleeding.
  - Altered bowel habits, i.e., loose motions or constipation.
  - Weight loss.
  - Family or personal history of colorectal cancer (CRC). Register patients with a strong family history through the [Familial GI Cancer Registry](#).
  - Previous bowel investigations eg colonoscopy or CT colon with results.
  - Inflammatory bowel disease or other bowel pathology.
  - Co-morbid conditions and other risk factors that may impact choice of diagnostic tests and/or management.

**Note:** If you have concerns about patient co-morbidity, phone Christchurch Hospital Endoscopy Unit to discuss preparation, or note it on your referral.
- Examination - check for abdominal and rectal masses.
- Investigations:
  - Arrange haemoglobin, MCV, ferritin and CRP (if diarrhoea or loose motions).
  - Faecal calprotectin<sup>1</sup> - is a 2<sup>nd</sup> line investigation only if inflammatory bowel disease is suspected. It also should not be requested if the patient requires a colonoscopy.
  - Faecal occult blood is not normally indicated. However, if you choose to do this test, there are [certain limitations](#).

#### Management

- Fill out a diagnostic request to determine whether the patient will be offered publicly funded investigations:
  - ERMS: Gastroenterology > CT Colon / Colonoscopy Diagnostic Request (Public), or
  - Print and fill out the [Colonoscopy / CT Colonography Diagnostic Request form](#).
- Further management is based on the score calculated in this form:
  - For scores  $\leq 10$ , consider management of possible causes e.g. haemorrhoids, constipation, or anal fissure.
  - For all scores  $\geq 11$ , refer for investigation, as this is the recommended evidence-based threshold:
    - Those with a score  $\geq 20$  are likely to qualify for publicly funded investigation.
    - Those with a score of 11 to 19 will be prioritised according to capacity.
  - Inform patients that the diagnosis of bowel cancer may be delayed if not investigated with a score  $\geq 11$  and document carefully. Suggest private referral if this is an option for the patient. If they cannot be managed privately, public referral allows an estimate of unmet need.

#### Request

**Note:** This pathway is for **symptomatic** patients only, unless anaemic. If you are referring an asymptomatic patient for surveillance, see [Bowel Cancer Screening](#).

- Refer as indicated in management:
  - ERMS: Gastroenterology > CT Colon / Colonoscopy Diagnostic Request (Public)
  - Other: Fax your referral to Christchurch Hospital Gastroenterology (03) 364-0419, including the [Colonoscopy / CT Colonography Diagnostic Request form](#).
- If your patient has any of [these features](#):
  - Select ERMS priority high suspicion of cancer, or write "high suspicion of cancer" on your referral.
  - Consider requesting [Cancer Care Coordination](#).
- If you are requesting consultation rather than an investigation, write to the following department as appropriate:
  - Department of Gastroenterology
  - Department of General Surgery

**Referral Outcomes**

- All referrals are triaged against the same criteria.
- Your patient will be offered either a CT colonogram or a colonoscopy which may be urgent or routine.
- If haemoglobin and ferritin are low, your patient may also be offered a gastroscopy.
- The CT colonogram or colonoscopy may be interchanged from time to time so as to maximise use of available services.
- The referring general practitioner remains responsible for follow-up of CT colonography and referral if needed.

Your patient may also wish to consider [private referral](#).

#### Information

- [Clinical Resources](#)
- [HealthInfo](#)
- [References](#)
- [Quality Assurance](#)

In 2010, the Canterbury DHB introduced an electronic request management system (ERMS) to transfer structured electronic referral information from general practices to a central database, and from there to community and hospital services. Each referral form on ERMS contains a link to the relevant condition on HealthPathways which provides reminders of key criteria required for acceptance of referrals.

### The quality assurance program for HealthPathways

To ensure the information on HealthPathways is up-to-date and accurate the website is open to continual scrutiny and improvement. A feedback button is located on each webpage, with all responses reviewed daily and acknowledged, and managed by clinical editors, where necessary. This ability for anyone in the health system to contribute to content and suggest improvements has led to increased acceptance and use of the website.

The clinical pathways are formally reviewed every 2 years, while pathways with the potential to change delivery of care are subject to clinical audit, with the frequency of audit depending on the potential for adverse events. The audit process involves longitudinal evaluation on subsets of referrals to determine if the clinical pathways have delivered timely and appropriate care. Based on the findings, recommendations for improving the quality and structure of the pathway or better safety monitoring of the patients may be initiated.

### The role of HealthPathways in healthcare integration in Canterbury

It is not possible to measure the impact of HealthPathways in Canterbury in isolation from the many other changes in healthcare delivery that occurred around the same time. Measures used in this paper as indirect indicators of the effectiveness of the website include changes in website access measured using Google Analytics (Google Inc, CA, USA), key indicators of healthcare delivery, review of pathway audits, and the role of the website as a change management tool.

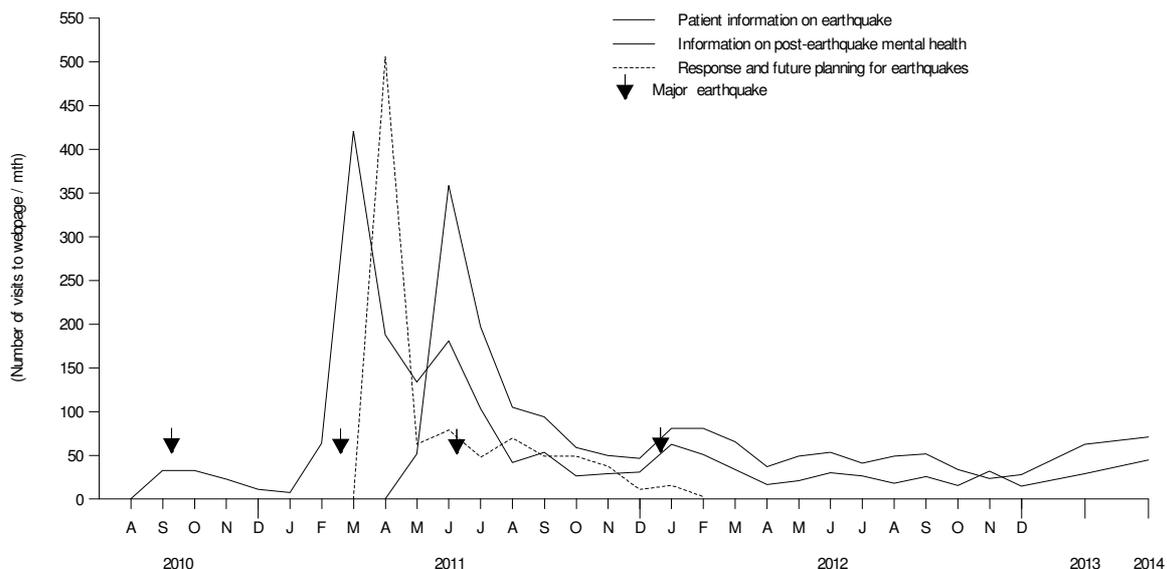
**Website use and activity**—Canterbury has a population of 510,000 with 140 general practices. Site access is restricted to health professionals. The total number of visits (1053 in 2009 vs. 7729 in 2014), pages viewed/month (20372 in 2009 vs. 313630 in 2014) and unique visitors to the website/month (280 in 2009 vs. 1285 in 2014) have increased steadily. The website is used daily by many general practice teams who currently make 5 new feedback comments each day. There are currently over 570 pathways on the site, covering 40 specialities, with 79 referral pages. The five most frequently accessed clinical areas are child health, women's health, gynaecology, mental health and diabetes. Localised versions of HealthPathways are now used or planned by 11 DHBs in New Zealand and 14 health organisations in Australia, covering approximately 10 million people.

An online survey of healthcare professionals in Canterbury on their perception and use of HealthPathways<sup>4</sup> showed a high rate of positive responses to questions regarding localised guidance on medical conditions and the referral process (88–97%), while about 50% of respondents considered the website had improved their relationships with patients and other healthcare professionals. About one-half of respondents considered HealthPathways had increased the duration of a patient consultation, with a similar proportion stating that they preferred to make their own clinical decisions rather than obtaining advice from structured decision support systems. HealthPathways does not provide structured decision support. The increase in consultation length may reflect the ability of general practice teams to provide more information and services for their patients. A future survey may explore this possibility.

The series of earthquakes in Canterbury demonstrated the usefulness of HealthPathways in emergencies as it was used as a communication tool for general practices, community nursing, and pharmacies with daily and sometimes hourly updates being provided. HealthInfo<sup>12</sup> was established

immediately after the major earthquake on 22 February 2011 and used to disseminate public health messages to the community. As shown in Figure 3, visits to earthquake-related pages peaked immediately after major quakes, with the earthquake recovery patient information sheet being the third most viewed page in 2011. The ability of the website to rapidly add information has also been useful in times of hospital gridlock and influenza outbreaks.

**Figure 3. Access of pages providing information related to the Christchurch earthquakes (2011–2014)**



**Key indicators of health care delivery**—By promoting better patient management in general practice HealthPathways has contributed indirectly to a number of positive changes in service delivery. These include an improvement in referral quality and a reduction in the overall rejection rate of referrals. A case study of changes in gynaecological services in the first 3 years after introduction of the website<sup>13</sup> showed referral acuity had increased, with a significant rise in the proportion of gynaecological referrals accepted for first specialist assessment (65% in 2007 to 80% in 2011).

Our online survey<sup>4</sup> showed that 69% of hospital clinicians considered HealthPathways had ‘improved the overall quality of referrals’. A similar response was obtained from meetings held in 2014 between hospital clinical directors and Canterbury Initiative members, with 14 of the 17 departments reporting better referral quality over the last 5 years.

Indicators of a more integrated health system include the fact that some investigations previously undertaken by the hospital can now be carried out in the community (e.g. 43000 fully-funded diagnostic investigations in 2013 including 381 pipelle biopsies and 2355 skin cancer removals). Waiting times for these procedures has decreased (e.g., investigation of heavy menstrual bleeding; 100 days in 2007 vs. 35 days in 2013). Other indirect indicators of successful healthcare integration include a slowing in growth of acute medical and surgical admissions against a background of an aging population, with an associated increase in elective surgery (297 procedures/10,000 people in 2007 vs. 424 procedures/10,000 people in 2013).<sup>1,14</sup>

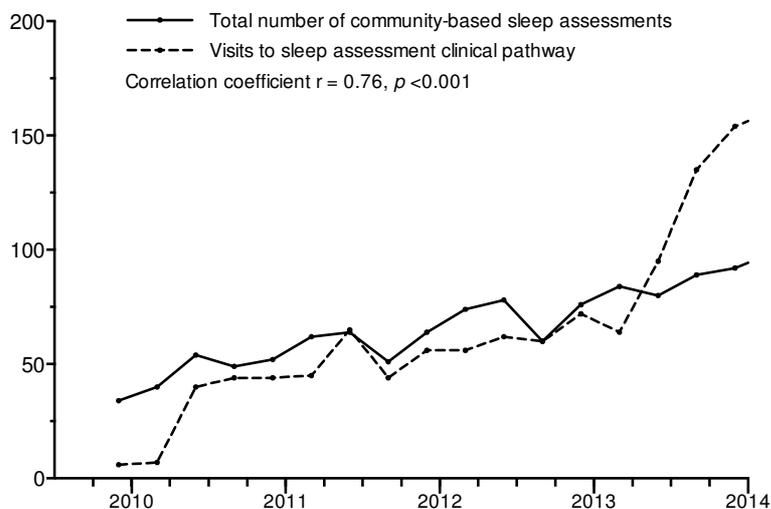
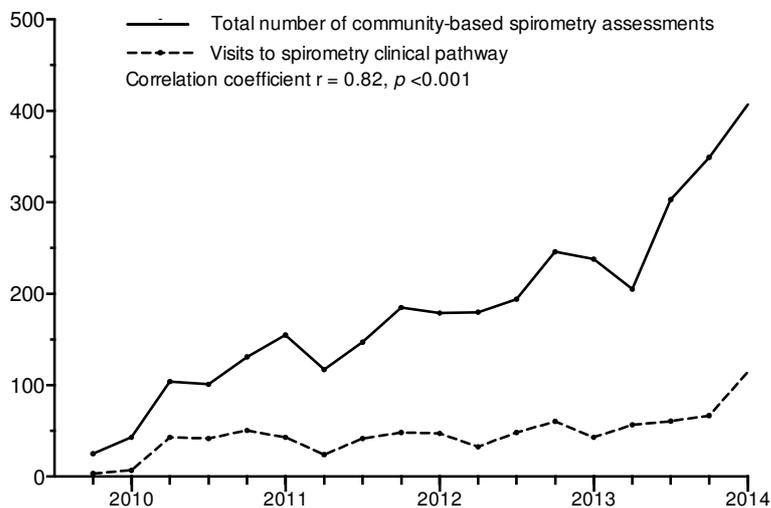
**Pathway audits**—Since 2011, 60 clinical pathways have been audited. The majority of audits confirm the increases in referral quality and acceptance rate described in the previous section. Wait-times for assessment and treatment in all the pathways audited either improved or were within accepted guidelines. Many of the audits identified factors that needed to be changed such as referral

criteria or information included in the pathways. If necessary, repeat audits were carried out to determine whether the changes had resulted in improvements in service delivery.

**HealthPathways as a change management tool**—The website has contributed to the negotiations, dissemination, and implementation of many of the major changes in healthcare delivery that occurred in Canterbury over the last 6 years.<sup>1</sup> For example, HealthPathways was an integral component in the development of several community-based services such as level 1 sleep studies and spirometry where a third of testing is now community-based.

As shown in Figure 4, there is a significant temporal relationship between changes in the number of sleep assessments and spirometry tests carried out in the community and access of information related to these services on the website.

**Figure 4. Graphs showing the association between provision of information on HealthPathways and the development of community-based clinical services for spirometry and sleep assessment**



## What lessons have been learned from the development of HealthPathways?

Why did HealthPathways prove popular with general practice teams at a time when it was generally recognised that clinical guidelines and structured decision support systems were not delivering the anticipated results of reduced variation and best practice management?<sup>15-17</sup> We consider this was attributable to the wide range of information that general practitioners require for decisions and that this information had not been integrated into a single repository that was easy to use in day-to-day clinical practice. Other systems that integrate practice management software with decision support tools require complex software that limits the rate clinical pathways can be produced and updated.<sup>18</sup>

These systems are not always popular with general practitioners who find them overly prescriptive and time consuming,<sup>19,20</sup> preferring instead to make decisions based on their experience and available information. Our online survey<sup>4</sup> emphasised the importance of time constraints during a patient consultation and showed that general practitioners preferred not to use structured decision support systems when making clinical decisions.

Another probable reason for HealthPathways becoming the preferred information source for general practice teams is that it contains information on locally available health resources and services. In contrast to other clinical guidance websites that may be perceived as being written by experts who do not understand general practice,<sup>21</sup> the clinical content on HealthPathways is written and edited by general practitioners and local subject specialists.

Another important factor in acceptance of the website by general practice teams is that it assists in the care of patients with the poorest health status by providing clear access guidelines based on the need, cost and availability of these services. The provision of local information for patients on HealthInfo<sup>12</sup> that is consistent with the guidance on HealthPathways is also considered to have been a helpful initiative.

The organised collaboration between general practitioners and hospital clinicians in writing the pathways has been a key component in the development of HealthPathways. At least 300 clinicians or local subject experts, 100 practice nurses and allied health professionals, and 80 hospital managers have been involved in development of the website, and our survey<sup>4</sup> showed this has led to improved communication and better working relationships. Specialist clinicians contributed to the educational seminars for some of the clinical pathways and HealthPathways is now used widely in hospitals for teaching. Some pathways are already shared with hospital clinical manuals and more work is planned to integrate the website with regional and national clinical guidance systems.

Key indicators of healthcare delivery<sup>14</sup> provide indirect evidence that the website has contributed to improvements in patient management and referral in primary care. The website has been an integral component in the establishment of new community-based clinical services, and was used to gain consensus amongst clinicians on the best site of care and management of these services and to disseminate this information to the clinical community. Because clinicians may be concerned about loss of control or degrading of patient services, these issues were addressed solely from the viewpoint of what was best for the patient and the health system. The changes were documented on HealthPathways so that they were visible to all health care professionals who were then able to contribute and alter by consensus.

Hospital clinicians have participated in the HealthPathways process with enthusiasm and acknowledge they now have greater ability to influence standards of care in the local district and decrease the amount of repetition on common clinical areas. Other perceived benefits are that referrals are now more comprehensive and patients referred are of higher acuity, resulting in higher acceptance rates and a greater proportion of patients requiring specialist assessment. The establishment of clear access criteria for services in HealthPathways and accurate triage has allowed measurement of the number of patients declined or not referred.

Estimation of the number of patients unable to access services at a clinical threshold agreed between general practice and hospital specialists represents challenging new work. The risk of imposing strict access criteria is that unmet need is not visible. Waiting lists have traditionally been used to manage and measure need, although as they contain referrals covering a wide range of acuity this may be an arbitrary and inaccurate method in the absence of clear access criteria. For example, a review of 5000 referred patients carried out in Canterbury in 2007 showed that about a third could be managed in the community, a third needed minor investigations, and a third required a specialist opinion.

The imposition of clear access criteria on pathways allows referred patients who do not meet the threshold for a funded service and are declined despite meeting the clinical threshold to be counted. We are now planning to determine the number of patients who meet the clinical threshold and are not referred because the pathway makes it clear they will be declined.

The development and dissemination of clinical guidance systems is best seen in the broader context of policy change. Implementation of the new pathways of care on HealthPathways required allocation of funding and resources supported by all levels of the Canterbury DHB especially the CEO, Board, and Planning and Funding Division. This close relationship has led to the website acting as a change management tool from inception of the changed services to their embedding in the health system. For example, during the Canterbury earthquakes, the movement of services to community settings was accelerated following the loss of buildings and hospital beds.

