

The  
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Medical Journal**

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A photograph of a champagne bottle in a wicker basket. The bottle is dark green with a gold foil top. The basket is made of light-colored wicker. In the background, a person's arm with a tattoo is visible, and a bowl of strawberries sits on a red and white checkered tablecloth.

# Why is alcohol in the government's 'too hard basket'?

**Time to stop making things worse:** an imperative focus for healthcare student bullying research

**Media portrayal of Māori and bariatric surgery in Aotearoa/New Zealand**

**How important to dairies is selling tobacco? Views of dairy owners and managers on tobacco retailing**

**Enough doctors support the End of Life Choice Bill to make it operable**

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**Medical Journal**  
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## Characteristics of lung cancers and accuracy and completeness of registration in the New Zealand Cancer Registry

Ross Lawrenson, Chunhuan Lao, Leonie Brown, Janice Wong, Karen Middleton, Melissa Firth, Denise Aitken

This study has examined the characteristics of patients newly diagnosed with lung cancer and compared this with the information available from the New Zealand cancer registry. This study highlights the incomplete information on cancer stage held in the National data set. The locally collected data highlights that few lung cancer patients present with early stage and potentially curable disease.

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## Alcohol consumption in New Zealand women before and during pregnancy: findings from the *Growing Up in New Zealand* study

Fiona Rossen, David Newcombe, Varsha Parag, Lisa Underwood, Samantha Marsh, Sarah Berry, Cameron Grant, Susan Morton, Chris Bullen

We measured drinking before and during pregnancy in 6,822 mothers of a sample of New Zealand children who were part of the Growing Up in New Zealand study, and looked at the connections between mothers' drinking with their age, ethnic group, education, whether the pregnancy was planned and numbers of previous pregnancies. Almost three-quarters of women drank alcohol before becoming pregnant, a quarter continued drinking during the first trimester and 13% after the first trimester. Drinking during the first trimester was higher for women who were European or Māori, with no secondary school qualification, in their first pregnancy, with an unplanned pregnancy; and in the second and third trimesters, higher for European or Māori women, aged 30 and over, in their first pregnancy. Drinking was common in New Zealand women before pregnancy but most women stopped drinking when they realised they were pregnant. However, a small proportion continued drinking, presenting a risk to their child.

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## How important to dairies is selling tobacco? Views of dairy owners and managers on tobacco retailing

Martin Witt, Amanda Dodd, Heather Kimber, Hannah M Mulrine, Christina K Lewis, Emily Box

Dairies in Christchurch were invited to take part in a face-to-face survey that aimed to capture the views of owners/managers concerning the sale of tobacco, its relative importance to their business and attitudes to tobacco-free retailing.

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## The New Zealand Surgical Site Infection Improvement (SSII) Programme: a national quality improvement programme reducing orthopaedic surgical site infections

Arthur J Morris, Sally A Roberts, Nikki Grae, Richard Hamblin, Carl Shuker, Alan F Merry  
Hip and knee replacements are a common procedure in New Zealand hospitals and the numbers performed are growing. However, sometimes such a procedure can end in an infection in the surgical site. These infections can be painful, difficult to manage, and result in long stays in hospital. The Health Quality & Safety Commission set out to establish a programme to conduct surveillance of surgical site infections following hip and knee replacement surgery in public hospitals across the country, and to encourage and monitor use of the best practice in avoiding such infections. This has resulted in an increase in use of best practice that was associated with a fall in surgical site infections nationwide by about a third.

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## Counting the costs of major trauma in a provincial trauma centre

Helena Lee, Rowan Croft, Olivia Monos, Christopher Harmston

This is the first study in New Zealand to examine costs associated with care of major trauma patients. We collected data on major trauma patients admitted to a New Zealand provincial hospital over a three-year period; including demographics, mechanisms of injury and in-patient care required. For each patient, two methods of costing were calculated and compared: 1. Case-weight costs and 2. Actual costs. Intensive care admission and surgery were found to be the main drivers cost in the care of major trauma patients. The total actual cost for patients was calculated to be NZ\$1,223,302 more than the total case-weight cost.

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## Improving quality of clinical coding of post-partum haemorrhage: the process and its effects on reported incidence rates in a New Zealand hospital maternity service

Geetha Galgali, Kim Fong, Karen Bissell, Delwyn Armstrong, Gayl Humphrey

The Waitemata District Health Board (DHB) improved the accuracy of post-partum haemorrhage (PPH) recording to understand its true incidence. PPH is leading cause of death among women giving birth worldwide and remains a risk in Western countries. Every inpatient discharged from a New Zealand public hospital has their doctor's notes read by clinical coders who translate the patient's diagnoses, complications, procedures and treatments into health codes according to an international classification system. This clinical coding process can miss complications such as PPH, if the doctor's documentation is incomplete or ambiguous. Therefore, the patients with PPH are undercounted. We investigated the incidence of PPH and concluded that the rate was under-reported. The Labour and Birth Summary Form was redesigned to include specific questions about the nature and treatment of PPH. Through a collaborative quality improvement project involving doctors, midwives and nurses, the form was redesigned, communicated to clinicians, checked for completion and returned if incomplete. This project changed behaviour and improved the use of preventative treatment for PPH. It improved accuracy of documentation and coding, and lifted the reported PPH rate from 4% to 12% within a year of project inception. The value of this increase is estimated at \$544,000 based on the 'national price' of inpatient stays. The approach of clinical leadership and engagement with clinical coding could benefit other services at Waitemata and other DHBs.