Funding was not removed from secondary care to develop these services, with secondary care clinicians fully involved in these initiatives. HealthPathways proved very useful for these innovations and although expectations cannot always be met the majority of clinicians accepted this reversal of traditional top-down resource allocation.

Like all new projects and systems, the development of HealthPathways was not without challenges. The online survey<sup>4</sup> showed that about 5% of respondents considered the introduction of HealthPathways was associated with an increased workload in their sector without a compensatory increase in funding. Future development needs to be aware of the risk of the website becoming too large, difficult to navigate, and overly prescriptive.

The editorial team tries to keep each pathway brief and target the information to the needs of general practice teams. However, none of the pathways are obligatory and the website is clearly only advisory. The ongoing resources and work required for quality assurance and ensuring the information on the website is up-to-date and accurate are other important challenges facing HealthPathways in the future.

In conclusion, this paper suggests that HealthPathways has contributed to better patient management by general practice teams in the Canterbury region, in addition to assisting with the provision of more health care in the community, and improvement in the quality of referrals for hospital treatment.

The points of difference between HealthPathways and other clinical websites include the involvement of multidisciplinary work groups, clinical editing by general practitioners, a brief and consistent layout, and relevant information with high local content. The website has also acted as a change management tool by helping to establish and disseminate the key principles required for successful health integration. These principles include a strong and consistent governance structure, equitable funding across a continuum of care, ongoing trust and collaboration between hospital management, general practices, and secondary care clinicians, and rigorous quality assurance of health services.

**Competing interests:** Nil.

**Author information:** Graham McGeoch, General Practitioner, The Canterbury Initiative, Canterbury District Health Board, Christchurch; Ian Anderson, Managing Director, Streamliners Ltd, Christchurch; Juanita Gibson, HealthPathways manager, Streamliners Ltd, Christchurch; Carolyn Gullery, General Manager, Planning, Funding and Decision Support, Canterbury District Health Board, Christchurch; David Kerr, General Practitioner, The Canterbury Initiative, Canterbury District Health Board, Christchurch; Brett Shand, Clinical Writer and Analyst, The Canterbury Initiative, Canterbury District Health Board, Christchurch

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**Correspondence:** Dr Graham McGeoch, The Canterbury Initiative, 4th floor, The Princes Margaret Hospital, Christchurch, New Zealand. [mcgeochg@gmail.com](mailto:mcgeochg@gmail.com)

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## VIEWPOINT

## The Health Quality and Safety Commission: making good health care better

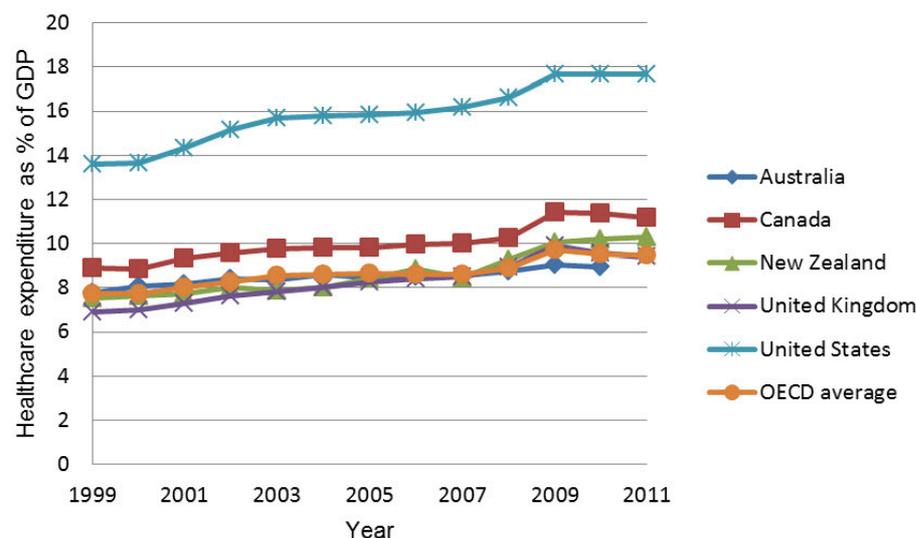
Carl Shuker, Gillian Bohm, Dale Bramley, Shelley Frost, David Galler, Richard Hamblin, Robert Henderson, Peter Jansen, Geraint Martin, Karen Orsborn, Anthea Penny, Janice Wilson, Alan F Merry

**Abstract:** New Zealand has one of the best value health care systems in the world, but as a proportion of GDP our spending on health care has increased every year since 1999. Further, there are issues of quality and safety in our system we must address, including rates of adverse events. The Health Quality & Safety Commission was formed in 2010 as a crown agent to influence, encourage, guide and support improvement in health care practice in New Zealand. The New Zealand Triple Aim has been defined as: improved quality, safety and experience of care; improved health and equity for all populations; and best value for public health system resources. The Commission is pursuing the Triple Aim via two fundamental objectives: doing the right thing by providing care supported by the best evidence available, focused on what matters to each individual patient, and doing the right thing right, first time, by making sure health care is safe and of the highest quality possible. Improvement efforts must be supported by robust but economical measurements. New Zealand has a strong culture of quality, so the Commission's role is to work with our colleagues to make good health care better.

New Zealand has one of the best value health care systems in the world. In absolute terms we spend less per capita on health care than Australia, Canada or the UK (and about a third the amount spent in the USA), and the health outcomes of our system compare well with all three of these countries.<sup>1,2</sup> And yet too many of our patients either fail to access services essential for their health, wellbeing and productivity, or fall through gaps in safety when they do.

Our expenditure on health, like that of many other countries, has increased year on year, from 7.5 percent of gross domestic product in 1999 to 10.3 percent in 2011 (see Figure 1). This proportion is higher than the OECD average and higher than Australia and the UK, though not the USA, where it is now 17.7 percent.<sup>2,3</sup>

**Figure 1. Health care expenditure as percentage of GDP**

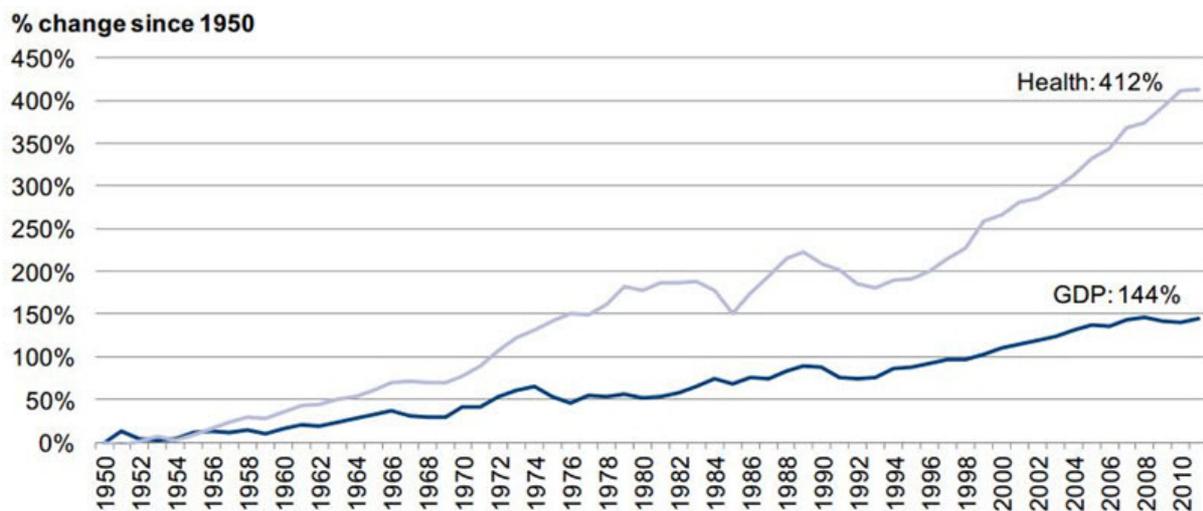


Source: OECD Health Statistics 2013

Spending more on health care leaves less money for other priorities such as education, law and order, and housing, which in themselves are prime determinants of the health of the population. Furthermore, the rate of increase exceeds the increase in GDP and simply cannot be sustained (see Figure 2).

Despite this increase in expenditure, and despite the very good overall outcomes achieved for the vast majority of our patients, things still go wrong.

**Figure 2. Core Crown health expenditure per capita and GDP per capita, indexed real growth, 1950–2011**



Source: The Treasury.

## Failures in care: some examples

James Jones (these selected case studies, though real, are anonymised. In particular this case is one of the adverse events reported to the Commission), an elderly rural man, was mobile and living at home. He had a serious fall and was hospitalised. On the ward, stretching out to get a walker that was too far from his chair, he fell again and fractured his hip. He is now in a rest home.

After mitral valve surgery, David Murray found his wound weeping. It took two weeks of operations to remove the infected tissue and drain the wound. Six weeks of IV antibiotics followed. The painkillers reduced his concentration span to the point where he couldn't read a newspaper.

Sean Black, a registered nurse, was a ward manager on a 'typically busy, chaotic day.' A nurse asked him if he could administer the 2 pm IV antibiotics. 'I said, yes, of course, overconfidently. It was a four-bed room. There were two ladies, one sitting, one lying in bed. My brain told me Mrs Smith was the one lying in bed.' He gave the antibiotics to the wrong patient. 'It was as I was walking away I realised. I remember that tunnel vision, everything-closing-in feeling of "I've made a terrible error."' He told the senior staff nurse and the woman's doctor and the patient herself. 'Straight away I went and sat with the patient and told her what I'd done. I said, "We'll keep a close eye on you, I'm incredibly sorry."'

These stories are typical of the 558 serious adverse events reported by health and disability providers in 2013/14 and subsequently published by the Health Quality & Safety Commission (the

Commission) in October 2014.<sup>4</sup> The aim of this reporting, and the analysis that goes along with it, is not finding who to blame but learning from events so they may be avoided or prevented in the future.

As Sean says:

Unless you've done this job you shouldn't pass judgment on an error. I was a good ward manager and a good nurse. I became a better one because on this occasion I wasn't. I made a mistake.

These are not isolated examples. In 2002, Davis and others reported that 12.9 percent of New Zealand public hospital admissions were associated with an adverse event, half of which were considered preventable.<sup>5</sup> Similar results have been found in the UK,<sup>6</sup> Spain,<sup>7</sup> the EU,<sup>8</sup> and the USA.<sup>9</sup> More recent New Zealand studies found some kind of harm (however temporary or minor) was associated with nearly 30 percent of hospital admissions.<sup>10</sup>

In New Zealand hospitals 170 reported falls were associated with a hip fracture between 2010 and 2012. Direct costs of falls in hospitals in 2010-11 were \$3 to 5 million and the total resources used by falls could well be 2 to 2.5 times higher—about \$6 to \$12 million per annum.<sup>11</sup> Around half of those who fracture their hip no matter where will thereafter require support with daily living or mobilising, and nearly 27 percent of older patients with a hip fracture will die within a year.<sup>12,13</sup>

The average rate for foreign bodies left in during a surgical procedure in New Zealand was 10.8 per 100,000—almost double the OECD average.<sup>14</sup> In 2012, 759 patients suffered deep vein thrombosis/pulmonary embolisms while still in hospital or readmitted within 28 days of surgery, requiring 2178 extra bed days. Estimated cost: \$1.7 million.<sup>15</sup>

## The establishment of the Health Quality & Safety Commission

The Health Quality & Safety Commission (the Commission) is a crown agent established in 2011 to influence, encourage, support and guide improvement in health care practice in New Zealand.

In 2009 the Report of the Ministerial Review Group ('the Horn report') recognised that any national body designed to improve quality and safety in New Zealand health care had to be independent of government to earn the support and trust of the sector that is integral to the chances of any improvement occurring.<sup>16</sup> A crown agency must by law give effect to government policy when directed by the responsible Minister. This new agency would however be 'independent of the regulatory, funding, and performance monitoring agencies of government, report directly to the Minister and have its own dedicated staff.'<sup>16</sup>

Effective quality improvement is a matter of hearts, minds, and culture. Even those interventions to improve quality and safety that are rigorously evidence-based, with records of success internationally, are unlikely to be sustained if forced upon district health boards and clinicians. The trust, confidence and alliance of health care professionals is essential if change in practice is to be embraced and become embedded. This trust and confidence must be earned.

In other words, though giving effect to government health policy, this agency was 'to leverage the experience of local centres of excellence across the whole system and to leverage the best international experience and expertise for the benefit of New Zealand as a whole.'<sup>16</sup> The Commission was to achieve this through the centralised collation and monitoring of data critical to demonstrating and motivating success, through encouragement, promotion and support of programmes adapted to the contexts of individual district health boards (DHBs), and by being a repository of international best practice and expertise.

The Health Quality & Safety Commission builds on the work of others. In the last fifteen years the international evolution in quality and safety has been rapid and the local response to developments has been dynamic (see sidebar). The New Zealand Health and Disability Act 2000 had a requirement that the Minister be advised on quality assurance matters. The National Health Epidemiology and Quality Assurance Advisory Committee (EpiQual) was formed and oversaw the establishment of the first

National Mortality Review Committees, introducing for the first time the requirement for national reporting and analysis of unanticipated deaths.

(This work has continued and expanded under the Commission. Four ongoing committees are dedicated to the review and analysis of perinatal and maternal mortality, deaths of children and young people, deaths resulting from family violence, and deaths associated with surgery.)

EpiQual ran for three years before being reformed as the Quality Improvement Committee (QIC) in 2007, chaired by Pat Snedden. QIC was designed to provide independent advice to the minister and funding was provided for a suite of quality improvement programmes, including optimising the patient journey, management of health care incidents, infection prevention and control, and safe medication management.

After three years of progress the Government, acting on the Ministerial Review report's recommendations, established the Health Quality & Safety Commission under section 59 of the Health and Disability Act (for the Commission's board members, key staff and clinical leads see <http://www.hqsc.govt.nz/about-the-commission/our-people/>).

## The Triple Aim

The Commission began with an intensive period of consultation with people from as many parts of the health and disability sector as possible, taking stock of what was already being done, and evaluating the likely effectiveness and return on investment of different options.

A key outcome from this work was an overarching goal, approved by the Minister of Health and agreed on by the Commission, the National Health Board and the Ministry of Health. It is New Zealand's form of the Institute for Healthcare Improvement's (IHI) Triple Aim—the simultaneous pursuit of three dimensions:<sup>17</sup>

- Improved quality, safety and experience of care
- Improved health and equity for all populations
- Best value for public health system resources

The New Zealand Triple Aim differs in two essential ways from the IHI original.<sup>18</sup> 'Improved health and equity for all populations' is an explicit reference to the fact that Māori and Pacific populations do poorer on many indicators of health outcome and access, and that reducing this inequity is a priority for the entire health care sector.

'Best value for public health system resources' means that there is no agenda to reduce health care expenditure. Rather, unless GDP per capita increases then health care spending cannot go on rising, so we must make certain that we do not waste the resources that Government has allocated to health care. Value is what matters—benefit for patients from every dollar spent.

## Lending a hand: doing the right thing

Two fundamental objectives drive progress toward the Triple Aim.

The first: we must do the right thing. This means providing care based on the best available and the most pertinent external clinical evidence, whether that be randomised controlled trials or at the least, expert consensus, integrated with individual clinical expertise, and the patient's expertise innate in their own experience.<sup>19-21</sup> Our goal is meeting the needs and values of the individual patient.

The IHI's president and CEO Maureen Bisognano says we must ask, in Barry and Edgman-Levitan's phrasing, "What matters to you?" as well as "What is the matter?"<sup>22</sup> This paradigm shift is easy to grasp in relation to the difficult questions around care near the end of life—few would advocate excessively aggressive treatment that is likely to be futile.

This principle applies throughout health care. There is, unfortunately, substantial variation between different providers and institutions in care delivered that does not reflect differences between patients or even differences in resource. Dartmouth in the USA have since 1996 led the way in demonstrating this variation.<sup>23</sup> In some cases, the rate of carotid endarterectomy for example, the variation in the USA is ten-fold. Similar variation, no less remarkable if less extreme, are reported in New Zealand.<sup>24-31</sup> There was, for example, in 2011-12 a four-fold variation in the rate for surgical insertion of a grommet to relieve otitis media with effusion in a child less than four years old: 21.1 per 1000 children in one part of the country received this treatment; in another, only 5.4.<sup>32</sup>

Another potent example is the treatment of diabetes, sufferers of which are expected to double in New Zealand in the next 20 years. The number of medical and surgical bed days occupied by people with diabetes in New Zealand varies between DHBs up to three-fold, for no clear reason. In 2013 the number of total medical and surgical bed days devoted to people with diabetes (25.2%) in one DHB was three times that in another (8.1%).<sup>33</sup>

These data provide no insight into which rate is optimal, but, having ruled out differences between case mix, the highest and lowest rates cannot both be right. The likelihood is that some patients are receiving treatments that are not effective, or that don't actually address the things that have really brought them to their doctors. This 'overtreatment' represents a serious opportunity cost and creates risk without prospect of benefit. At the same time, it is likely that other patients are failing to receive effective treatment that addresses their real needs. This 'undertreatment' is an equally important failure. Understanding inappropriate (i.e. provider-driven) variation and replacing it with appropriate (i.e. patient-driven) variation is probably the single most important key to affordable, high quality health care.

The Commission's Health Quality Evaluation team has, therefore, introduced the New Zealand Atlas of Healthcare Variation, first published in 2012, and is progressively increasing its content in constant sector consultation to ensure the accuracy of the data and the pertinence of the accompanying commentary. The Atlas is a powerful new tool in the New Zealand context to improve the quality of health care through stimulating thinking about the right things to do (<http://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/atlas-of-healthcare-variation/>).<sup>34</sup>

## Lending a hand: doing things right

Having decided on the right things to do, the second imperative, perhaps more obvious, is to ensure things are done right, first time. The people who work in health care in New Zealand are already highly motivated in this regard—our aim is to work with front-line workers to make their efforts more effective.

Take for example a talented surgeon, nurses, allied health professionals and pharmacists undertaking a technically demanding total hip replacement supported by state of the art anaesthesia services to manage multiple comorbidities in an older patient. The value to this patient of all of this technical expertise depends critically on meticulous hand hygiene every day by everyone involved in his postoperative ward care, and also by the care with which an unnecessary fall is avoided as he mobilises. It matters too that the operation is carried out on the right patient and the right side. Specific projects that address simple process issues of this kind spread and embed principles of quality improvement that apply generally. People learn by doing, so the investment produces not only the direct benefit of the specific project but a wider benefit too: the sector's capacity and capability to effect improvement grows.

With a limited budget, a strong sense emerged that the investment already made into the projects initiated by QIC should not be wasted. These were carefully selected projects, such as the hand hygiene programme, and addressed important areas with clear problems in quality and safety. Pulling the funding on existing programmes, changing the signals and forgetting last year's messages would have been a waste of resources and not an example of responsible, long-term quality improvement. The obvious thing to do was to take advantage of momentum already built up and to continue work in

progress. The decision was made to continue and expand upon the projects the Commission had inherited, while recognising that existing and future projects must extend beyond the hospital into primary care and the disability sector.

### Box 1: Current programmes

#### Reducing harm from falls

Falls are a major source of harm especially in aged populations, and create a massive burden for health care. Baselines established by the Commission show that on average two patients fell and broke their hip in New Zealand hospitals every week in 2012. The average cost for any serious fracture after an inpatient fall is estimated at \$26,000—that's \$52,000 a week.<sup>35-38</sup>

Ask Assess Act<sup>38-40</sup> is an intervention based on the best and latest evidence. It structures screening, multifactorial assessment and provision of a care plan to people at risk of falling, connecting their risk factors with appropriate interventions. The results are assessable through a simple quality and safety marker (or QSM), which measures provision of the intervention, and an indication of outcome—reports of fractured neck of femur. The Commission has also developed interventions for signalling the risk of a fall and safe mobilizing. It is active widely in the sector in falls education and supporting falls prevention programmes.

#### Infection prevention and control—Health care associated infections

New Zealand studies show that 10–12% of hospitalised patients develop a health care associated infection, 20% of which are surgical site infections (SSIs).<sup>41</sup> A recent international study put SSIs at 31% of all health care associated infections—the most common.<sup>42</sup>

The Commission's current focus is on a programme of SSI surveillance in combination with three interventions for reducing site infections after hip and knee arthroplasties—common procedures with well-established interventions and available robust data on rates of infection. The impact of such serious infections on patients and their families is substantial, as are the costs: between 2005 and 2011 the ACC paid out \$6.3m for 526 accepted claims for site infections related to hip or knee surgery/replacements.<sup>43</sup>

The interventions include standardisation of antibiotic prophylaxis; best practice use of skin antisepsis; and clipping not shaving of surgical wound sites—all interventions with a sound international evidence base.

The Commission is also sponsoring a nationally standardised approach to generating and reporting on successful hand hygiene programmes in individual DHBs, as well as the central line associated bacteraemia (CLAB) collaborative and intervention. The national rate of compliance with the WHO Five Moments for Hand Hygiene is currently 73%, still well short of Scotland's self-reported national rate of 97%.<sup>44</sup>

#### Reducing perioperative harm

The major focuses of the perioperative harm programme are bringing all New Zealand clinicians and surgeons on board with proper use of the WHO Surgical Safety Checklist, briefings and debriefings, and with the need for venous thromboembolism prophylaxis. Haynes et al's original 2009 study demonstrated a 47% reduction in perioperative mortality (from 1.5% to 0.8%) and a 36% reduction in inpatient complications (from 11% to 7%) through use of the Checklist.<sup>45</sup> There is an extensive literature since, testifying to its success and its adaptability.<sup>46</sup>

#### Medication safety

Medication safety is a complex area with multiple objectives that has been in process since the days of QIC. The Commission is working with the National Health IT Board on improving the safe prescribing, dispensing, administration and monitoring of medicines via electronic medication management and a standardised paper national medication chart. Another major objective is electronic medication reconciliation to quickly and accurately establish what medications patients are taking within 24 hours of admission, transfer or discharge from hospital. We are also working on interventions to improve the safety of high risk medications, such as opioids, and high risk patients, such as older people on multiple and complex drug regimes.

## Shining a light: measurement and data

In 2008, the UK NHS Next Stage Review final report was unequivocal: ‘we can only be sure to improve what we can actually measure.’<sup>47</sup> Measurement is integral to improvement of any undertaking, particularly in health care.<sup>48</sup> The Health Quality Evaluation team has established a suite of measures that can be used like dials on a dashboard to monitor the state of health care nationally over time and at different DHBs at any one time, and to assess how quality improvement interventions are put into practice and their effects.

The resource invested in measurement must match the value of the information obtained. The aim is not just to collect data—it is to drive improvement in patient care. We place considerable emphasis on minimising the burden (and opportunity cost) of data collection, and on ensuring that the data are reliable and the measures are sound. Measurement of the quality and safety of health care is not always straightforward and, notwithstanding the importance of measurement, common sense and pragmatism should prevail: there are times when initiatives to improve care make sense without the need for measurement, or when costs of meaningful data outweigh the potential benefits.

The Commission’s collection and use of data and measurement for health quality evaluation, the Atlas of Healthcare Variation, and efforts to address unwarranted variation in New Zealand, are the subject of a forthcoming paper.

### *Open for better care*

What do data collection methodologies mean to a Tairāwhiti nurse who, at the unexpected death of a grandfather, knows to move his body to a single room because her ward will quickly fill with his whānau as they come to grieve?

*Open for better care* is an awareness-raising national patient safety campaign to promote the Commission’s programmes and interventions and involve doctors, nurses and the people they care for in the improvement of our system. Specific messages deal with programme topics, and wider messages address fundamental principles of safety and quality in healthcare—the importance of communication and teamwork in the operating theatre, for example. Clinical leads include John Barnard, Sandy Blake, Ian Civil, Josh Freeman, Nigel Millar, Arthur Morris, Miranda Pope, Gillian Robb, Sally Roberts, David Sage, and Shawn Sturland—the clinicians leading our improvement programmes.

Sandy Blake, for example, clinical lead on the falls programme and Director of Nursing at Whanganui Hospital, is doing pioneering work in reducing falls in ageing, cognitively impaired patients on her wards. Sandy is building on workshop techniques presented by NHS falls specialist Frances Healey, to cohort these patients in her ward under the observation of a single designated, trained watcher to keep them safe. Her lessons? Make the watchers special, give them recognition and the power to call in other nurses if there is a problem. Give them permission to not feel guilty that they can’t provide care themselves if it means losing direct vision of all the patients in the room.

She has seen the improvement in culture: ‘When a charge nurse comes to me about a fall that has caused harm,’ Sandy says, ‘they’re really sad about it. It’s not just in their heads, it goes right through their hearts to their heads.’

### **‘... and curiosity abounds’**

The major finding (among the 290 or so recommendations) that arose from the 2013 Francis inquiry’s report into the disorder and failures in care at Stafford Hospital in Mid-Staffordshire in the UK in the mid-2000s was that the failings were not those of individual doctors or nurses but those of culture and climate. There was a climate of fear and a culture of silence within an overall context of management’s focus on financial goals and elevation to foundation trust status.<sup>49</sup> There is a risk that

we will repeat these mistakes in New Zealand. There is an equal risk, however, in trying to solve someone else's problem in our own country.

There is a balance to be struck, wrote Don Berwick, in the 2013 National Advisory Group report on Stafford Hospital, 'between the hard guardrails that keep things in proper order and the culture of continual learning that helps everyone to grow. A phrase that I believe I heard first in England captures that sense: "All Teach—All Learn." In such a culture, measurement is not a threat, it is a resource; ambition is not stressful, it is exciting; defects are seen as opportunities to learn; and curiosity abounds.'<sup>50</sup>

Those of us who work in health care in New Zealand know that as in the NHS the vast majority of our colleagues are inspirational in their commitment to their patients and in their willingness to go the extra distance to achieve good outcomes for them. There are occasional examples of poor culture, and some get substantial coverage in the media, but it is a fundamental mistake to assume that these reflect the culture of the majority.

### A culture of quality

Examples of excellence in culture tend to get less exposure. One such example was the collective response to the 2011 Christchurch earthquake. There are numerous stories of bravery and dedication that could be told. To choose just one: the orthopaedic community rallied to provide an emergency service in the days following the disaster. They were supported by anaesthetists from Christchurch Hospital itself, and by nurses, technicians and the other essential staff. They did so without being directed or instructed by any administrator, or employer, or any improvement, regulatory, or other agency. They asked for no payment or acknowledgement. They, like all concerned, just did the right thing.

One tampers with a culture of this quality at one's peril. At the same time, however, the system is not perfect. The challenge is to identify areas that are not going well despite good intentions, perhaps because of lack of knowledge or data, or because of inertia—things being done the way they have always been done without reflection on how they might be done better. Health care professionals around the world, for example, have been slow to adopt tools and techniques such as checklists and appropriate standardisation, proven in other industries to be effective in improving performance.

What has changed? What has been achieved? A clear example of improvement that could have been implemented years ago has been the near-eradication of infection related to central venous catheterisation (central line associated bacteraemia, or CLAB) in New Zealand, building on the example set in Johns Hopkins Hospital and then in the state of Michigan.<sup>51</sup> CLAB is associated with high morbidity and a mortality rate of 10 to 50 percent. Estimates place the cost of each case somewhere in the range of \$20,000 to \$54,000.<sup>52</sup>

The Target CLAB Zero campaign was a national collaborative—for the first time in this nation's history, every ICU in the country worked together to a single end, deploying an evidence-based preventative care bundle shown to prevent central line infections. The campaign was funded by the Commission and managed by Ko Awatea, and resulted in a decrease from a 2012 baseline of 3.2 CLAB cases per 1000 line days to fewer than 0.5 over the year to May 2014, including some months with no cases in the country at all.<sup>53</sup>

The reduction seen at the end of the campaign has been sustained, and this improvement in practice seems to have become embedded. A problem previously thought to be inherent in the practice of central line insertion has turned out to be no more than a consequence of insufficient attention to detail, and entirely amenable to a simple, systematic, measurable, process-oriented intervention. The underlying general lesson is obvious.

Future directions for the Commission extend beyond the hospital into primary care and the disability sector.

The task facing the Commission is to work with those who are actually caring for patients and who know what they are doing, so that together the good results we have come to expect can be the better results that our patients deserve.

#### Sidebar: NZ health quality and safety in a global context—a timeline

(bold dates indicate NZ items)

**1988**—Gibbs report, *Unshackling the Hospitals*, calls for better monitoring, measuring and quality control in NZ healthcare.

**1988**—*The Report of the Cervical Cancer Inquiry* (the Cartwright report) calls for ‘an independent complaints resolution and educational body.’

1991—US Institute for Healthcare Improvement (IHI) founded by Don Berwick.

**1994**—Office for the NZ Health and Disability Commissioner (HDC) created, with powers ‘to enquire as to the contribution to an adverse event by anyone responsible for provision of healthcare, including administrators.’

1996—Dartmouth Atlas of Health Care variation in the US published.

**1998**—Canterbury Health Inquiry Report published.

1999—US Institute of Medicine (IOM) publishes landmark report in the patient safety movement: *To Err is Human* estimates adverse events to be the 7th leading cause of death in the US.

**2000**—Audience at Christchurch Hospital asks incoming HDC Ron Paterson: ‘Can your office ever be more than the ambulance at the bottom of the cliff? Do you have to wait till things go wrong?’ (<http://bit.ly/1uSsKMr>)

**2000**—NZ Health and Disability Act 2000 establishes the National Health Epidemiology and Quality Assurance Advisory Committee (EpiQual) and the National Mortality Review Committees.

**2001**—Gisborne Cervical Screening Inquiry report published. HDC report on Gisborne Hospital finds ‘a traumatised community within [Gisborne] hospital and a worried community beyond ... Suspicion and distrust [between management and staff] was endemic.’

2001—Bristol Royal Infirmary Inquiry report into deaths of paediatric cardiac surgical patients published.

2001—US IOM publishes its second landmark report, *Crossing the Quality Chasm*.

**2002**—Davis et al’s landmark study in the *NZ Medical Journal* estimates that 12.9% of New Zealand hospital admissions are associated with an adverse event—around 14,000 patients per year—and that a third are ‘highly preventable.’

2004—IHI launches the ‘100 000 Lives Campaign’ in the US with six interventions.

2006—In the US, Pronovost and colleagues publish ground-breaking ‘An intervention to decrease catheter-related bloodstream infections in the ICU’; AKA: ‘Michigan.’

2006—UK Department of Health publishes *Safety First* patient safety review in England.

2006—IHI launches the ‘5 Million Lives Campaign’ now with twelve interventions.

**2007**—NZ Quality Improvement Committee (QIC) established.

2007—UK Healthcare Commission identifies first mortality outliers at Stafford Hospital, part of the Mid-Staffordshire NHS Foundation Trust.

2008—UK NHS ‘Patient Safety First’ campaign launches.

2008—UK Healthcare Commission identifies seven different patient safety alerts at Stafford Hospital.

**2008**—NZ: Middlemore Hospital adapts Pronovost’s work for their ICU to reduce occurrences of central line associated bacteraemia (CLAB).

**2009**—NZ: Ministerial Review Group report (the Horn report) calls for replacing QIC with an independent national agency—what will become the Health Quality & Safety Commission (the Commission).

2009—UK Healthcare Commission publishes highly critical report on Stafford Hospital amid growing public outcry.

2009—WHO Surgical Safety Checklist successfully piloted in Auckland City Hospital and seven other hospitals worldwide.

2009—‘Matching Michigan’: the UK National Patient Safety Agency starts a two-year programme to reduce CLAB in English ICUs.

2010—UK NHS Atlas of Variation in Healthcare published.

2010—Publication of independent inquiry led by Robert Francis, QC into Stafford Hospital. Recommendations include a public inquiry, which is immediately commissioned by Andrew Lansley, incoming health secretary in the new Coalition government, and begins in July under Francis.

**2010**—National’s NZ Health and Disability Amendment Act 2010 establishes the Health Quality & Safety Commission (the Commission), an ‘independent, clinician-led agency to establish quality improvement across the whole health service.’ Establishment of the Commission gains broad support in parliament and the sector.

The Commission is tasked to advise the Minister of Health; to determine measures, to measure, and to report; and to promote and support the voluntary uptake of quality and safety improvement activities in New Zealand healthcare.

**2011**—Mary Seddon and colleagues publish on Middlemore’s CLAB intervention. Target CLAB Zero national collaborative campaign is launched by Ko Awatea, Counties Manukau DHB, the Commission and with participation of all DHBs.

**2012**—The Commission publishes first edition of New Zealand Atlas of Healthcare Variation. Baselines for CLAB in New Zealand suggest a national rate of 3.2 per 1000 line days.

2013—The Francis report on Stafford Hospital is published.

**2013**—The Commission’s *Open for better care* patient safety campaign launches.

**2014**—The New Zealand national CLAB rate is less than 0.5 for the past year. In some months there are no cases in the country.

**Competing interests:** The authors are employees or past or present board members of the Health Quality & Safety Commission. Shelley Frost holds a number of roles in the NZ health system: Chair, General Practice New Zealand (GPNZ); Executive Director (Nursing), GPNZ; Quality Clinical Advisor (Royal NZ College of GPs). David Galler is Clinical Director at Ko Awatea, which managed the national programme to eliminate central line infection and has provided a number of learning sessions and educational resources that the Commission has supported. Robert Henderson reports personal fees from the Commission’s Perioperative Harm Advisory Group, Australasian College of Surgeons, NZ Theatre Managers Conference, Hutt Valley District Health Board, Southern Cross Health Insurance, Victoria University, Wellington, Health Round Table, and non-financial support from the NZ Accident Compensation Commission. Geraint Martin reports roles as Adjunct Professor of Healthcare Management at AUT, Executive Board Member of the NZ Institute of Healthcare Management, CMDHB nominee as trustee on Middlemore Foundation Board, and Adjunct Professor of Healthcare Management at Victoria University. His wife is Director of Mackmurdie Solutions and Executive Director, Takanini Care Medical Services Limited Partnership. The company comprises two Accident and Medical Clinics (Takanini Care and Counties Care) and two general practices at the same location. Wife is also board member, Home Vision and contracted to be the National Facilitator for the Children’s Action Plan. Alan Merry is shareholder and board member of Safer Sleep LLC, with which he holds a patent.

**Author information:** Carl Shuker, Principal Advisor Publications, Health Quality & Safety Commission, Wellington; Gillian Bohm, Principal Advisor Quality Improvement, Health Quality & Safety Commission, Wellington; Dale Bramley, Chief Executive Officer, Waitemata District Health Board, Auckland; Shelley Frost, Chair and Executive Director (Nursing), General Practice New Zealand, Wellington & Quality Clinical Advisor, Royal NZ College of General Practitioners, Wellington; David Galler, Clinical Director, Ko Awatea, and Intensive Care Specialist, Department of Intensive Care Medicine, Middlemore Hospital; Richard Hamblin, Director of Health Quality Evaluation, Health Quality & Safety Commission, Wellington; Robert Henderson, Captain, Air New Zealand, Auckland; Peter Jansen, Senior Medical Adviser, Accident Compensation Corporation, Wellington; Geraint Martin, Chief Executive Officer, Counties Manukau District Health Board, Auckland; Karen Orsborn, General Manager, Health Quality & Safety Commission, Wellington; Anthea Penny, Principal, Penny & Associates Ltd, Akaroa; Janice Wilson, Chief Executive Officer, Health Quality & Safety Commission, Wellington; Alan Merry, Chair of the Board of the Health Quality & Safety Commission + Head of the School of Medicine at the University of Auckland

**Correspondence:** Alan F Merry, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland. New Zealand. [a.merry@auckland.ac.nz](mailto:a.merry@auckland.ac.nz)

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## CASE REPORT

## Sarcoidosis presenting with acute hydrocephalus in a New Zealand European female

Arjun Chandna, Christopher Todd, David Murphy, Ronald Boet, Roderick Duncan

### Abstract

Hydrocephalus as the presenting feature of sarcoidosis is extremely rare. We report the case of a 41-year-old New Zealand European female who presented with acute hydrocephalus as the first manifestation of systemic sarcoidosis.