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## Media portrayal of Māori and bariatric surgery in Aotearoa/ New Zealand

Jamie-Lee Rahiri, Ashlea Gillon, Sai Furukawa, Andrew Donald, Andrew Graham Hill, Matire Louise Ngarongoa Harwood

This study sought to analyse all print and online news articles published over the last 10 years related to Māori and bariatric surgery. This topic is of interest because Māori health, obesity and bariatric surgery are topics of contention within the media. Over all included articles, the major themes that emerged were those related to access and attitudes towards bariatric surgery. Despite Māori having disproportionately higher rates of obesity and obesity-related disease, there was limited reporting on equity of bariatric surgery for Māori.

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## Time to stop making things worse: an imperative focus for healthcare student bullying research

Althea Gamble Blakey, Lynley Anderson, Kelby Smith-Han, Tim Wilkinson, Emma Collins, Elizabeth Berryman

In this article we argue that bullying intervention is failing because of how it is done. We argue for a new focus for bullying intervention, based on adult learner needs.

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# Why is alcohol in the government's 'too hard basket'?

Doug Sellman, Jennie Connor

If there was a virus that produced devastating brain damage to the children of women who were infected during pregnancy, the rational response from health authorities and the government would be to take urgent steps to reduce the possibility of women contracting the virus; not just those who know they are pregnant, but all women of reproductive age. When the Zika virus came to attention in Brazil in 2015, this is what happened.

What if it was a neurotoxin that could produce devastating brain damage to the children of women who ingested it during pregnancy and it was known that consuming it during pregnancy was not a rare event but in fact occurred in a high proportion of unsuspecting pregnant women? If we knew up to 3,000 children were being needlessly brain-damaged every year in New Zealand because of exposure to this neurotoxin you would expect action of the highest priority by health authorities and the government to reduce this human misery and economic burden, using the best scientific evidence available.

Rossen and colleagues<sup>1</sup> in this edition of the *NZMJ* report this scenario. In a large representative study of pregnant women in New Zealand, they found that 71% women drank alcohol before becoming pregnant, and that 23% drank alcohol during the first trimester, when the risk of neurotoxic impacts of alcohol are highest. It is noteworthy that drinking alcohol during pregnancy was found in both European and Māori women, although not surprisingly that less fortunate and less educated women showed higher risk.

Despite multiple reports over many years of the damage that alcohol is inflicting on individuals and communities, including the critical issue of fetal alcohol spectrum

disorder (FASD) risk, little real action is occurring. It is as if the New Zealand population has been brainwashed and in the grips of a mass social delusion—viewing alcohol as a harmless recreational product which enhances quality of life, and thinking if you are not regularly consuming the tonic you are clearly not part of the cool and successful social mainstream, and possibly a rather 'iffy' member of society.

In utero alcohol-induced brain damage is a “preventable tragedy”<sup>2</sup> but active prevention measures by government have been sorely lacking. In 2009/2010 the most comprehensive review of the liquor laws was conducted in New Zealand out of which came a set of major recommendations for reducing alcohol-related harm.<sup>3</sup> However, the John Key-led government of the time chose to enact a range of minor recommendations, while seeing off all of the major population-based interventions that have robust scientific evidence backing for their effectiveness in reducing alcohol-related harm.<sup>4,5</sup> Of particular note are dismantling alcohol marketing (sponsorship and advertising beyond simple product information), increasing the retail price of alcohol through raising excise tax with the possible addition of minimum pricing per standard drink, and reducing accessibility of alcohol through limiting the numbers of liquor outlets and limiting the hours of sale. The political cleverness of the government at the time in appearing to be responding to the Law Commission's report but actually maintaining the status quo desired by the alcohol industry has been previously documented.<sup>6</sup>

In 2015 the Inter-agency Committee on Drugs, led by the Ministry of Health, published a five-year National Drug Policy,<sup>7</sup> which although identifying drinking in pregnancy as a problem, proposed only to

establish a plan for FASD action. An FASD Action Plan<sup>8</sup> was subsequently enacted but contained none of the effective measures that would work to reduce population consumption or hazardous drinking.<sup>9</sup> It is important to note that FASD is not the only adverse outcome of consuming alcohol in pregnancy, with recent estimates from a large multi-national study suggesting twice the risk of stillbirth and four times the risk of sudden unexplained death in infancy ('cot death') in drinkers compared with non-drinkers who do not smoke.<sup>10</sup>

FASD is one of two important illustrations of the absence of a "safe" level of alcohol consumption,<sup>8</sup> and given that more than 40% of pregnancies are unplanned<sup>1</sup> the challenge is how to reduce the risk of FASD from the beginning of a pregnancy when almost all of women of reproductive age drink in New Zealand. The other pertinent example is breast cancer, the leading cause of alcohol-related death for New Zealand women, for both Māori and non-Māori, where a substantial proportion of the risk is in those women who drink at a level that is generally socially acceptable and considered "safe"—up to two standard drinks per day. These examples underlie the importance of population-based measures to reduce alcohol consumption overall and make not being a regular drinker a socially acceptable choice.

Effective population-based measures, most importantly marketing, pricing and accessibility controls, are the best ways to achieve a reduction in alcohol-related harm, with subsequent reductions in health disparities. However, these measures will also reduce the gains for those who profit from the heavy drinking culture of New Zealand, and thus the stakes are high. The normalised heavy drinking of many New Zealanders is maintained through the drowning out of health messages about issues such as alcohol-related breast cancer in women and FASD by very clever alcohol

marketing that draws on the best knowledge available about human motivation and decision-making, and uses saturation as a tactic. Even more sinister is the orchestrated endeavours by the industry to discredit alcohol scientists and their deliberate attempts to confuse the public about the harms from alcohol.<sup>11</sup> The large multi-national alcohol corporations have virtually unlimited financial resources to engage in these types of strategies designed to defeat commercial threats such as scientific evidence and maintain the status quo.<sup>12</sup> Only the government is powerful enough to stand up for public health in the face of this "Big Business" activity.

There is a range of existing avenues for the current Jacinda Adern-led government to act to reduce the risk of FASD and other disastrous outcomes for women drinking alcohol during pregnancy, along with other alcohol-related harms. These include the Tax Working Group; the Government Policy Statement on Land Transport 2018; the Mental Health and Addiction Review; and an amendment to the Sale and Supply of Alcohol Act.<sup>13</sup> Also sitting on the shelf of government is the report of the Ministerial Forum on Alcohol Advertising and Sponsorship (2014), which advocated a dismantling of alcohol sponsorship for sport. But most importantly is a government-funded blueprint for change—the Law Commission's report on curbing the harm from alcohol,<sup>3</sup> strongly supported by both the Labour Party and Green Party when in Opposition, as reflected in their alternative Select Committee Reports to Parliament.

For government to leave alcohol control in the too-hard basket, often labelled as 'not our first priority', suggests there is a substantial unnamed barrier to action. The health, social and economic benefits of drinking less—for the country and for individuals—are clear. Don't we deserve to know why we can't have them?

**Competing interests:**

Nil.

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# Unprofessional behaviours have no place in the future of medicine

Steven Kelly

In 1982, Henry Silver published a paper that for the first time suggested a “medical student abuse syndrome”.<sup>1</sup> It was noted that when medical students first started medical school they were enthusiastic and eager. Over time a majority would become cynical, dejected, frustrated and depressed. Dr Silver had seen the same symptoms in abused children and wondered whether what was occurring in medical students was the same as abused children from impoverished environments.

In 1990, a survey of third-year medical student abuse was undertaken.<sup>2</sup> The students reported that mistreatment was pervasive and that unprofessional behaviours by doctors were very common. Three quarters of students had become cynical of the medical profession since entry because of the mistreatment. More than a third had considered dropping out of medical school.

I trained in medicine 25 years ago and can personally attest to having witnessed over the subsequent years some disgraceful unprofessional behaviours. One would be hopeful that these unprofessional behaviours have improved over this time. However, as well described by Althea Gamble Blakey and colleagues in this edition of *New Zealand Medical Journal*,<sup>3</sup> medical student bullying remains a significant problem and is regarded as an “unspoken emergency”.

Workplace bullying is a substantial whole-of-society problem in many developed countries. It is estimated to cost the Australian economy over AUD\$6 billion annually.<sup>4</sup> In 2012, the Australian Government established a parliamentary inquiry into workplace bullying. The government’s response to this problem was the creation of a specific bullying jurisdiction within the Fair Work Commission.

In the recent New Zealand media, there has been much publicity of unprofessional behaviour in the legal profession. The focus was on sexual harassment perpetrated by senior lawyers against junior lawyers at Russell McVeagh.<sup>5</sup> This is similar to the abuse of medical students by senior doctors where a power and seniority differential are exploited.

Medicine has a culture of tolerating and therefore perpetuating unprofessional behaviours. Colleagues of individuals with these behaviours have found it too hard to confront them. They fear retaliatory attacks for what is considered an insolvent problem. However, the continuation of unprofessional behaviours is bad for medical students, hospital staff, patients, hospitals and societies.<sup>6</sup> The future of medicine needs the elimination of unprofessional behaviours. The solution will require an institutional and collective individual commitment to the same goal. It must be made very clear what defines unprofessional behaviour. All individuals should be held to the same standard no matter what the seniority or importance to the organisation the individual is.

All healthcare providers should have compulsory training in the identification and management of bullying, sexual harassment and discrimination. Currently the Royal Australasian College of Surgeons is the only organisation that comprehensively provides this in New Zealand. This training includes giving healthcare workers the ability to give feedback and also tools for conflict resolution. There needs to be local and national resources available for victims to contact and have effective resolution.

The perpetrator needs to have ongoing monitoring of their behaviour. If unprofessional behaviour continues then an

escalation of intervention should occur. This may ultimately lead to an employment dismissal. There must be a zero tolerance for retaliatory behaviour from the perpetrator.

With these comprehensive procedures in place there will over a period of time be an institutional culture change where medical students will remain happy, enthusiastic and eager for their entire careers in medicine.

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Nil.

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# Characteristics of lung cancers and accuracy and completeness of registration in the New Zealand Cancer Registry

Ross Lawrenson, Chunhuan Lao, Leonie Brown, Janice Wong,  
Karen Middleton, Melissa Firth, Denise Aitken

## ABSTRACT

**AIMS:** This study aims to report the characteristics of newly diagnosed lung cancer cases, and to examine the data accuracy of registrations in the New Zealand Cancer Registry (NZCR) in 2011–2015.