Sarcoidosis is a multisystem granulomatous disorder of unknown aetiology. Neurosarcoidosis is reported in only 5–10% of cases.<sup>1</sup> If neurological involvement occurs, it tends to happen early in the natural history of the disease: diagnosis can be challenging and neurosarcoidosis is frequently under-recognised.<sup>2,3</sup>

We present a case of acute hydrocephalus as the first manifestation of systemic sarcoidosis. To our knowledge this is the first such case described in New Zealand.

### Case report

A 41-year-old New Zealand European female was admitted to hospital after the incidental finding of a blurred right optic disc margin during routine diabetic retinal screening (Figure 1). CT brain scan demonstrated “*acute hydrocephalus and multiple enhancing lesions consistent with intracerebral and leptomeningeal metastases*”.

**Figure 1. Right retinal photograph. Blurred right optic disc margin detected during routine retinal photography performed as part of diabetic screening service**

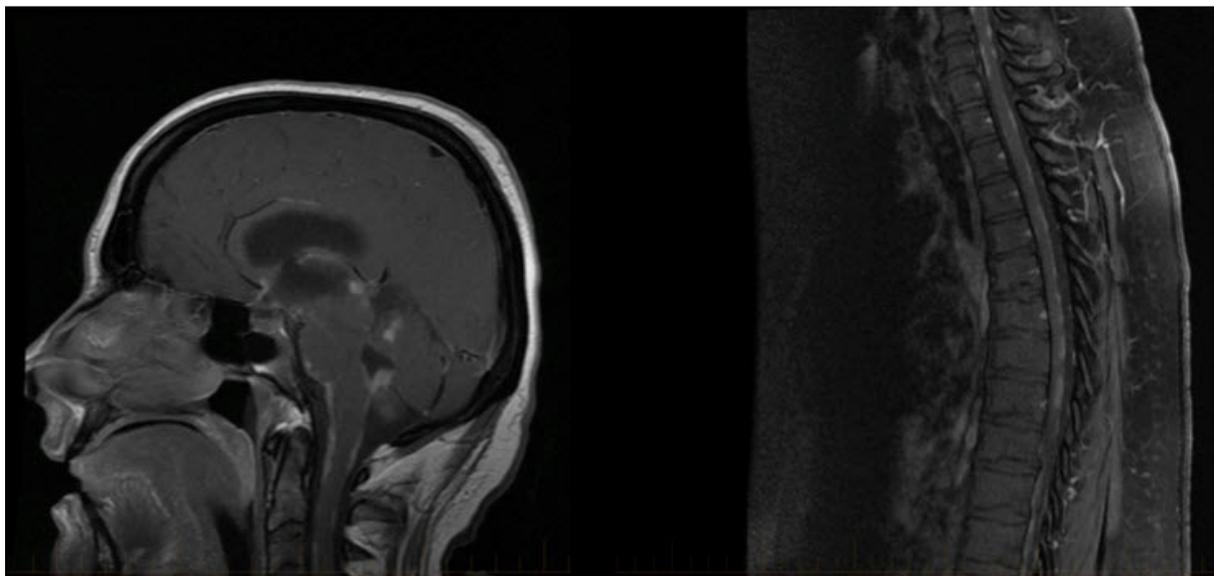


On admission to neurosurgery she reported a 2-month history of lethargy, anorexia and intermittent early morning vomiting. More recently she had become unsteady on her feet, developed diplopia and right-sided weakness. Her past medical history included diabetes mellitus type 2, hypertension and asthma.

On examination she had mild weakness in her right leg, with spasticity, sustained clonus and upgoing plantar reflex. She reported diplopia in all directions of gaze.

Gadolinium-enhanced MRI scan of her brain and spine showed “*acute hydrocephalus with diffuse nodular enhancing lesions throughout the neuraxis including at the cerebral aqueduct*” (Figure 2). Differential diagnoses included carcinomatous meningitis, tuberculosis and sarcoidosis.

**Figure 2. Gadolinium-enhanced post-contrast T1-weighted MRI scan of brain and thoracic spine. Sagittal sections of T1-weighted MRI scan demonstrating acute hydrocephalus and diffuse nodular enhancing lesions throughout the neuraxis, including at the cerebral aqueduct and foraminae of Luschka and Magendie**



A chest radiograph and subsequent CT scan confirmed bilateral hilar and mediastinal lymphadenopathy. Serum calcium was 2.5mmol/L (range 2.2–2.6), angiotensin converting enzyme 30IU/L (range 12–52). Quantiferon-TB® test, and tumour marker panel were negative.

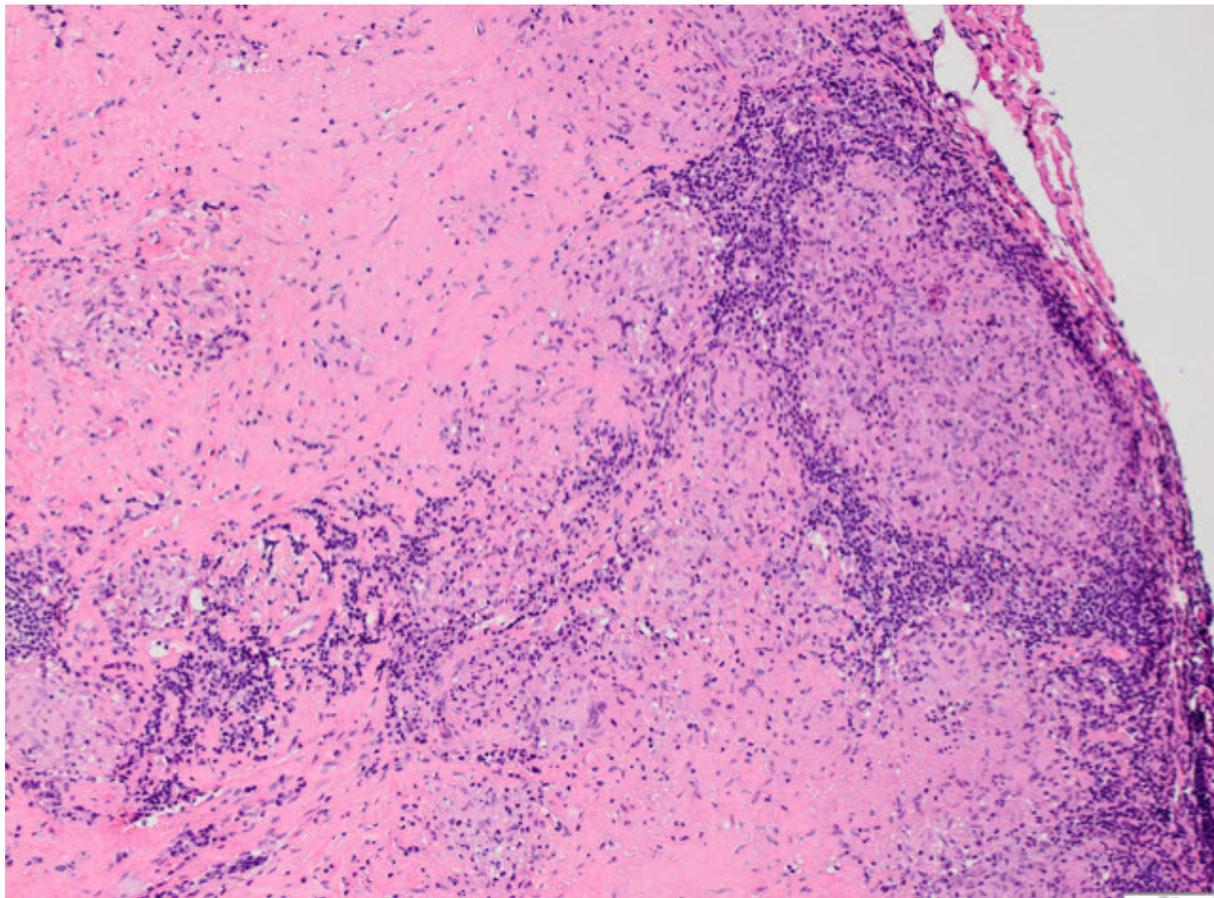
She was commenced on 8mg oral dexamethasone and referred to oncology to investigate a possible malignant cause, where mediastinal lymph node biopsy confirmed granulomatous inflammation consistent with sarcoidosis (Figure 3).

With a diagnosis now ascertained, neurology were consulted and advised 1g intravenous methylprednisolone followed by 60mg oral prednisone. During the following 8 days the patient deteriorated with imaging confirming progression of hydrocephalus. An external ventricular drain was inserted and later replaced with ventriculoperitoneal shunting.

Subsequent improvement in her systemic and neurological symptoms was accompanied by interval reduction in ventricular size and the patient was discharged.

Two days post-discharge she represented with tachypnoea. A CT pulmonary-angiogram confirmed extensive bilateral pulmonary emboli with features of right heart strain. Sadly, resuscitation attempts, including intravenous thrombolysis, were unsuccessful and the patient died.

**Figure 3: Haematoxylin and eosin stained section of mediastinal lymph node. Histology from mediastinal lymph node demonstrating non-caseating granulomatous inflammation consistent with sarcoidosis**



## Discussion

Neurosarcoidosis is often considered in the differential diagnosis for patients who present with neurological symptoms in the context of a known history of sarcoidosis. Unfortunately however, neurosarcoidosis rarely has a systemic harbinger, rendering diagnosis difficult.<sup>2</sup> This case highlights the importance of obtaining a histological diagnosis in patients with suspected neoplastic disease.

Involvement of the nervous system is reported in 5–10% of cases of sarcoidosis,<sup>1</sup> however post-mortem studies suggest this is an underestimate.<sup>3</sup> A recent Australian study reported neurological involvement in 26% of patients with sarcoidosis.<sup>4</sup>

Hydrocephalus as the first manifestation of sarcoidosis is rare: a review of the literature reveals six previous documented cases.<sup>5</sup> Five of these patients were male and none were Caucasian (2 African-American, 2 Korean, 1 Japanese and 1 Malian). The only case of neurosarcoidosis described in the New Zealand medical literature is that of a 48-year-old woman presenting with a vagal mononeuropathy.<sup>6</sup>

Sarcoidosis carries significant morbidity.<sup>7</sup> Patients with neurological manifestations, particularly hydrocephalus, have increased mortality and are more likely to relapse on treatment.<sup>8</sup> However new treatments are emerging<sup>9</sup> and hence early diagnosis is crucial.

Criteria are available to assist with the diagnosis of neurosarcoidosis<sup>10</sup> but a high index of suspicion is required in patients with otherwise unexplained neurological symptoms. Increased awareness amongst clinicians may lead to earlier diagnosis and treatment.

**Author information:** Arjun Chandna<sup>1\*</sup>; Christopher Todd<sup>1</sup>; David Murphy<sup>1</sup>; Ronald Boet<sup>2</sup>; Roderick Duncan<sup>1</sup>.

1) Department of Neurology, Christchurch Public Hospital, Christchurch, New Zealand

2) Department of Neurosurgery, Christchurch Public Hospital, Christchurch, New Zealand

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**Correspondence:** Dr Arjun Chandna. Email: [arjunchandna@gmail.com](mailto:arjunchandna@gmail.com)

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## MEDICAL IMAGE

## A classical image of dumbbell-shaped neurofibroma

Tony Ete, Sumantro Mondal, Debanjali Sinha, Jyotirmoy Pal, Alakendu Ghosh

**Clinical**—A 53-year-old male presented with progressive lower limbs weakness followed by weakness of both upper limbs without any bladder and bowel involvement. He had multiple non-tender, bead-like nodular swellings on his face, chest, back, both upper limbs, and few on lower limbs (Figure 1).

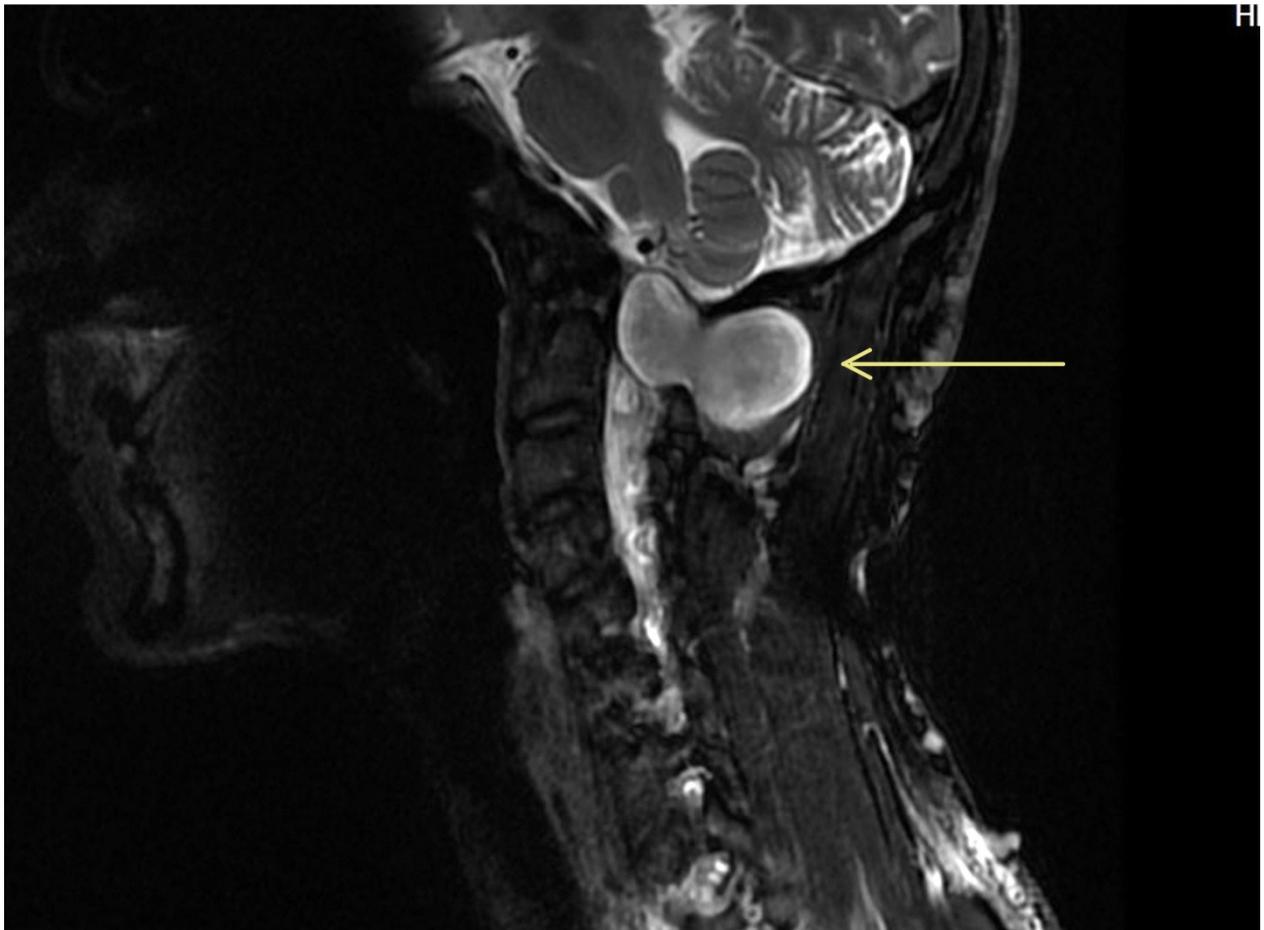
**Figure 1. Multiple non-tender bead-like nodular swellings in a patient suffering from neurofibroma**



His abdominal and cremasteric reflexes were absent, plantar response was extensor, and had brisk deep tendon jerks in all four limbs.

Sagittal T2-weighted MRI of cervical spine showed a dumbbell-shaped exophytic solid hyperintense lesion at the level of C2 spine (Figure 2).

**Figure 2. Sagittal T2-weighted MRI showing dumbbell-shaped exophytic solid hyperintense lesion (neurofibroma; arrowed) at the level of C2 spine**



**Discussion**—Spinal neurofibromas are the most prevalent group of spinal tumours. They occur in association with neurofibromatosis type 1, and also sporadically. When myelopathy and motor deficits develop, surgical intervention is indicated to remove the tumour.<sup>1</sup>

**Author information:** Tony Ete, Internal Medicine, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences Shillong, Meghalaya; Sumantra Mondal, Rheumatology, Institute of Postgraduation Medical Education and Research; Debanjali Sinha, Rheumatology, Institute of Postgraduation Medical Education and Research; Jyotirmoy Pal, Internal Medicine, Institute of Postgraduation Medical Education and Research; Alakendu Ghosh, Rheumatology, Institute of Postgraduation Medical Education and Research. Kolkata, West Bengal, India

**Correspondence:** Dr Tony Ete, Internal Medicine, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Mawdiangdiang, Shillong 793018, India. [tetepete@gmail.com](mailto:tetepete@gmail.com)

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**100 YEARS AGO**

## **Some remarks on the treatment of tuberculosis amongst the Maoris at Tuahiwi Park**

*Excerpt of an article by J. Henry Crawshaw (M.R.C.S. Eng., L.R.O.P. Lond.) and read at the Canterbury Division's Meeting. Published in NZMJ 1914;13:346-8.*

In 1912, on account of the prevalence of phthisis amongst the Maoris at Tuahiwi, it was deemed advisable to try and do something for the native race. Accordingly, at the instigation of the Health Department, Drs. Blackmore and Pearson were deputed to examine the Maoris, and, having done that, to report as to what, in their opinion, was the best course to pursue.