**METHODS:** The accuracy and completeness of lung cancer registrations in the NZCR was explored using the Midland Lung Cancer Register (MLCR, including Lakes, Waikato, Tairāwhiti and Bay of Plenty District Health Boards) and clinical records. A combined Midland Lung Cancer Dataset was created based on the NZCR and the MLCR. The characteristics of lung cancer cases was described and compared between Māori and non-Māori patients. The subgroup differences were examined by Chi-Square tests. The odds ratio of having small cell lung cancer compared to non-small cell lung cancer between Māori patients and non-Māori patients was estimated using the logistic regression model.

**RESULTS:** The combined Midland Lung Cancer Dataset included 2,057 verified lung cancer registrations, including 656 (31.9%) Māori patients and 1,401 (68.1%) non-Māori patients. Māori patients were more likely to be diagnosed at a younger age, more likely to be female, more likely to be a current or ex-smoker and more likely to have small cell lung cancer than non-Māori. The difference of cancer stage at diagnosis between Māori and others was not significant. After adjustment, the odds ratio of having small cell lung cancer for Māori patients compared to non-Māori patients was 1.55 (95% CI: 1.17–2.05). The adjusted odds ratio of having small cell lung cancer was 4.06 (95% CI: 1.72–9.60) for current smokers and 2.68 (95% CI: 1.14–6.30) for ex-smokers compared to patients who never smoked.

**CONCLUSIONS:** Combining the two sources of data gives a more complete picture of the incidence and tumour characteristics of lung cancer in our region. Our dataset suggests that Māori patients are more likely to have small cell lung cancer than non-Māori patients.

Lung cancer is the leading cause of cancer death in New Zealand with approximately 1,500 deaths per year.<sup>1</sup> It has a significant impact due to the high rates of morbidity and mortality associated with the disease.<sup>2</sup> Survival from lung cancer in New Zealand is poor with a five year survival of 9.5% for men and 11% for women.<sup>3,4</sup> Internationally many countries achieve better survival outcomes than New Zealand, including Canada, Australia and Sweden where five-year survival is between 16–18%.<sup>5</sup> Māori

have a greater incidence of lung cancer, with Māori men having 2.0 times the incidence and Māori women having 3.4 times the incidence of Europeans/others.<sup>1,6</sup> The age standardised mortality rate for Māori is 3.5 times that of non-Māori.<sup>7</sup> One of the key reasons for the poor prognosis for newly diagnosed patients with lung cancer is that most patients present with advanced stage disease. Treatment is therefore generally palliative, with few patients being suitable for potentially curative treatment such as surgery

or stereotactic ablative body radiotherapy (SABR).<sup>8,9</sup> Another important influence in patient outcome is the tumour biology, for instance those with small cell lung cancer have a poorer prognosis.<sup>10,11</sup> Non-small cell lung cancer (NSCLC) and those who are epidermal growth factor receptor (EGFR) positive have a better outcomes.

The New Zealand Cancer Registry (NZCR) is a population-based tumour registry, collecting and storing cancer incidence data. The new cancer registrations are mainly based on the pathology reports sent by reporting laboratories electronically. Other sources include discharge reports from publicly funded and private hospitals, death certificates and autopsy reports.<sup>12,13</sup> Data collected in the NZCR includes demographic information (such as date of birth, gender and ethnicity) and tumour information (such as cancer site and extent of disease). The NZCR is the major source of “information on the incidence of, and mortality from, cancer” and “a basis for cancer survival studies and research programmes”.<sup>14</sup> Its completeness and accuracy are vital for cancer control in New Zealand.

The completeness and accuracy of registrations in the NZCR have been reported to be diverse for different cancers.<sup>13,15–17</sup> Approximately 88% of the breast cancer cases recorded in the NZCR have information on disease extent with a 94% accuracy rate in those with disease extent.<sup>13</sup> For colon cancer 96% cases have disease extent with a 87% accuracy rate,<sup>15</sup> but only 31% prostate cancer cases have disease extent with a 89% accuracy rate.<sup>16</sup> An audit was conducted to assess the lung cancer data in NZCR using the data recorded in the Auckland and Northland regional databases in 2004.<sup>17</sup> Of the 565 audit cases, 66 (12%) cases were not included in the NZCR, and one duplicate registration and 78 (14%) ineligible cases were identified in the NZCR. Only 58% of the lung cancer cases recorded in the NZCR have information on disease extent with a 79% accuracy rate in those with disease extent.<sup>17</sup> The audit of the lung cancer data in the NZCR was conducted a decade ago, and improvement on data quality may have been achieved. An updated quality assessment on the lung cancer data is needed.

The Midland Respiratory Group has been collecting data on all newly diagnosed cases of lung cancer who are referred to their multidisciplinary review meetings onto an access database: Midland Lung Cancer register (MLCR). It has maintained a register of all patients seen since 2004 and the centre has relatively complete recording of cases for the Midland Cancer Region (Lakes, Waikato, Tairāwhiti and Bay of Plenty District Health Boards (DHBs)) since 2007. These four DHBs serve a combined population of 700,000 and generate approximately 400 new cases of lung cancer a year. The region has 27% Māori population and of the over 2,000 cases on the register, 600 are Māori. The register includes data on date and source of presentation, results of investigations including CT and spirometry, date of diagnosis and pathological reporting. All patients are staged and mode of treatment is then recorded (radiotherapy, chemotherapy or surgery).

This study aims to report the characteristics of newly diagnosed lung cancer cases in the Midland Cancer Network region, and to examine the data accuracy of registrations in the NZCR in 2011–2015.

## Methods

### Data cleaning and verification

Experienced clinicians validated the lung cancer cases diagnosed in 2011–2015 in the MLCR by comparing the clinical records and the data recorded in the MLCR. Lung cancer (ICD code: C33, C34)<sup>18</sup> diagnosed in the Lakes, Waikato, Tairāwhiti and Bay of Plenty DHBs in 2011–2015 were extracted from the NZCR and the MLCR.

Registration duplications were removed from the two datasets. Then they were linked together by the National Health Index (NHI) number, a unique identifier assigned to every person who uses health and disability support services in New Zealand. We classified all the combined cases into three groups: 1) matching cancer cases in both datasets, 2) cancer cases identified in the MLCR only, 3) registrations identified in the NZCR only. For registrations identified in the NZCR only, clinical records were examined by clinicians to verify the lung cancer diagnosis: 1) lung cancer diagnosed in 2011–2015, 2) lung cancer diagnosed

before 2011 or after 2015, 3) not lung cancer, 4) cannot confirm due to insufficient information.

### Combined lung cancer dataset

To understand the characteristics of lung cancer cases in the Midland Cancer Network region, we created a combined dataset based on the NZCR data and the MLCR data. The combined lung cancer dataset included all cancer cases in the MLCR and the additional verified lung cancer cases diagnosed in 2011–2015 and recorded in the NZCR. We have categorised the cancer cell types into six groups: small cell, NSCLC, NSCLC-other, malignant carcinoid, others and unknown. The characteristics of these patients by ethnicity (Māori, Pacific and others) was explored, and the differences were examined by Chi-Square tests, with a p-value of less than 0.05 considered significant. The odds ratio of having small cell lung cancer compared to non-small cell lung cancer between Māori patients and non-Māori patients was estimated using the logistic regression model after adjustment for age, gender, smoking status (recorded in the MLCR), DHB and year of diagnosis.

### Accuracy and completeness of the NZCR

The accuracy of demographic data of the verified lung cancer cases in the NZCR including cancer extent/stage, date of diagnosis, DHB, gender and ethnicity (Māori, Pacific, Asian, European and others) were compared with the MLCR data and clinical records. As demonstrated in the audit<sup>17</sup> on lung cancer data in NZCR in 2004, the difference on date of diagnosis between the NZCR and regional dataset may be due to difference regarding the definition of date of diagnosis. The NZCR may collect the date of diagnosis from 1) date of operation or biopsy, 2) date of admission, 3) date of death if diagnosed at autopsy or 4) 'approximate time between onset and death' as reported by certifying doctor on the death certificate if the only notification of a cancer comes from the death certificate.<sup>16</sup> However, a regional dataset may record the date of diagnosis from 1) date of issue of the first report confirming malignancy, 2) the date of final report suggesting invasive malignancy or 3) the first documentation of the diagnosis in the clinical records.<sup>17</sup>

The MLCR records the patient characteristics at the time of diagnosis including date of birth, gender, ethnicity and patient domicile. These data are taken from the patient's hospital records at the time of diagnosis. Cancer stage is recorded after discussion at the multi-disciplinary meeting, using the Tumour Node Metastases (TNM) staging system.<sup>19</sup> The NZCR applies the Surveillance Epidemiology and End Results (SEER) programme cancer staging definitions.<sup>20</sup> The TNM classification was updated by the American Joint committee on Cancer. 'T' describes the extent of the primary tumour. 'N' describes the extent of regional lymph node metastasis. 'M' describes the occurrence of distant metastasis.<sup>19</sup> The SEER staging definition was developed by the American National Cancer Institute. Extent at diagnosis in the NZCR is coded as B (limited to organ of origin), C (Extension to adjacent organs), D (Extension to regional lymph nodes), E (distant metastases) and F (unknown).<sup>20</sup> In this study, stage IA and IB in the TNM system were considered to be extent B, stage IIA, IIB, IIIA and IIIB were comparable to extent C and D, and stage IV were extent E.<sup>17</sup> All data analyses were performed in IBM SPSS statistics 25 (New York, US).