These gentlemen examined the Maoris in June, 1912, and they found phthisis very rampant. They found practically the whole number of the children were affected, viz., 37 boys and 30 girls. Inter alia, they recommended that a trained nurse should be appointed to the pah.

The Health Department carried this recommendation into effect, and a trained nurse was appointed, and took up her duties in July, 1912. This was followed immediately by better hygienic conditions. For instance, with regard to sleeping accommodation, the parents were made to understand they could not be allowed to have three and four of their children sleeping in one bed, as had been the habit heretofore.

The filthy habits of chewing gum, and then passing it on from mouth to mouth, and also passing cigarettes from mouth to mouth, were stopped. They were also given instructions in feeding their babies. The children attending school were provided with a place out-of-doors, so that they could be taught in the fresh air. I might mention, incidentally, that this latter is not taken advantage of as it ought to be.

The injection of tuberculin was strongly recommended. This was provided by the Health Department, and the injections have taken place practically once a week since July, 1912. Although it is stated that tuberculin is not so effectual in pulmonary phthisis as in other forms of tuberculosis, I am strongly of opinion that the injections of tuberculin have been beneficial to the Maori race at Tuahiwi, and I feel that, if we are really sincere about preserving the Maori race, this injection of tuberculin will be found to be one of the factors at our disposal.

Of course, it might be said that the other precautions we have taken have been beneficial. No doubt they have. It might, however, be said that the question of living under proper hygienic conditions, under the supervision of trained nursing, has been tried before at Tuahiwi, but the results have not been so encouraging as they have been with the addition of the tuberculin treatment.

Where enlarged tonsils and adenoids have been found to exist, these have been removed, and these cases have been found to do remarkably well after the removal of the tonsils and adenoids.

It behoves us very seriously to try and stamp out this disease amongst the Maori race, because by so doing we are removing a disease that is a menace to the white race in New Zealand. I feel sure we are on right lines in the treatment that has been adopted, as is well exemplified in the last examination of the Maoris by Dr. Blackmore on April 17th, 1914.

Let us compare the results of Dr. Blackmore's examination in June, 1912, and those of his examination in April, 1914.

In June, 1912, 37 boys and 30 girls examined; all affected.

In April, 1914, 19 boys and 17 girls examined. Out of these, 12 boys and 11 girls were declared to be quite well. The rest were improving.

**METHUSELAH**

## Cardiovascular risk with non-steroidal anti-inflammatory drugs

Non-steroidal anti-inflammatory drug (NSAID) use is prevalent in the USA, reflecting the aging of the population and the concomitant rise in musculoskeletal diseases, particularly osteoarthritis and rheumatoid arthritis. NSAID usage is usually very beneficial in the treatment of these conditions. The downside is that inhibition of cyclo-oxygenase-1 may cause cardiovascular damage.

New data from observational studies and meta-analyses of randomised controlled trials have suggested that naproxen may be associated with a lower risk of cardiovascular thrombotic events as compared to other NSAIDs. In February 2014, the US Food and Drug Administration (FDA) convened an advisory committee meeting to discuss the accumulated data relating to the cardiovascular risk of NSAIDs and the potential implications on the class prescribing labelling.

The committee's report published in December 2014 states that the current data does not support the conclusion that naproxen has a lower risk of thrombotic events than other NSAIDs.

Drug Safety 2014;37:897–902.

## Metoclopramide for patients with intractable hiccups

Intractable hiccups, by definition, last for more than 1 month and are very difficult to treat. A wide range of pharmacological interventions for intractable hiccups include baclofen, gabapentin, chlorpromazine, haloperidol, and carvedilol. Several previous clinical studies have reported that metoclopramide may help treat intractable hiccups.

This report concerns a randomised, controlled pilot study which attempts to elucidate the role of metoclopramide. 36 patients were randomised to either metoclopramide 10mg thrice daily for 15 days or placebo. The hiccups were cured in 2 patients and improved in 9 of the metoclopramide patients. There were no cures in the placebo patients but there was improvement in 4 patients.

Internal Medicine Journal 2014;44:1205–1209.

## A possible role of serum uric acid as a marker of metabolic syndrome

The association between serum uric acid (SUA) levels and metabolic syndrome (MetS) has recently been reported in several cross-sectional and longitudinal studies. This study reviews the SUA and its relationship to the subsequent development of MetS in healthy Korean men without diabetes or hypertension.

A retrospective cohort study was conducted using data from healthy men who received a general health check-up in 2003. This involved 1809 participants. During 13,802 person years of follow-up, 127 developed MetS. The follow-up revealed that there was a significant increase in the incidence of MetS in those with elevated levels of SUA and also in those whose SUA levels were elevated but within the normal range.

Internal Medicine Journal 2014;44:1210–1216.

## PROCEEDINGS

## Proceedings of the Annual Scientific Meeting of the NZ Society of Gastroenterology: 26–28 November 2014

### Clinical and endoscopic predictors of cytological dysplasia or cancer in a prospective multicentre cohort study of large sessile serrated adenomas/polyps

**Burgess NG**<sup>1,10</sup>; Hourigan LF<sup>2,3</sup>; Zanati SA<sup>4,5</sup>; Brown GJ<sup>4,6</sup>; Singh R<sup>7</sup>; Williams SJ<sup>1</sup>; Raftopoulos SC<sup>8</sup>; Moss A<sup>5</sup>; Ormonde DG<sup>8</sup>; P'Ng H<sup>9</sup>; McLeod D<sup>9</sup>; Bourke MJ<sup>1,10</sup>

Departments of Gastroenterology: Westmead Hospital<sup>1</sup>, Sydney, Australia; Lyell McEwin Hospital<sup>2</sup>, Adelaide, Australia; Princess Alexandra Hospital<sup>3</sup>, Brisbane, Australia; Greenslopes Private Hospital<sup>4</sup>, Brisbane, Australia; The Alfred Hospital<sup>5</sup>, Melbourne, Australia; Western Hospital<sup>6</sup>, Melbourne, Australia. Epworth Hospital<sup>7</sup>, Melbourne, Australia. Sir Charles Gairdner Hospital<sup>8</sup>, Perth, Australia. Department of Tissue Pathology: ICPMR Westmead Hospital<sup>9</sup>, Sydney, Australia. University of Sydney<sup>10</sup>, Sydney, Australia.

**Aim:** Sessile serrated adenoma/polyps (SSA/P) are recognized as an important precursor to colon cancer. The development of cytological dysplasia within an SSA/P (SSA/P-D) is thought to be a critical step along the pathway to malignancy. There are no studies describing the clinical and endoscopic characteristics of SSA/P-D. We aimed to examine the clinical and endoscopic characteristics of SSA/P  $\geq 20$ mm resected by Wide Field Endoscopic Mucosal Resection (WF-EMR) and identify the characteristics and predictors of SSA/P-D

**Methods:** Prospective multicentre data of large sessile colorectal polyps referred for resection by WF-EMR (September 2008 - May 2013) were analysed. Comprehensive patient and procedural data was collected including scheduled follow up at 14 days, 5 and 16 months. All histology was reviewed by expert gastrointestinal pathologists and classified according to the World Health Organisation criteria (2010)

**Results:** 268 SSA/Ps were found in 207/1546 patients (13.4%). SSA/P-D comprised 32.4% of SSA/Ps. Cancer occurred in 3.9%. On multivariable analysis, SSA/P-D was associated with increasing age (OR 1.69 per decade (1.19-2.40, p.004) and increasing lesion size (OR 1.90 per 10mm (1.30-2.78), p.001) an 'adenomatous' pit pattern (Kudo III, IV or V) (OR 3.98 95%CI (1.94-8.15), p<.001) and any 0-Is component within an SSA/P (OR 3.10 95%CI (1.19-8.12) p.021). Conventional type dysplasia was more likely to exhibit an adenomatous pit pattern than serrated dysplasia. HGD or cancer was present in 7.2% and on multivariable analysis, was associated with increasing age (OR 2.0 per decade; 95%CI 1.13-3.56) p.017) and any Paris 0-Is component (OR 10.2; 95%CI 3.18-32.4 p <.001).

**Conclusion:** Simple assessment tools allow endoscopists to predict SSA/P-D or HGD/cancer in SSA/Ps. Correct prediction is limited by failure to recognise SSA/P-D which may mimic conventional adenoma. Understanding the concept of SSA/P-D and the pitfalls of SSA/P assessment may improve detection, recognition and resection and potentially reduce interval cancer.

## Chronic exposure to LPS induces goblet cell differentiation in human colonic organoids

Rodrigues E<sup>1&2</sup>, Slobbe L<sup>2</sup>, Schultz M<sup>1</sup>, Butt AG<sup>2</sup>

Department of Medicine, Dunedin School of Medicine and Department of Physiology, University of Otago, Dunedin, New Zealand

**Aim:** Modification of the intestinal microbiota results in marked changes in the properties of the intestinal epithelium. This response is believed to result from direct interaction between the microbiota and the intestinal epithelial cells (IEC), and changes induced by signals arising from the gastrointestinal immune system. Here we have used colonic organoids, which are primary cultures of human colonic intestinal epithelium, to investigate the effect of microbial stimuli on the development of the intestinal epithelium, independent of immune input.

**Methods:** Organoids were grown from crypts isolated from the transverse colon of healthy individuals and transferred to Matrigel and growth media for 15 days in the presence and absence of the lipopolysaccharide (LPS, 20 ng ml<sup>-1</sup>). Organoid structure was assessed by light microscopy and gene expression of proliferation, differentiation, maturation and stem cell activity markers was analysed by qPCR.

**Results:** After 15 days of culture a mixed population of organoids developed that consisted of 70% undifferentiated colonospheres and 30% colonoids. The colonoids had a well-differentiated epithelium consisting entirely of colonocytes with no evidence of goblet or enteroendocrine cells. The inclusion of LPS in the culture media had no effect on the growth of organoids or the relative proportions of colonoids or colonospheres. However, the number of goblet cells in the colonoids increased to 20±3% (P<0.05) of the total cells. Associated with this was an increase in the transcript levels of the goblet cell specific markers Muc2 (P < 0.005), trefoil factor 3 (P < 0.005) and the goblet cell specific transcription-factor KLF4 (P < 0.05).

**Conclusions:** LPS, a microbial agonist of the pattern recognition receptor TLR4, induced goblet cell differentiation in the colonic epithelium independent of immune modulation. This is consistent with direct cross-talk between the IECs and the microbiota and is likely to be important in epithelial homeostasis in the intestine.

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## Infliximab and adalimumab trough concentrations and anti-drug antibodies correlate with response in inflammatory bowel disease

Barclay ML<sup>1,2</sup>, Helms E<sup>2</sup>, Hock B<sup>3</sup>, Stamp LK<sup>3</sup>, Schultz M<sup>4</sup>. Depts of Gastroenterology<sup>1</sup> and Clinical Pharmacology<sup>2</sup>, Christchurch Hospital<sup>1</sup>, Christchurch, New Zealand; Depts of Medicine and Haematology, University of Otago Christchurch<sup>3</sup> and Dunedin<sup>4</sup>, New Zealand.

**Aims:** The TNF $\alpha$  antagonists infliximab (IFX) and adalimumab (ADA) are the most effective treatments for inflammatory bowel disease (IBD) but more than half of patient fail to respond, or lose response, by 12 months of treatment. Failed treatment may be due to low drug concentrations and/or presence of anti-drug antibodies. We aimed to measure trough concentrations of ADA and IFX, and antidrug antibodies, in patients with IBD, and correlate concentrations with disease activity.

**Methods:** Subjects included gastroenterology outpatients and inpatients at Christchurch Hospital with IBD treated with IFX or ADA. Blood samples were collected just prior to dosing, at least 12 weeks after treatment initiation. Disease activity indices for CD and UC were recorded at the time of

sampling and at the time of treatment initiation. Drug and anti-drug antibody concentrations were measured by enzyme-linked immunosorbent assay (ELISA).

**Results:** Sixty-one patients were studied, including 33 on IFX (24 CD, 7 UC, 1 indeterminate) and 28 on ADA (all CD). Median (range) IFX and ADA concentrations were 7.9 (0-58) and 4.9 mg/L (0-59). Twenty-five patients had concentrations below 5 mg/L, a suggested threshold for drug activity. Crohn's Disease Activity Index (CDAI) was significantly higher in patients with drug concentrations <5 versus >5mg/L (median 166 vs 89, p=0.007). ROC analysis suggested a threshold value of 5-7mg/L is appropriate. There was no correlation between treatment duration and trough drug concentrations (p=0.282). Of 10 patients with drug concentrations <1mg/L, 5 had detectable anti-drug antibodies (3 IFX and 2 ADA antibodies).

**Conclusions:** It is now possible to measure drug concentrations of IFX and ADA, and anti-drug antibodies to both drugs, in New Zealand. These results confirm published results showing that trough concentrations are correlated with disease control in IBD and that drug concentration and anti-drug antibody monitoring may aid in dosing decisions.

## Annual incidence of IBD in the Otago region: an 18-year epidemiological analysis

Galts C, Fokko H, Norton Jo, Gray A, Coppel K, Schultz M

University of Otago

**Background:** Recent research suggests that internationally the rates of IBD have been increasing, but in some areas may be beginning to plateau. While regions of New Zealand have among the world's highest incidence rates of IBD, changes over time are unknown.

**Aims:** The aims of this study were to determine the annual incidence of IBD in the Otago region between 1996 and 2013, and to identify changes in phenotypic presentation of the disease between the 4-year period 1996-1999 and the 4-year period 2010-2013.

**Methods:** All NHIs with an IBD associated ICD code assigned between 1996 and 2013 were gathered into a master list. The earliest date of IBD diagnosis was confirmed by colonoscopy or histology or both. Demographics, IBD phenotype and IBD management data were extracted from the medical notes. Disease behavior was recorded using the Montreal classification. Annual incidence was age-standardised using the Otago region census population and the WHO world standard population.

**Results:** Of 1,089 ICD coded NHIs, 443 confirmed IBD diagnoses were made in the Otago region. There was an overall increase of 0.27 cases per 100,000 people per year in age-adjusted annual incidence for IBD, however this increase was not statistically significant. In 2012 the IBD incidence was highest at 23.67 cases per 100,000. Age-specific rates were highest between 15 to 40 years of age for all types of IBD. Besides disease location, the phenotypic presentation was consistent between the first and last four years of investigated cases.

**Conclusions:** Annual IBD incidence in the Otago region is high compared to the rest of the world but less than in other NZ regions. There has been a slight but non-significant increase in incidence over the past 18 years. There have been minimal changes in phenotypic presentation of the diseases over the past 18 years.

## Deep mural injury and perforation associated with colonic endoscopic mucosal resection: classification, risk factors, management and outcomes

Burgess NG<sup>1,2</sup>; Bassan MS<sup>1</sup>; McLeod D<sup>3</sup>; Mahajan H<sup>3</sup>; Williams SJ<sup>1</sup>; Byth K<sup>4</sup>; Bourke MJ<sup>1,2</sup>

<sup>1</sup>Department of Gastroenterology and Hepatology, Westmead Hospital, Sydney NSW Australia

<sup>2</sup>University of Sydney, Sydney, NSW, Australia. <sup>3</sup>Department of Pathology, ICPMR, Westmead Hospital, Sydney NSW Australia <sup>4</sup>NHMRC Clinical Trials Centre, University of Sydney, Sydney NSW Australia.

**Aims:** Perforation is the most serious complication associated with Wide Field Endoscopic Mucosal Resection (WF-EMR) of large colonic lesions. We aimed to describe the spectrum of deep mural injury (DMI) following WF-EMR, determine associated patient and procedural factors, propose a classification system and examine clinical outcomes in relation to this system.

**Methods:** Prospective data for WF-EMR of colorectal sessile polyps  $\geq 20$  mm (Feb 2010-July 2013) were analysed. Case notes and a comprehensive standardised photographic record were reviewed to confirm and further characterise DMI syndromes. A DMI classification score was proposed (Fig 1)

**Results:** WF-EMR was performed on 714 lesions (mean size 38.5mm, proximal colon 53.3%) in 625 patients (mean age 66.8 years). DMI features were identified in 57 patients (9.1%). Intraprocedural perforation occurred in 0.6%. A clinically significant perforation occurred in 1 patient. 86% of patients had same-day discharge, all without sequelae

On multivariable analysis, DMI types 3-5 were strongly associated with transverse colon location (OR 5.8 p.005), lesions with high-grade dysplasia (HGD) or submucosal invasive cancer (SMIC) (OR 3.6, p.008) and en-bloc excision (OR 2.9, p.029 95%CI 1.13-8.68)

**Conclusion:** After WF-EMR, DMI features are found in 9.1%. DMI is strongly associated with transverse colon location, HGD or SMIC and en-bloc excision. Defect classification guides the management of patients with DMI. The majority of patients can be safely discharged the same day.

### Sydney Classification of Deep Mural Injury (DMI) following WF-EMR

<b>Type 1</b>	Muscularis propria (MP) visible, but no mechanical injury
<b>Type 2</b>	Focal or generalized loss of the submucosal plane raising concern for MP injury or rendering the submucosal plane uninterpretable.
<b>Type 3</b>	MP injured, specimen target sign (STS) or defect target sign (DTS) identified
<b>Type 4</b>	Actual hole within a white cautery ring, no observed contamination
<b>Type 5</b>	Actual hole within a white cautery ring, observed contamination

## Exclusive enteral nutrition and reintroduction of solid food affect faecal microbiota composition: results of a pilot study

Wall CL<sup>1</sup>, Tannock GW<sup>2</sup>, Lawley B<sup>2</sup>, Otal A<sup>2</sup>, Garry RB<sup>1</sup>, Day AS<sup>1</sup>

<sup>1</sup>University of Otago, Christchurch and <sup>2</sup>University of Otago, Dunedin

Support received from Laurenson Fund and New Zealand Society of Gastroenterology

**Aims:** Dietary intake is known to affect faecal microbiota composition. Individuals have a microbiota with distinct compositions. The aim of this study was to document faecal microbiota changes during 8 weeks of exclusive enteral nutrition (EEN) and upon reintroduction of solid food in a group of patients with active Crohn's disease.