## Results

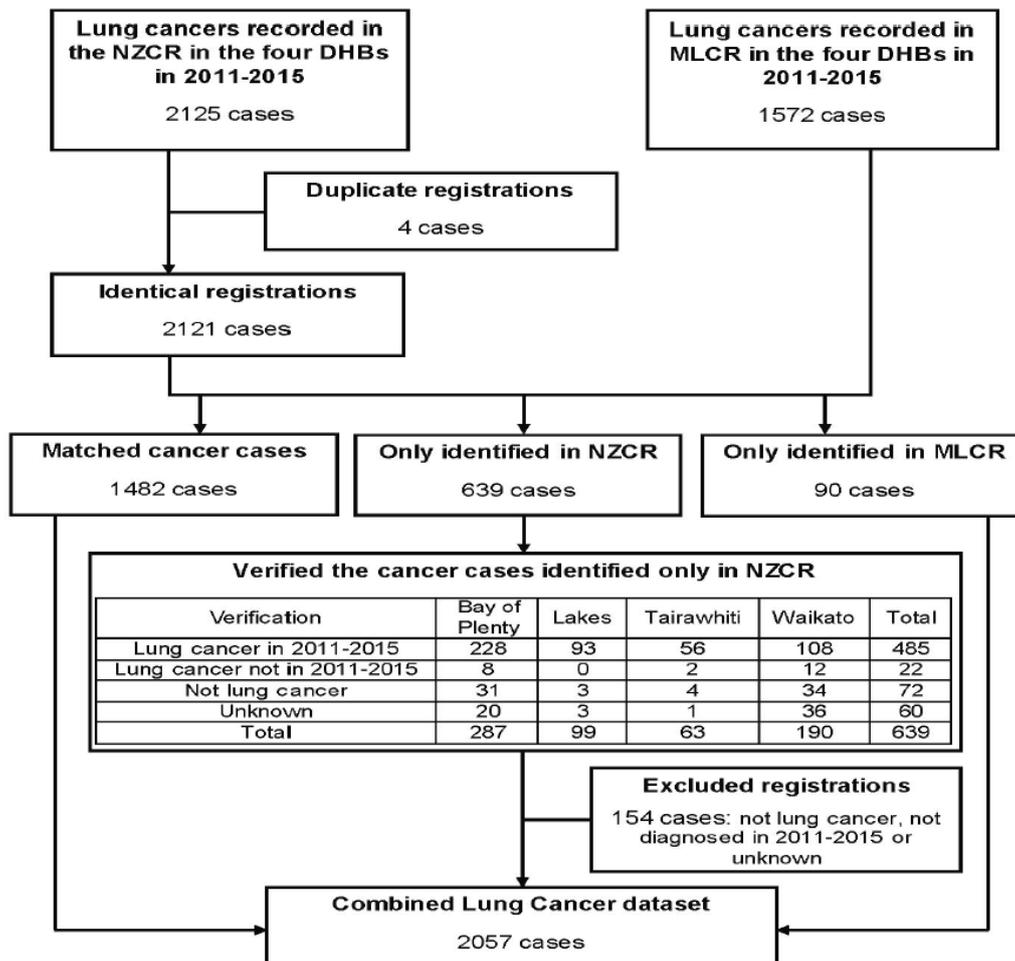
### Data cleaning and verification

We identified 2,125 lung cancer registrations in the NZCR, and 1,572 lung cancer registrations in the MLCR (Table 1) in 2011–2015. We found four duplicate lung cancer registrations in the NZCR (Figure 1). Of the cancer cases recorded in the MLCR, 1,482 (94.3%) lung cancer cases were also registered in the NZCR. There are 639 lung cancer registrations recorded in the NZCR that were not identified in the MLCR. After examining the clinical records of these 639 patients, 485 (75.9%) were confirmed to be diagnosed with lung cancer in 2011–2015, 22 (3.4%) were diagnosed with lung cancer before 2011 or after 2015, 72 (11.3%) did not have lung cancer, and 60 (9.4%) could not be verified due to lack of information in the clinical records. Of the 485 lung cancer cases recorded in the NZCR but not in the MLCR, 20 (4.1%) were stage I, 9 (1.9%) stage II, 39 (8.0%) stage III, 341 (70.3%) were stage IV and 76 (15.7%) with unknown stage. Of the

**Table 1:** Number of cancer cases by year of diagnosis and DHB.

Categories		MLCR	NZCR
<b>Year of diagnosis</b>			
	2011	300	417
	2012	293	410
	2013	297	398
	2014	315	436
	2015	367	460
<b>DHB</b>			
	Bay of Plenty	403	681
	Lakes	223	306
	Tairāwhiti	85	140
	Waikato	861	994
<b>Total</b>		<b>1,572</b>	<b>2,121</b>

**Figure 1:** Flow chart of the Combined Midland Lung Cancer Dataset.



**Table 2:** Characteristics of lung cancer patients between Māori and Non-Māori in the combined dataset.

Factors		Māori		Non-Māori		P-value (chi-square test)	Total	
		N	%	N	%		N	%
Year of diagnosis						0.907		
	2011	122	18.6%	274	19.6%		396	19.3%
	2012	136	20.7%	272	19.4%		408	19.8%
	2013	126	19.2%	259	18.5%		385	18.7%
	2014	132	20.1%	281	20.1%		413	20.1%
	2015	140	21.3%	315	22.5%		455	22.1%
DHB						<0.001		
	Bay of Plenty	179	27.3%	448	32.0%		627	30.5%
	Lakes	138	21.0%	182	13.0%		320	15.6%
	Tairāwhiti	83	12.7%	58	4.1%		141	6.9%
	Waikato	256	39.0%	713	50.9%		969	47.1%
Age (years)						<0.001		
	<50	33	5.0%	45	3.2%		78	3.8%
	50–59	158	24.1%	145	10.3%		303	14.7%
	60–69	230	35.1%	370	26.4%		600	29.2%
	70–79	179	27.3%	485	34.6%		664	32.3%
	80+	56	8.5%	356	25.4%		412	20.0%
Gender						<0.001		
	Female	363	55.3%	610	43.5%		973	47.3%
	Male	293	44.7%	791	56.5%		1,084	52.7%
Smoking status						<0.001		
	Current smoker	252	49.6%	288	27.4%		540	34.7%
	Ex-smoker	243	47.8%	650	61.9%		893	57.3%
	Never smoked	13	2.6%	112	10.7%		125	8.0%
	Unknown	148		351			499	
Cancer stage						0.137		
	I	63	10.0%	154	11.5%		217	11.0%
	II	34	5.4%	75	5.6%		109	5.5%
	III	161	25.4%	278	20.8%		439	22.3%
	IV	375	59.2%	830	62.1%		1,205	61.2%
	Unknown	23		64			87	
Cell type						<0.001		
	NSCLC	403	73.9%	945	83.5%		1,348	80.4%
	NSCLC-other	8	1.5%	22	1.9%		30	1.8%
	Small cell	126	23.1%	157	13.9%		283	16.9%
	Malignant carcinoid	0	0.0%	3	0.3%		3	0.2%
	Others	8	1.5%	5	0.4%		13	0.8%
	Unknown	111		269			380	
<b>Total</b>		<b>656</b>		<b>1,401</b>			<b>2,057</b>	

**Table 3:** Adjusted odds ratios of having small cell lung cancer compared to non-small cell lung cancer.

Factors		P-value	Adjusted odds ratio (95% CI)
Smoking status	Never smoked	Ref	
	Ex-smoker	0.024	2.68 (1.14–6.30)
	Current smoker	<0.001	4.06 (1.72–9.60)
	Unknown	-	-
DHB	Waikato	Ref	
	Bay of Plenty	0.014	0.66 (0.48–0.92)
	Lakes	0.571	0.89 (0.60–1.32)
	Tairāwhiti	0.815	1.06 (0.64–1.76)
Ethnicity	Non-Māori	Ref	
	Māori	0.002	1.55 (1.17–2.05)
Age (continuous)		0.075	0.99 (0.98–1.00)
Gender	Female	Ref	
	Male	0.402	0.89 (0.68–1.16)
Year of diagnosis (continuous)		0.480	0.97 (0.88–1.06)

90 lung cancer cases recorded only in the MLCR, 43 (47.8%) had clinical diagnosis only without any pathology report. Twenty-six patients (28.9%) had stage I lung cancer, 7 (7.8%) stage II, 16 (17.8%) stage III, 36 (40.0%) stage IV and 5 (5.6%) with unknown cancer stage.

### Combined Midland Lung Cancer Dataset

The combined dataset included 2,057 lung cancer cases (Table 2). The mean age of the cohort was 70 years old at diagnosis, and 52.7% of the patients were male. There were 656 (31.9%) Māori patients, 22 (1.1%) Pacific patients and 1,379 (67.0%) patients of other ethnicities. Waikato DHB has the largest number of lung cancer cases, followed by Bay of Plenty, Lakes and Tairāwhiti DHB. Sixty-one percent of patients were diagnosed with metastatic cancer, while 11.0% of those who had been staged had stage I disease. Eighty percent of patients had NSCLC, while 16.9% had small cell lung cancer. Māori patients were more likely to be diagnosed at a younger age (p-value <0.001, mean age: 66 years for Māori and 72 years for non-Māori), and more likely to be female (p-value <0.001) than others. The difference of cancer stage

at diagnosis between Māori and others was not significant (p-value =0.137). Almost 50% Māori patients were current smokers, another 47.8% were ex-smokers and only 2.6% had never smoked, compared to 27.4% current smokers, 61.9% ex-smokers and 10.7% never smoked for non-Māori patients (p-value <0.001). The proportions of missing data in smoking status, cancer stage and cell type between Māori and non-Māori were similar: 22.6% and 25.1% for smoking status; 3.5% and 4.6% for cancer stage; and 16.9% and 19.2% for cell type.

After adjustment for age, gender, year of diagnosis and DHB (Table 3), the odds ratio of having small cell lung cancer for Māori patients compared to non-Māori patients was 1.55 (95% CI: 1.17–2.05). The odds ratio of having small cell lung cancer was 4.06 (95% CI: 1.72–9.60) for current smokers and 2.68 (95% CI: 1.14–6.30) for ex-smokers compared to patients who never smoked. Patients in Bay of Plenty DHB were less likely to have small cell lung cancer compared to patients in Waikato DHB (odds ratio: 0.66, 95% CI: 0.48–0.92). Age, gender and year of diagnosis did not have a significant impact on the risk of being diagnosed with small cell lung cancer.

**Table 4:** Accuracy of characteristics of lung cancer patients in NZCR.

Demographics	Accuracy	Details							
Gender	99.2%	Gender in NZCR		Gender in MLCR/clinical records			Total		
				Female	Male				
		Female	928	12	940				
		Male	3	1,024	1,027				
		Total	931	1,036	1,967				
Ethnicity	97.0%	Ethnicity in NZCR		Ethnicity in MLCR/clinical records				Total	
				Māori	Pacific	Asian	European		Others
		Māori	623	1	37	1	662		
		Pacific	2	18	1	2	23		
		Asian		1	35	1	37		
		European	6		1	1,227	1	1,235	
		Others				1	3	4	
		Unknown	1	1		1		3	6
		Total	632	21	37	1,269	5	3	1,967
DHB	98.6%	DHB in NZCR		DHB in MLCR/clinical records			Total		
				Bay of Plenty	Lakes	Tairāwhiti		Waikato	
		Bay of Plenty	604	15		3	622		
		Lakes	1	296		3	300		
		Tairāwhiti	1		132		133		
		Waikato	1	2	2	907	912		
Total	607	313	134	913	1,967				
Date of birth	99.9%	Differences of date of birth in both dataset			Number of records				
		0 day			1,965				
		6 days			1				
		731 days			1				
		Total			1,967				