**Methods:** Patients aged 16 – 40 years old with newly diagnosed ileal or ileocolonic Crohn’s disease were recruited to undertake eight weeks of EEN. Stool samples were collected at weeks 0, 2, 4, 6, 8, 12 and 26. Faecal microbiota composition was analysed using 16S rRNA gene sequencing.

**Results:** The faecal microbiotas of 6 patients were analysed. The patients had microbiotas of unique bacterial compositions which changed while on EEN and again on reintroduction of solid food. The faecal microbiota of patients was grouped according to “community type”, at baseline four of the six patients had community type C whereas at week 8 all patients had community type C: absence of *Prevotella*, low abundance of *Bacteroides* and higher abundance of *Faecalibacterium* and *Ruminococcaceae*. Upon reintroduction of solid food, the faecal microbiota composition changed to a similar, but not identical, pattern to that seen at baseline. Despite individual microbiotas, bacterial species characteristic of EEN or solid food consumption were detected.

**Conclusions:** Based on the results of our pilot study faecal microbiota composition changed while on EEN and again on reintroduction to solid food but does not revert to original structure. Further research is required to ascertain the clinical significance of such changes.

## Factors associated with adverse outcomes of endoscopically excised malignant colorectal polyps

<sup>1</sup>Sekra A, <sup>1</sup>Ryniker E, <sup>1</sup>Ogra R

<sup>1</sup>Department of Gastroenterology, Middlemore Hospital, Auckland

**Background and Aims:** Management of patients following endoscopic excision of malignant colorectal polyps is debated. It is unclear whether they should have surgery or endoscopic surveillance. We aimed to assess factors associated with adverse outcomes of these polyps. Adverse outcomes were defined as endoscopic recurrence of cancer, cancer or nodal metastases in surgical specimen; or distant metastases on follow up.

**Methods:** Prospective database of endoscopically excised malignant polyps is maintained. Case notes were retrospectively reviewed.

**Results:** Complete data was available on 55 patients. Median age 73 years (range 46-90), 32/55 females.

26/55 proceeded to surgery. Surgical specimen of 10/26 with endoscopically negative margins showed no residual cancer. One had nodal metastases. This patient had lymphovascular invasion (LVI) on initial histology. Surgical specimen of remaining 16 with endoscopically positive margins showed cancer in 6/16. 2/16 had nodal metastases and 1/16 had distant metastases despite no cancer in surgical specimen. 7/26 died of unrelated cause with no recurrence after median follow up of 62 months. Remaining 9/26 had no recurrence after median follow up of 66 months.

29/55 did not have surgery. 22/29 had negative margins endoscopically. 1/29 had endoscopic recurrence after 6 months. This patient had positive margins endoscopically. 7/29 died of unrelated cause with no recurrence after median follow up of 45 months. Remaining 21 had no recurrence after median follow up of 78 months (range 4-133).

11/55 polyps had adverse outcomes. 8/11 had endoscopically positive margins ( $p=0.003$ ), 1/11 had LVI ( $p=0.002$ ), and 2/11 had both.

**Conclusions:** Factors associated with adverse outcomes of endoscopically excised malignant polyps are positive margins and LVI. These patients should undergo surgery. Patients who do not have these risk factors can be surveyed endoscopically.

## Colonoids – a model of the colonic epithelium in IBD?

Gadeock S, Shultz M, Butt G,

University of Otago

**Aims:** Increased permeability may contribute to the pathogenesis of Inflammatory Bowel Disease (IBD), but inflammation also increases intestinal permeability. Therefore, whether the permeability changes in IBD are a cause or consequence of inflammation is unknown. *In vivo*, the influence of the microbiota and immune system prevent investigation of the intrinsic details of the epithelium. Therefore, the development of colonic organoids was characterised to determine their suitability as a model to investigate the inherent properties of the intestinal epithelium.

**Methods:** Organoids were grown from crypts isolated from transverse colonic biopsies from healthy and IBD patients and grown in Matrigel plus stem cell media. Organoid structure was determined by light and electron microscopy, transcript levels of tight junction (TJ) proteins by qPCR, and quantification and localization of TJ proteins by immunoblotting and immunofluorescent microscopy. Statistical significance was determined by unpaired Student's *t*-test.

**Results:** After 4d only thin walled colonospheres were present, whereas after 15d colonospheres and thick walled colonoids were present. Colonospheres had an undifferentiated epithelium, whereas the colonoids had a well-developed polarised columnar epithelium, linked by TJs and consisting entirely of colonocytes without goblet cells. Despite the absence of polarisation, TJs were evident in colonospheres and the transcript levels of the TJ proteins, occludin, claudin-1-4, 7 and ZO-1, ZO-2, in colonospheres were not different from those in colonoids ( $n=6$ ). Consistent with this there was no significant difference in the expression of occludin, ZO-1 and claudin-2 in colonospheres and colonoids. Furthermore, in both the colonoids and colonospheres there was punctate staining of occludin and ZO-1 localized to the apical pole of the epithelial cells ( $n=3$ ). Similar results were obtained from IBD patients ( $n=3$ ).

**Conclusion:** Spontaneously maturing colonoids provide a colonocyte model, but their use in investigating the effects of IBD on the colonic epithelium maybe limited by the absence of goblet cells.

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## NKp30+ natural killer cells have enhanced cytotoxicity that protects blood transfusion recipients from acquiring hepatitis C infection

Ow MGM, Hegazy D, Warshaw U, Cramp, ME. Hepatology Research Group, Peninsula Schools of Medicine and Dentistry, Plymouth, UK

We recently identified a rare cohort of individuals who received hepatitis C (HCV)-contaminated blood products but did not become infected. Protection from HCV infection has been described in injecting drug users but not in transfusion recipients.

**Methods:** Recipients of HCV-infected blood pre-1991 were identified from the English Lookback programme. Eight exposed but uninfected recipients (EUs) who tested negative for anti-HCV and HCV RNA following exposure to blood products from an HCV-positive donor were identified. We examined innate and adaptive responses in the 8 EUs and compared them with 10 healthy controls, 10 spontaneous resolvers and 10 chronic HCV patients.

**Results:** Of 1340 cases who received HCV-infected blood, we identified 8 who had verified exposure without developing infection. Five of the 8 EUs received blood from donors who transmitted HCV to at least 2 other recipients, one transfused before and one after the EU subject. In the other 3 EUs, each

received blood products from single donations that were split into different components and transfused to others who became infected.

EUs had higher percentages of circulating NK cells than healthy controls and those with chronic infection ( $p < 0.01$ ). NK cells of EUs expressed higher levels of the activating receptor NKp30 relative to other groups ( $p < 0.05$ ). Expression of killer immunoglobulin-like receptor KIR2DL3 was also increased on CD56<sup>bright</sup> NK cells of EUs relative to other groups ( $p < 0.05$ ).

NK cells of EUs had enhanced cytotoxicity relative to healthy controls and chronically infected patients ( $p < 0.05$ ). Cytotoxicity was correlated with the expression of NKp30 ( $p = 0.02$ ). T cell responses to HCV antigens were minimal in EUs.

**Conclusion:** Protection from HCV infection is rare following transfusion-related exposure. NK cells of EUs are readily activated with increased NKp30 and enhanced cytotoxicity. T cell responses did not play a significant role. Innate immunity is key to conferring protection from HCV infection.

## Ethnic disparity in incidence and outcome of biliary atresia in New Zealand children

Helen M Evans, Hayley Wong\*, Sonja Farthing, Philip Morreau

Starship Children's Hospital, Auckland and \*Department of Paediatrics, University of Auckland

**Background:** Biliary atresia (BA) is the commonest liver disease in infancy. Incidence in Europe and North America is approximately 1/20,000 live births but commoner in Taiwan (1/8000) and French Polynesia (1/3000). Corrective Kasai portoenterostomy can prevent or delay the need for liver transplantation (LT) but is most successful if performed before 6-8 weeks of age.

**Aim & methods:** To investigate the incidence of BA in children presenting to Starship Hospital 2002-2013 using casenote review and comparison to Statistics New Zealand birth rate data for Auckland-born children. Ethnicity was recorded according to parental report. Outcomes for Kasai success (bilirubin  $< 20$  mmol/L by 6 months), need for liver transplantation and overall survival were calculated overall and according to ethnicity.

**Results:** 75 children (36M; 39F) presented with BA. Ethnicity was European in 25 (33%), Maori in 31 (41%), Pacific in 12 (16%), South East Asian in 4 (5%) and Other in 3. Overall incidence was 1/8,002 but 1/17,893 for European babies and 1/5,430 for Maori children. Maori babies presented earlier than European babies (median 31 days versus 46 days), were more likely to have a successful outcome following Kasai (62% successful versus 20%) and proceeded to LT later (4.8 years compared to 0.8 years). Need for LT was high overall with transplant-free survival being 70%, 49% and 30% at 1, 2 and 5 years of age respectively but overall survival was 92%, 87% and 86% at these timepoints.

**Conclusions:** BA is commoner in New Zealand likely due to an excess incidence in Maori children who have better outcomes related to earlier presentation and operation. It is important that Maori infants with prolonged jaundice are promptly investigated for BA.

*Hayley Wong received a Summer Studentship from the University of Auckland for her participation in this project*

## Rising incidence of hepatitis C-related hepatocellular carcinoma and impact of surveillance

Shaik R<sup>1</sup>; Gane E<sup>1</sup>

<sup>1</sup>NZ Liver Transplant Unit, Auckland City Hospital

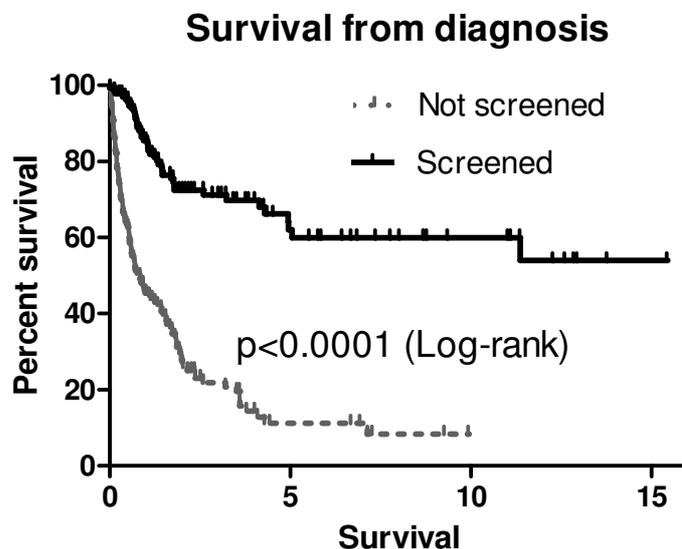
**Aims:** To determine rates of hepatocellular carcinoma (HCC) in patients with chronic hepatitis C (HCV) and impact of regular surveillance on treatment outcomes and overall survival.

**Methods:** A retrospective analysis of all HCC patients referred to NZLTU from 1999-2014.

**Results:** 1326 new HCCs were diagnosed, of whom 286 were HCV-related. Number of HCV-HCCs increased from 1/27 (3.7%) in 1999 to 47/183 (25.7%) in 2013. 126 (44.06%) HCV-related HCCs were detected by surveillance whilst remaining 160 (55.94%) were diagnosed incidentally or following onset of symptoms. Of 160 symptomatic or incidentally picked up cases, 31 were not known to have prior diagnosis of HCV, 76 were diagnosed with HCV and known to have cirrhosis but lost to follow-up and 53 were diagnosed with HCV but thought to be non-cirrhotic. Of the 53 non-cirrhotic patients, 35 never underwent staging with either biopsy or a fibroscan. At most recent staging of remaining patients 6/18 had severe fibrosis (F3 or LSM>9.5 kPa), 8/18 had moderate fibrosis (F2 or LSM>7.1 kPa) and 4/18 had mild fibrosis (F0/F1 or LSM<7.1 kPa).

At time of detection, 101/126 (80.1%) screen-detected HCCs were suitable for curative interventions compared to 63/160 (39.3%) not detected through screening.

**Conclusions:** HCV has become the leading cause of HCC in New Zealand. Unfortunately, more than half HCCs are only diagnosed following onset of symptoms or incidentally, when advanced stage precludes curative intervention and reduces survival. More frequent staging with a liver biopsy or fibroscan is needed with regular surveillance in all HCV cirrhotic patients.



## Hepatitis B e-Antigen (HBeAg) loss with antiviral therapy in South Auckland population: a large retrospective analysis

<sup>1</sup>Sekra A, <sup>1</sup>Young J, <sup>1</sup>Gerred S, <sup>1</sup>Upton A, <sup>2</sup>Gane E

<sup>1</sup>Department of Gastroenterology and Hepatology, Middlemore Hospital, Auckland

<sup>2</sup>New Zealand Liver Transplant Unit, Auckland City Hospital, Auckland

**Background and aim:** HBeAg loss and the development of Anti-HBe antibodies (seroconversion) is an important event during the course of chronic hepatitis B virus (HBV) infection. Loss of HBeAg is typically associated with a sustained fall in viral load and resolution of hepatic inflammation. HBeAg seroconversion rates after one year of anti-viral therapy have been reported in 12% to 21%. We aimed to assess HBeAg seroconversion rates in the South Auckland population.

**Methods:** A prospective database of all the patients with chronic HBV infection has been maintained since 1998. Data on patients who were HBeAg positive at baseline were obtained retrospectively for this audit.

**Results:** We identified 597 patients with positive HBeAg serology. HBeAg loss was detected in 328/597 (55%) patients after median follow-up of seven years. 235 (72%) of those who had HBeAg loss had raised ALT and received anti-viral treatment. Median time to HBeAg loss was 9 months in this group. 80/235 discontinued anti-viral therapy after median of 2 years following HBeAg loss. 77 (96%) remain HBeAg negative off therapy after median follow up of 6 years. 69/80 patients had follow up HBV DNA levels and all were <2000 IU/ml.

93/328 (28%) with normal ALT had spontaneous HBeAg loss with median time to HBeAg loss of 13 months. 83/93 (89%) remain HBeAg negative after median follow up of 6 years.

**Conclusion:** HBeAg relapse rates are low with or without treatment. Patients who have sustained HBeAg loss on antiviral therapy for two years can be considered for cessation of anti-viral therapy.

## Tumour secretion of integrated hepatitis B surface antigen post transplant: case series

Shaik R<sup>1</sup>, Kramer N<sup>2</sup>, Abbott WG<sup>1</sup>, Gane E<sup>1</sup>

<sup>1</sup>NZ Liver Transplant Unit, Auckland City Hospital

<sup>2</sup>Department of Anatomical Pathology, Auckland City Hospital

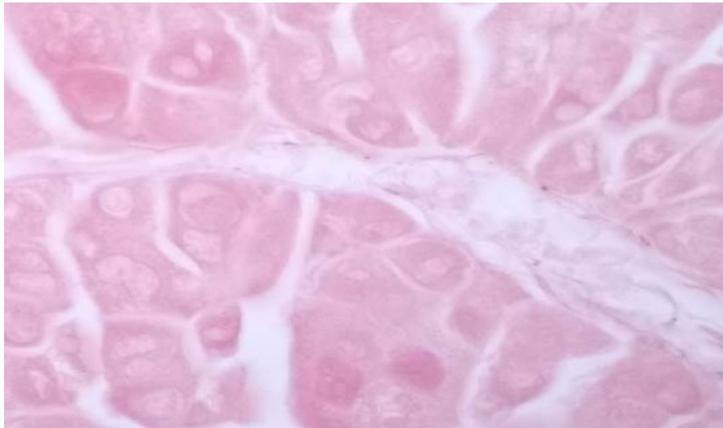
**Aims:** Prior to highly effective antiviral prophylaxis, reappearance of serum Hepatitis B surface antigen (HBsAg) following liver transplantation for HBV was often accompanied by recurrence of hepatocellular carcinoma (HCC) suggesting that HCC recurrence is a direct consequence of HBV reinfection. This hypothesis is challenged by recent observations that HBV DNA remains undetectable in serum.

**Methods:** At NZLTU, 55/478 adult liver transplants were performed for HBV-related HCC, of whom 6 developed recurrent HCC. In 4 cases, HCC recurrence was accompanied by reappearance of HBsAg in serum without detectable HBV DNA. These cases have been studied in detail.

**Results:** The first 2 cases presented >6 years posttransplant with symptomatic advanced tumour and both died within 3 months. The remaining 2 cases presented <3 years with palpable subcutaneous masses, reflecting pretransplant seeding at the site of percutaneous procedures (needle track from a diagnostic biopsy and laparoscopic RFA). Both were treated with local resection and switch to sirolimus. Serum HBsAg disappeared following resection. In the recent patient, the excised tumour stained positive for HBsAg. Molecular studies are ongoing to determine whether tumour tissue

contains the HBs gene, closed circular (ccc) DNA, HBV replicative intermediates, HBsAg mRNA and integrated HBsAg DNA.

**Conclusions:** This case series demonstrates for the first time that the reappearance of HBsAg in serum following recurrence of HBV-related HCC is not due to recurrent HBV infection. Rather, this reflects expression of HBs protein from transcription of integrated HBs gene within tumour tissue. This observation may help improve tumour surveillance post-liver transplantation for HBV related HCC.



**Fig 1:** Cytoplasmic Orcein positivity in a perinuclear location within tumour cells, consistent with HBsAg production

## Growth, body composition & bone density post paediatric liver transplant

Sheikh A<sup>\*</sup>, Evans H M<sup>\*</sup>, Cundy T<sup>^</sup>

<sup>\*</sup> Starship Children's Health, Auckland District Health Board

<sup>^</sup> University of Auckland, Faculty of Medical & Health Sciences

*Research grant obtained from the New Zealand Society of Gastroenterology*

**Aims:** Cholestatic liver disease and consequent liver failure is the most common indicator for paediatric liver transplant (LT). These patients are often vitamin deficient & malnourished pre-transplant, with significant corticosteroid exposure post-transplant. There are no long-term studies assessing bone acquisition post-transplant. There is also increasing evidence of obesity and metabolic syndrome post-LT. Our study aimed to assess growth, body composition and bone density in patients post paediatric LT.

**Methods:** Body composition and bone densitometry scans were performed on 21 patients (12 male). Pre and post-transplant anthropometric data were analysed on all patients. Physiological bone health was assessed using serum alkaline phosphatase, calcium, phosphate & procollagen-1 N-peptide levels. Median age at transplant and at this assessment was 2.7 and 10.6 years respectively. Indications for LT included cholestatic liver disease (16/21), acute liver failure (3/21), paracetamol overdose (1/21) & metabolic disorders (1/21).

**Results:** Physiological markers of bone health were normal in all patients. 2 patients (transplanted for ALF) had reduced bone density; 19 were normal.

Anthropometrics	Pre-transplant median z-score (range)	Post-transplant median z-score (range)	Delta Median (range)
Weight	0.6 (-0.52 to 2.17)	0.58 (-1.53 to 2.68)	-0.28 (-1.76 to 2.01)
Height	-0.85 (-3.62 to 2.81)	0.09 (-2.01 to 1.95)	0.87 (-2.35 to 3.71)
Body Mass Index	1.8 (-0.19 to 3.93)	0.76 (-0.76 to 3.08)	-0.53 (-3.25 to 2.03)

### Total Body Fat % Post-transplant

	Number (percentage)
Underweight (<2 <sup>nd</sup> centile)	2 (9.5)
Normal (2 <sup>nd</sup> – 85 <sup>th</sup> centile)	6 (28.6)
Overweight (>85 <sup>th</sup> centile)	5 (23.1)
Obese (>98 <sup>th</sup> centile)	6 (28.6)

**Conclusions:** Bone density is preserved post paediatric LT despite significant corticosteroid exposure, with good catch-up growth, particularly height, which is reassuring. However, 11/21 patients (52%) were either overweight or obese post-transplant potentially placing them at an increased risk of developing metabolic syndrome and its sequelae in later life. Further studies are required to corroborate these findings.

## Association of NOD2 mutations with disease phenotype in an Otago cohort of patients with Crohn's disease

Lim MH<sup>1</sup>, Phipps-Green M<sup>2</sup>, Merriman T<sup>2</sup>, Schultz M<sup>1,3</sup>

<sup>1</sup>Gastroenterology Unit, Dunedin Hospital, Southern District Health Board, Dunedin, <sup>2</sup>Department of Biochemistry, University of Otago, Dunedin and <sup>3</sup>Department of Medicine, Dunedin School of Medicine, Dunedin

**Background:** The presence of NOD2 mutations in patients with Crohn's disease (CD) has been associated with a younger age of disease onset, ileal involvement and stricturing/penetrating disease as well as surgery.

**Aim:** To document the NOD2 prevalence and analyse the association with phenotypic characteristics.

**Methods:** CD patients in Otago were prospectively recruited between 01.03 – 31.05.2014. Blood (10mL) was collected from each patient for DNA extraction and genotyping for the three most common NOD2 mutations i.e. R702W (rs2066844), G908R (rs2066845) and 1007fs (rs2066847) using Taqman PCR. Phenotypic data was obtained retrospectively using paper and electronic medical records. Patients were phenotyped according to the Montreal classification. Disease severity was judged according to prescription of immunomodulators and surgery.

**Results:** 71 CD patients (34 female) were recruited, mean age of diagnosis was 32 years (range 2-73). 64 patients (90%) had immunomodulators prescribed and 37 patients (52%) had surgery. 12 patients (17%) were NOD2 positive (11 simple heterozygotes, 1 compound heterozygote). Allelic frequencies for R702W and G908R were 0.063 and 0.028 respectively. None of the patients had the 1007fs mutation. Mean age of diagnosis was significantly younger for CD patients with NOD2 mutations (26 versus 34 years old, p=0.003). There was no statistically significant difference between NOD2 positive and negative groups for more severe outcomes although there was a trend towards

stricturing/penetrating disease (67% versus 51%,  $p=0.16$ ) and having had bowel resection (58% versus 37%,  $p=0.11$ ) for NOD2 positive CD patients. There was no difference in immunomodulator prescription between the two groups.

**Conclusion:** Allelic frequencies for R702W and G908R were comparable with previous NOD2 studies in New Zealand. NOD2 positivity was associated with a younger age at diagnosis and a trend towards more complicated disease behaviour and patients having had bowel resection in our small cohort of CD patients.

## Does computerised cognitive behavioural therapy help people with inflammatory bowel disease? A randomized controlled trial

McCombie, AM\*, Mulder, RT\*, and Geary, RB\*.

\*University of Otago, Christchurch

**Background and Aims:** Psychotherapy, especially cognitive behavioural therapy (CBT), may be a useful intervention for at least some inflammatory bowel disease (IBD) patients, especially those with psychiatric comorbidities. However, CBT can be financially and practically difficult to access. These difficulties can be overcome by computerised CBT (CCBT). This is a randomized controlled trial of a CCBT intervention for IBD patients. It is hypothesised that CCBT completers will have an improved health-related quality of life (HRQOL), anxiety, depression, stage of change, coping strategies, perceived stress, and IBD symptoms relative to people not allocated to the CCBT.

**Methods:** IBD patients were randomly allocated to CCBT ( $n=113$ ) versus treatment as usual (TAU;  $n=86$ ). Inflammatory bowel disease questionnaire (IBDQ) at twelve weeks after baseline was the primary outcome while generic HRQOL, anxiety, depression, stage of change, coping strategies, perceived stress, and IBD symptoms were the secondary outcomes. Outcomes were also measured at six months after baseline.

**Results:** Twenty-nine CCBT participants (25.7%) completed the CCBT. IBDQ was significantly increased at twelve weeks in CCBT completers compared to TAU patients ( $F=6.38$ ,  $p=0.01$ ). SF-12 mental ( $F=5.00$ ,  $p=0.03$ ) and the action stage of change ( $F=4.86$ ,  $p=0.03$ ) were also significantly better in CCBT compared to TAU patients at twelve weeks. These outcomes were no longer significant at six months after baseline.

**Discussion:** Improvements in IBDQ scores at twelve weeks after baseline were not maintained at six months. The high dropout rate from the CCBT was of concern and future research should aim to improve adherence rates.

## New scoring systems on factors predictive of requirement for endoscopic therapy in patients presenting with upper gastrointestinal haemorrhage: a prospective study in Waikato Hospital

Chan HS, Smith AC

Waikato Hospital.

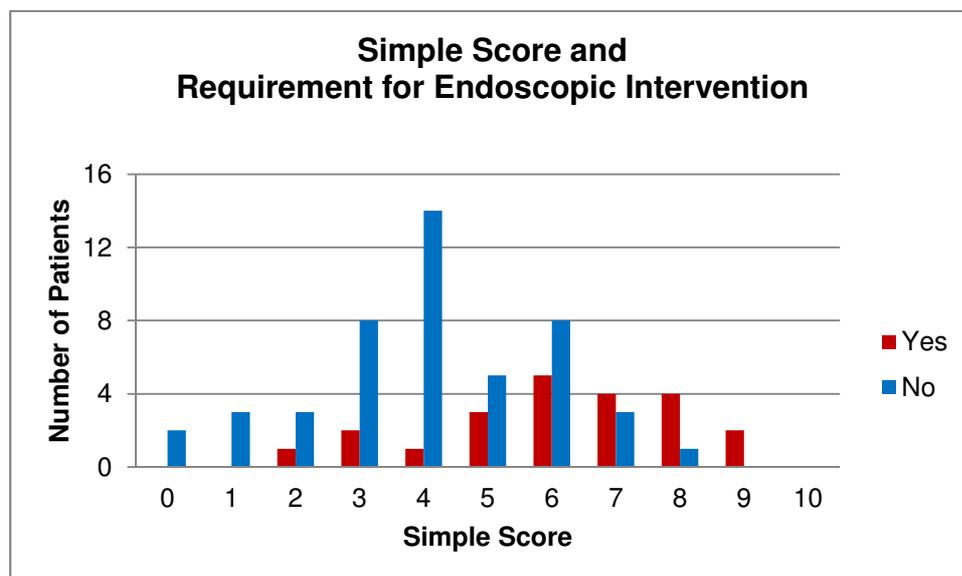
**Introduction:** Endoscopic treatment of high-risk lesions reduces mortality in upper gastrointestinal haemorrhage (UGIH). The Rockall score and Blatchford score predict mortality and need for in-hospital treatment (transfusion, endoscopic or operative intervention inclusive) respectively.

New scoring systems have been derived to specifically predict requirement for endoscopic therapy (RET) in UGIH, assisting in triaging endoscopy.<sup>1</sup>

**Aim:** To validate the mentioned scoring systems in predicting RET.

**Methods:** Prospective data collection on all UGIH cases presenting to Waikato Hospital from 01/01/2014 to 31/05/2014. Patients with known cirrhosis or previous bleeding event(s) during study period were excluded. The scoring systems were applied (Simple Score: fresh haematemesis=2, fresh melaena=2, haemoglobin <130=2, urea >10=1, BP <100=1, male sex=1, history of peptic ulcer disease=1).

**Results:** 69 patients were identified, 47 were male, 19 were Maori, median age was 71 (range 21-97). 22 cases exhibited RET, rates were 11.8% (4/34) and 51.4% (18/35) for Simple Scores  $\leq 4$  and  $>4$  respectively. Lesions included 12 peptic ulcerations with stigmata of recent haemorrhage, 10 vascular lesions and no varices.



**Conclusions:** Interim results parallel with reported trend of requiring endoscopic intervention once Simple Score  $>4$ , longer period of study and external validation are warranted for statistical analysis.

<sup>1</sup>Irwin J, et al. *Frontline Gastroenterology* 2014;5:2-9

## An overview of upper gastrointestinal bleeding and assessment of referrals to endoscopy unit at BOP DHB

Karim S<sup>1</sup>, Chin J<sup>1</sup>, Claydon A<sup>1</sup>, Cunliffe R<sup>1</sup>

<sup>1</sup>Department of Gastroenterology, Tauranga Hospital.

**Aims:** Acute upper gastrointestinal bleeding (UGIB) is a common medical emergency with significant morbidity and mortality risks. In this audit, we assess our local cohort's characteristics and referrals made by other services for urgent endoscopy.

**Method:** A prospective audit of all referrals made for urgent endoscopy between June and December 2013. Patients' demographics, inpatient vs new admission, medications, comorbidities, Glasgow-Blatchford Score, time to endoscopy, diagnosis, endotherapy, length of stay, rebleed rate, transfusions and mortality were recorded. Referral forms were assessed for whether Glasgow-Blatchford Score, medications and blood results were fully documented by referring team.

**Results:** 95 cases were identified; 70.5% male, average age of 73.2 and 53.7% were already inpatients. 25.3%, 19%, 45.3% and 18.9% were on PPI, NSAIDs, anti platelets and anti coagulation treatment respectively. Peptic ulcer disease (PUD) was the commonest cause (33.7%) followed by gastritis, oesphagitis and variceal disease (8.4%, 8.4% and 3.2% respectively). Rebleeding was noted in 5.3% of which 80% were new admissions, had Glasgow score of >10 and had transfusions on admission. Overall, 22% of patients required endoscopic treatment and only 1 case required surgical intervention.

Average time to endoscopy was 1.2 days; average length of stay was 10.2 days. Mortality rate of 6.3%; the majority were current inpatients.

Only 62.1%, 56.8%, 67.4% and 39% of referrals had Glasgow-Blatchford score, blood results, patients' medications and a coagulation screen documented respectively.

**Conclusion:** UGIB remains a common condition with relatively high mortality and significant length of stay especially amongst inpatients. Our data correlates with international studies e.g. BSG audit of UGIB in 2011. Poor information on referral forms limits proper triaging of urgent endoscopies.

## High dose vitamin D therapy in children with IBD is effective and safe

Shepherd D, Day AS, Leach ST, Lopez R, Messenger R, Whitehead HJ, Lemberg DA.

School of Women's and Children's Health, UNSW Medicine, Sydney, Australia; Department of Gastroenterology, Sydney Children's Hospital, Randwick, Sydney, Australia; Department of Paediatrics, University of Otago, Christchurch, Christchurch, New Zealand.

**Aims:** Vitamin D deficiency is commonly seen in children with IBD. Intermittent high dose (STOSS) therapy has not previously been evaluated in paediatric IBD. This retrospective study aimed to assess the impact of STOSS therapy upon vitamin D status and disease activity.

**Methods:** The records of children with IBD were reviewed to determine those with Vitamin D deficiency managed with STOSS therapy. Children were administered up to 800,000 units of Vitamin D as a single dosage according to an age based protocol. The background characteristics of the children, response to therapy, side-effects and requirement for repeated dosing were reviewed. Disease activity was also noted.

**Results:** 76 children with IBD were identified to have had a total of 99 STOSS treatments (22 children had more than one course) with no toxicity noted. Mean 25-OHD levels were 40.8 (7.5) nmol/L at baseline, rising to 145.6 (51.8) nmol/L 1 month following STOSS therapy. All subjects had a 25-OHD level greater than 50nmol/L at 1 month, whilst this level was seen in 96.6% at 3 months and 76.4% at 6 months. Paediatric Crohn disease activity index (PCDAI) scores reduced from a mean of 10 [0-47.5] to 2.5 [0-85] after 6 months ( $p=0.0013$ ). Albumin and haemoglobin levels also improved.

**Conclusions:** Single high-dose therapy for children with IBD effectively and safely corrects vitamin D deficiency in children with IBD. Clarification of dosage and timing for scheduled repeat dosing requires further evaluation. Optimised vitamin D status may be associated with better disease control: further prospective studies are required.

## Evolving endoscopic management options for symptomatic stenosis (SS) post-laparoscopic sleeve gastrectomy (LSG) for morbid obesity: CMDHB experience

<sup>1</sup>Sekra A, <sup>1</sup>Kini G, <sup>1</sup>Ogra R

<sup>1</sup>Department of Gastroenterology, Middlemore hospital, Auckland

**Background and Aims:** SS is an increasingly recognised complication following LSG to treat obesity with a reported prevalence between 0.1 and 3.9 %. There are no clear guidelines on management of this. We aimed to determine the prevalence and management options for SS after LSG.

**Methods:** A total of 857 patients underwent LSG at CMDHB between May 2008 and June 2013. All cases referred for management of SS after LSG were recorded.

**Results:** SS developed in 26/857(3.03%) following LSG confirmed by barium swallow. 3/26 patients developed a fixed stenosis in proximal stomach. These were all successfully treated by one dilatation of controlled radial expansion (CRE) balloon of <20 mm. 23/26 had a fixed stenosis at incisura angularis. 7/23 had short strictures (<3cm). 6/7 were successfully dilated by a CRE balloon and one improved after 30mm achalasia balloon dilatation. 16/23 had long strictures (>3cm). 9/16 were initially dilated with CRE balloon with symptomatic improvement noted only in 1 patient. Out of remaining 8 symptomatic patients, 6 were successfully dilated with achalasia balloon and 2/8 had self-expandable metal stent (SEMS) with resolution of symptoms. CRE balloon failure with long strictures was 89% (p<0.002). 7/16 were dilated with 30mm achalasia balloon directly with symptomatic improvement in 5/7 patients. Remaining 2 had temporary SEMS with resolution of symptoms. None of the 26 patients required a surgical procedure to correct their stenosis.

**Conclusions:** Use of a 30mm achalasia balloon and SEMS is an effective and safe treatment for patients with SS post-LSG who do not respond to standard dilatation. Achalasia balloon could be the first-line treatment in patients with longer stricture (>3cm) at the incisura angularis.

## The cytological diagnostic yield of endoscopic ultrasound (EUS)-guided fine needle aspiration/biopsy (FNA/B)

Pandey, R. Russell, C. Craik, J. Rodgers, MR. Walmsley, RS.

North Shore Hospital, Auckland

**Aims:** To determine cytological diagnostic yield (CDY) of EUS-FNA/B and compare to International Standards.

**Methods:** Retrospective analysis of pathology and endoscopy databases of all EUS FNA/B cases 2008-2014 was performed. Data collected included: site of lesion, endosonographic diagnosis, needle used, number of passes, and final histological diagnosis. Where available and relevant, data referring to corresponding radiology, tumour markers, and follow up was obtained.

**Results:** 218 EUS-FNA/Bs were undertaken (110 male, 108 female). The mean age of patients was 62.8 years (range 25-88). 170 EUS-FNA/Bs were of solid lesions; 48 were of pancreatic cysts. Needle gauges were 19, 22 or 25. The mean number of passes was 3 (range 1-8).

Figure 1 below shows the breakdown of EUS FNA/Bs by site, positive CDY as well as malignant diagnosis.

For solid lesions, 53.5% of all diagnoses were malignant. 17.1% were inconclusive, non-diagnostic, non-specific, or morphologic cytological descriptions only. 0.6% were insufficient, with no histology available for 1.2%. Overall, the positive CDY was 80%.

CDY for major lesion groups were: mediastinal lymph nodes 91%, pancreatic cysts 27%, solid pancreatic lesions 80%, left adrenal lesions 83%.

**Conclusions:** This data is in keeping with the limited published series from major international EUS centres. It is also above the standards of Quality Performance Indicators for EUS upheld by the ASGE and JAG, and proposed for New Zealand.

## Increased colorectal cancer risks during follow up in patients with serrated polyposis syndrome (SPS): a single centre study

<sup>1</sup>Sekra A, <sup>1</sup>Ogra R

<sup>1</sup>Department of Gastroenterology, Middlemore Hospital, Auckland

**Background and aims:** Patients with SPS follow an accelerated pathway to develop colorectal cancer (CRC). The optimal surveillance interval for colonoscopy is still debated. We aimed to review our patients with SPS and timing of development of interval CRC.

**Methods:** A prospective database of all patients with SPS was maintained and reviewed retrospectively. Endoscopy and histopathology reports were collected to evaluate frequency of endoscopic surveillance and to obtain information regarding polyp and presence of CRC.

**Results:** In 40 patients with SPS, 1398 polyps were identified during a median follow up of 1.5 years. The median duration of surveillance colonoscopy was 19.6 months. In 13 (32.5%) patients CRC was detected of which 8 (20%) at index colonoscopy. CRC was detected during surveillance in 5 patients (cumulative incidence: 12.5%) after a median follow up of 10 years and a median surveillance colonoscopy interval of 5 years. The cumulative risk of CRC under surveillance was 7.5% at 5 years. An increasing number of sessile serrated polyps (SSP) (OR 3.79, 95% CI 1.6-9.2; p=0.001) was significantly associated with CRC presence. Increasing number of proximal SSP (OR 1.73, 95% CI 1.05-2.97, p=0.01) was significantly associated with interval CRC development.

**Conclusions:** SPS patients have risk of developing interval CRC despite being on surveillance. Increasing number of proximal SSP is strongly associated with interval CRC development. The number of serrated adenomas is positively correlated with presence of CRC in SPS, thus supporting a "serrated pathway" to CRC. To prevent development of CRC adequate detection and excision of these polyps is important. If this is not feasible then surgical resection should be considered.

## Association between obesity and colonic adenoma

**Namasivayam V** (Singapore General Hospital), Assam PN, (Duke-NUS graduate Medical School), Wan WK (Singapore General Hospital), Lim KH (Singapore General Hospital), Rafay A (Singapore General Hospital), Wong WY (Singapore General Hospital), Connolly J (Institute of Molecular and Cell Biology)

Study was supported by Nurturing Clinician Scientist and Khoo Pilot awards

**Aims:** Colon cancer is the number 1 cancer in Singapore with mortality rates comparable to the West. Colon carcinoma is related to obesity and physical inactivity. Regular exercise can reduce the likelihood of colon carcinoma. Epidemiological evidence supports an association between obesity & colon carcinoma. We seek to determine in a pilot study the relationship between colon adenoma status and obesity (as defined by Asian BMI of 27.5 or more) in a Singaporean cohort.

**Methods:** Consecutive outpatients aged 45-70 years scheduled for colonoscopy were prospectively interviewed by a trained research coordinator. Anthropometric measurements and detailed medical histories were obtained. Validated questionnaire (IPAQ) was administered to characterize their physical activity patterns. Colonoscopy findings were prospectively obtained. Standard statistical methods were used to determine the relationship between colonic adenoma and obesity.

**Results:** 121 patients were studied. 31 were excluded because of poor bowel preparation (Boston bowel preparation score of less than 6). 90 patients were analysed. 49 were males (54.4%) Median age was 57.5 years (range 46-69). 19 patients (21.1%) had colonic adenoma. Median BMI is 23.4 (range 18-37). 15.6% were obese.

The prevalence of adenoma in obese patients was non-significantly higher than in the non-obese (28.6% vs 19.6%  $p=0.34%$ ).

**Conclusion:** The prevalence of colonic adenoma is associated with obesity status in a non-significant manner. Larger studies are needed to clarify the association.

## Management of chronic pancreatitis at CMDHB: inter-rater agreement of management between surgeons and gastroenterologists and comparison with American Pancreatic Association (APA) guidelines

<sup>1</sup>Sekra A, <sup>1</sup>Ho Charles, <sup>1</sup>Luo D

<sup>1</sup>Department of Gastroenterology, Middlemore hospital, Auckland

**Background and Aims:** Chronic pancreatitis is an inflammatory condition resulting in impairment of exocrine and endocrine function. We aimed to analyse agreement of management between surgeons and gastroenterologists at CMDHB and compare adherence with APA guidelines.

**Methods:** Cases were identified retrospectively by searching clinical coding database for ICD-10 codes for chronic pancreatitis from 1/1/2008 to 31/12/2013. Their demographics, symptoms, and management strategies were recorded. Kappa coefficient was measured to express agreement of management between surgeons and gastroenterologists. Adherence to APA guidelines was calculated.

**Results:** 125 patients were identified. Mean age was 57 (range 25-98 years). 63% were male. 44/125 managed by gastroenterologists and 81/125 by surgeons. Results are summarised below.

Symptoms	APA guidelines	Management at CMDHB	Adherence to APA guidelines	Kappa coefficient (agreement between surgeons and gastroenterologists)
Pain Management a) Opiate use b) Gabapentin use c) Pancreatic enzyme replacement therapy(PERT)	Tramadol should be first line opiate Should be used in patients who use opiates chronically Should not be used for pain	37/58 0/58 8/81	64% 0% 10%	0.148 (poor) N/A 0.39 (fair)
Alcohol cessation advise	For all with alcoholic pancreatitis	62/64	97%	-0.06(poor)
Smoking cessation advise	For all smokers	61/68	90%	0.01 (poor)
Steatorrhoea management Stool fat measurement b) PERT	Not necessary Everyone should have it	14/19 had faecal testing 10/19	N/A 52%	N/A 0.184 (poor)
Dietician referral	Everyone should be referred	58/125	46%	0.248 (fair)

<http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2015/vol-128-no-1408/6424>

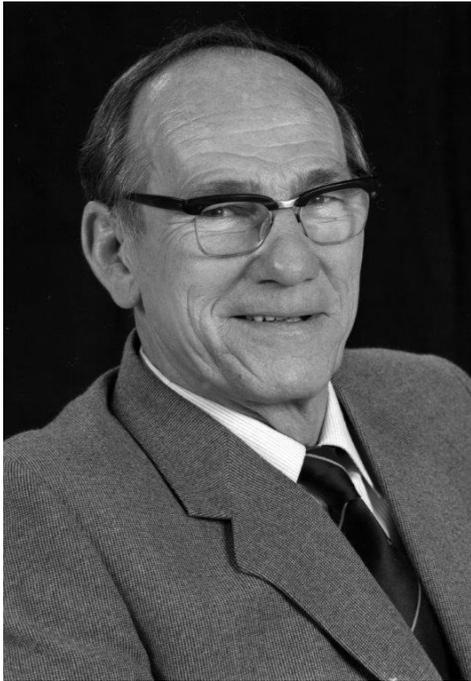
**Conclusions:** There was a significant discrepancy in the management of chronic pancreatitis at CMDHB and there was poor adherence to APA guidelines. There is a need for establishment of guidelines for standard and consistent care of these patients.

## OBITUARY

**David John (Jack) Gudex**

*31 January 1920 – 30 November 2014, MB ChB (NZ) 1945; MRCP (Edin) 1953, FRCP (Edin) 1971; MRCP (Lond) 1954, FRCP (Lond) 1977; MRACP 1965, FRACP 1969*

Jack Gudex was born in Hamilton, the elder son of Emilie and Michael Gudex, and brother of Bob and Jean. His younger brother, Bob, was a Waikato Hospital obstetrician and gynaecologist, and a longstanding member of the Waikato Hospital Board and the Medical Council of New Zealand.



He attended Hamilton West School, Hamilton High School and Otago University where he graduated MB ChB in 1945. He was a good all-round sportsman and a New Zealand University Rugby Blue.

After graduation he spent two to three years as a house surgeon and registrar at Waikato Hospital, before joining Dr WC (Wilf) Mills in general practice in Frankton, where he spent over four years in all aspects of general practice, including a visiting anaesthetist position at Waikato Hospital.

In 1947, he married his first wife, Norma (nee Bicknell) and subsequently had two children, David (a radiologist in Sydney) and Adrienne. A second son, John, died in infancy. Norma died in 1997.

After spending two years (1952–1954) with his family in postgraduate studies in Edinburgh and London, he returned to New Zealand to set up as a consultant physician in Hamilton in 1954.

In 1955, he was appointed a part-time visiting physician to Waikato Hospital, a position he held until retirement in 1979. In his hospital role, he developed a special interest and expertise in endocrinology in collaboration with Dr Kaye Ibbertson in Auckland and initially established this as a local speciality until the appointment of a specialist endocrinologist in 1979. He presided over much of the specialisation in medicine at Waikato Hospital in the 1960s and 1970s, in particular as Chairman of Medicine, a position he held for nine years.

His longstanding associations in the community, wide experience in general practice, and personal empathy conferred particular credibility as a competent general physician. He was involved in the care of many colleagues and their families, and has been referred to as “the physicians’ physician.”

It was as a respected “father figure” physician in the community that Jack particularly made his mark, and where his heart lay. He came from a prestigious Hamilton family, his father a renowned language scholar and botanist, and senior master at Hamilton High School. This family background and his education at Hamilton West School and Hamilton High School stood him in good stead when he returned to Waikato Hospital as a medical student, house surgeon, registrar, and subsequently launched into private practice after general practice and postgraduate experience.

Jack had an open friendly manner and he was an empathic listener, willing to give freely of his time. His personality and broad general experience and professional judgement inevitably lead to the care of many colleagues and their families.

<http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2015/vol-128-no-1408/6425>

He was a prominent Rotarian, and as a member of the Board of Trustees of the DV Bryant Trust Board strongly backed the development and financial support of a major education centre at Waikato Hospital.

He retired to Waiheke Island where he tended an orchard and farmed a few head of stock. Never one to stand still when there were things to be done, he was active till the end.

He is survived by second wife Shirley (nee Appelton), a former Otago classmate who he married in 2005, one son, one daughter, six grandchildren and one great-grandchild.

Peter Rothwell (retired physician) and Roy Bourke (journalist) of Hamilton wrote this obituary.

## OBITUARY

## Meredyth Colston Gunn (nee Wilson)

Born 2 May 1925. Died 8 September 2014.

Dr Meredyth Gunn was one of only 15 women in her class at University of Otago in 1944. Meredyth grew up in Te Kuiti.



Her mother Mabel was a graduate from the University of New Zealand (Auckland) and had a double MA in Art and History. She had taught at Opotiki School where she met Norman who was the son of the Headmaster, Henry Wilson. Norman had served in WW1 and been awarded the Military Cross. Meredyth was the first born of three daughters.

During her high school years at Te Kuiti High School where Mabel was also a teacher she showed an interest in medicine and so for the last two years of high school she attended Hamilton High School in order to learn the required Latin.

In 1943 she went to university in Auckland, for the intermediate year and was then successful in gaining entry to medicine in Otago in 1944.

It is not an understatement to say that Meredyth had a challenging time completing her medical studies. She had to repeat her first year in Otago as she had a ruptured appendix

close to exams and had a slow recovery. Then in 4th year she married (Bryce Malcolm Gunn) and had her first of four children.

In those days many women medical students left medical school when they married, let alone an unplanned baby. However Meredyth continued her studies and was fortunate to have a mother in law who looked after the baby (Graeme) in Wellington while she returned to Otago for her 5th year. That can't have been easy. She was able to do her 6th year in Wellington but unfortunately also had to repeat the year. Finally she completed her medical studies after repeating 6th year and her second child (Diana) was born in the following January. Her medical studies took two extra years to complete and by the end of her studies she had married and had two children.

Her first year after graduation was as a school doctor and where she was paid more than Bryce who was a house officer in Palmerston North at the time. After two years they moved to Coromandel where they were the only doctors north of Thames and provided medical care for several remote communities. But it was a difficult place to be a GP. The roads were unsealed and dangerous, the communities were sometimes 2–3 hours drive away and the trip to Auckland by road was 4 hours and the road was often washed out. The ferry was faster. While in Coromandel, Meredyth had two more children (David born in 1954, and Cynthia in 1956) travelling to Auckland for each birth. Meredyth was busy with a family of four and did not do much medical work in those days.

In 1958 they moved to Cambridge and set up medical practice together. It was a busy practice, with no cover except for weekends when there was a roster with the other GPs in town. There was a maternity unit and plenty of babies were delivered. After 27 years of marriage Bryce and Meredyth separated in 1974.

After several difficult years of ill health, Meredyth finally settled into work at Tokanui Hospital as a medical officer. She retired from Tokanui in 1991 and spent her retirement breeding Burmese cats and playing bridge and enjoying her 7 grandchildren. She moved to Auckland in 1991 where she remained until her death on 8 September 2014.

<http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2015/vol-128-no-1408/6426>

She is remembered by her 4 children, 7 grandchildren and her two sisters, Florence (trained as a school teacher) and Jennifer (who also trained in medicine and specialized in obstetrics and gynaecology).

Professor Cynthia (Cindy) Farquhar (Postgraduate Professor of Obstetrics and Gynaecology, University of Auckland), her youngest daughter, wrote this obituary.

**ERRATUM**

## **Self-rated health, health related behaviours and medical conditions of Māori and non-Māori in advanced age: LiLACS NZ (4 July 2014)**

The authors (Ruth Teh, Ngaire Kerse, Mere Kepa, et al) of the above article that was published on 4 July 2014 advise that some cancer data in Table 3 needed correction plus one sentence in the Discussion has been changed.

Please refer to the following link for the corrected copy:

<http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2014/vol-127-no.-1397/artteh>

*NZMJ*

**NOTICE****2015 NZMJ Publication Dates and Themes**

2015 Publication Dates (NZ Medical Journal)		Theme
January	30	Hospital Care
February	20	
March	13	Infectious Disease
	27	
April	17	
May	1	
	15	
	29	Cancer
June	12	
July	3	Obesity
	24	
August	7	
	21	Pacific Islanders in NZ
September	4	
	25	HIV
October	16	
	30	
November	20	Equity in Health Care
December	4	
	18	

## NOTICE

## Reviewers for the New Zealand Medical Journal in 2014

The Editorial Board (F Frizelle, R Mulder, J Connor, L Beckert) and Team (B Edwardes, S Cuzens) thank all those who generously gave their time and expertise in reviewing papers for the *NZMJ* in 2014. (We apologise to anyone whose name has been inadvertently omitted from the following list.)

Abel G	Crane J	Harper P	Menkes DB	Stevenson A
Adams C	Cree L	Harwood M	Meredith I	Stevenson S
Adams J	Cressey P	Hay N	Merry AF	Stewart R
Adamson S	Crowe M	Heppenstall C	Metcalf S	Stokes T
Aitken A	Crozier I	Herbison P	Metcalf S	Stone P
Allen S	Cumming JM	Highton J	Mills G	Strother M
Al-Sallam H	Cunningham W	Hill A	Milne RJ	Stubbs R
Ardagh M	Daly BM	Hoare K	Mitchell L	Swain AH
Armfield J	Davis A	Hoek J	Moller P	Swinburn B
Ashton T	Dawes P	Hollis J	Moore MP	Sykes P
Babington S	Dawson J	Hooper G	Morreau J	Taylor S
Bagg W	Day A	Horsburgh S	Morton JB	Taylor W
Baimatova I	de Boer S	Hughes R	Mouat S	Teh R
Baird S	Denny S	Hulme-Moir M	Munn S	Tenbenschel TG
Baker MG	Derraik JGB	Hunt P	Murdoch D	Than M
Barrow M	Derrett S	Ingram J	Nightingale S	Theis J-C
Barry D	DeVilliers P	Jackson G	Norris P	Thomas M
Beaglehole B	Diesfeld K	Jackson E	O'Dochartaigh C	Thompson A
Beasley S	Donnelly S	Jackson C	Perez D	Thompson J
Beasley M	Doogue M	Jackson R	Peters J	Thorne P
Beasley R	Dovey S	Jayathissa S	Petousis-Harris H	Thornley P
Beban G	Dowell T	Jennings LC	Pitama S	Thyne G
Benowitz N	Eglinton T	Jonas M	Pithie A	Tobias M
Best E	Ekeroma AJ	Jones D	Poole P	Toomath R
Bird P	Elder D	Jones R	Porter R	Toop L
Bissett I	Elley CR	Kaysers B	Priest P	Tordoff J
Blackmore T	Ellis PM	Kelly S	Quigley P	Turner N
Blakely T	Ellis C	Kenealy T	Rademaker M	Turnidge J
Bonning J	Epton M	Kennedy R	Rajakakse C	van Rij AM
Bowker A	Erasmus J	Kerse N	Richardson A	Vaughan MM
Braatvedt G	Exeter DJ	Kim B	Roake J	Waa A
Brennan M	Finger R	Kingham S	Roberts S	Wakefield M
Broad J	Fink J	Kuipers F	Robertson R	Walker R
Buchanan J	Fitzharris B	Kydd R	Robertson A	Walls T
Buchanan J	Foulds J	Kypri K	Robust Te Tuhi	Waters N
Bunton RW	Fountain JS	Lacey C	Ruseckaite R	Wearn A
Burt MJ	Fraser A	Landford J	Sarfati D	Weatherall M
Butler A	Freebairn R	Lavoie JG	Sayers R	Weilert F
Campbell I	Freeman JT	Lawrence A	Schep L	Weir R
Carr J	French R	Lawrenson R	Schlup M	Werno A
Cave G	Garett J	Leckey E	Schmiedel O	White HD
Chambers S	Gauld R	Lintott CJ	Scragg RKR	Wilkinson T
Chapman P	Geary RB	Lunt H	Searchfield G	Williams M
Cheung MJ	Gee P	Macleod S	Sellman D	Wilson N
Child S	Gentles DGR	Mann S	Sharpe N	Wiltshire E
Chin P	Gerrard DF	Mann J	Shaw JHF	Wong C-K
Ching D	Gilchrist N	Mark S	Sheerin IG	Woon K
Clarke R	Glue P	Marsh L	Shipton E	Wyeth E
Collins C	Gommans J	Mason D	Simcock J	Yang C-C
Connolly A	Gray A	Maze M	Simmers D	
Cook L	Grundy K	McCall J	Simpson J	
Coppell KJ	Haines M	McDaniel P	Smith N	
Corra L	Hamer A	McGee R	Smith S	
Coulter G	Hammond-Tooke G	McGill A-T	Smith MP	
Cox B	Hanger HC	McLean RM	Sneyd M-J	
Cram F	Hanna L	McMillan W	Stamp L	
Crampton P	Haretuku R	Mcminn J	Stanley TV	