**Table 4:** Accuracy of characteristics of lung cancer patients in NZCR (continued).

<b>Date of diagnosis</b>	87.0% (within one month difference)	Number of days: Difference between date of diagnosis in NZCR and MLCR/clinical records		Number of records	Percentage				
		0 days		423	21.5%				
		1–30 days		1,289	65.5%				
		31–182 days		159	8.1%				
		183–364 days		27	1.4%				
		≥365 days		10	0.5%				
		No date of diagnosis in clinical records		59	3.0%				
		Total		1,967					
<b>Cancer extent and cancer stage</b>	55.3%	Extent in NZCR	Stage in MLCR/clinical records						
			I	II	III	IV	Unknown	Total	
		B: Localised to organ of origin		80	16	2	1	3	102
		C: Invasion of adjacent tissue or organ		14	8	9	16	0	47
		D: Regional lymph nodes		4	24	118	82	10	238
		E: Distant		11	8	74	802	2	897
		F: Unknown		79	46	220	266	72	683
		Total		188	102	423	1,167	87	1,967

### Accuracy and completeness of the NZCR

The demographic data in the NZCR has high accuracy, with 99.2% accuracy for gender, 97.0% for ethnicity, 98.6% for DHB and 99.9% for date of birth among the 1,967 verified lung cancer cases in the NZCR (Table 4). For the date of cancer diagnosis, 21.5% of the cancer cases were on the same date and another 65.5% were within one month difference. However, the recording of cancer extent in the NZCR is poor, with 1,041 (55.3%) cancer cases recorded with correct cancer extent.

## Discussion

Lung cancer in the Midland Cancer Network region is relatively common with over 400 new cases per year. There has been a 15% increase in the number of lung cancer cases between 2011 and 2015. This has implications on the capacity of the cancer services to manage the increasing workload. Sixty-one percent of patients present with stage IV disease at diagnosis, while only 17% had potentially curative stage I or II disease.

Early diagnosis is the key to improving the prognosis for lung cancer patients. Reasons for diagnostic delay in New Zealand are complex and multifactorial.<sup>21</sup> Previous New Zealand research has demonstrated that patient delay is common and many are diagnosed in the emergency department, although most patients had seen a general practitioner (GP) before diagnosis. Possible interventions to improve early diagnosis include ‘community initiatives to educate and resource at-risk patients to seek help, supporting and resourcing primary care to increase timely referral and implementing strategies to reduce system complexity for GPs and patients, and the employment of care coordinators’.<sup>21</sup>

Māori patients were younger (mean age: 66 years) compared to non-Māori patients (mean age: 72 years). More Māori with lung cancer were women (55.3%), whereas in non-Māori the majority of cancers were in men (56.5%). This is likely due to differences in smoking status. In 2009, the smoking prevalence for Māori was 44% compared to 18% for non-Māori.<sup>22</sup> Māori

women have the highest smoking prevalence rate (48% in 2009).<sup>22,23</sup> It is worth noting that 10.7% of non-Māori patients and 2.6% Māori patients diagnosed with lung cancer had never smoked.

We found no difference in the risk of diagnosing metastatic lung cancer between Māori and non-Māori patients, but Māori patients are more likely to have small cell lung cancer than others. Small cell lung cancer is strongly associated with smoking.<sup>24</sup> This study showed that *Māori patients are more likely to be smokers or ex-smokers* than others. However, after adjustment for smoking status and other factors, Māori patients are still 1.55 times more likely to have small cell lung cancer than non-Māori patients. Reasons for this need further investigation. A 2010 audit conducted in the Auckland and Lakes region showed no significant difference in having small cell lung cancer between Māori and non-Māori patients.<sup>25</sup> This study only included 57 Māori patients and may have been under powered to show the difference,<sup>25</sup> while our study has 656 Māori patients and 126 of them have small cell lung cancer.

The NZCR and MLCR are both of great value in understanding the epidemiology of lung cancer in the Midland Cancer Network region. There was some under-reporting in both the NZCR (4%) and the MLCR (24%), and a 5% misrecording in the NZCR. The quality of demographic data of the lung cancer registrations in the NZCR is excellent, but the completeness and accuracy of lung cancer extent has not improved much since 2004: 35% with unknown cancer extent in this study and 42% in the 2004 audit; 81% of accuracy in this study and 77% in the 2004 audit among those with known cancer extent in the NZCR.<sup>17</sup> Further efforts will be needed to improve the cancer extent recording that will be critical for lung cancer research and cancer control in New Zealand.

Around 87% (1712) of the registrations in the NZCR had a date of diagnosis within one month difference compared with the MLCR/clinical records. Though the definition of date of diagnosis in the MLCR is considered to be more reasonable by clinicians, it is more feasible for NZCR to collect the date of diagnosis based on their definition: 1) date of operation or biopsy, 2) date of admission, 3) date of death if diagnosed at autopsy or 4) 'approximate time between onset and death' as reported by certifying doctor on the death certificate.<sup>17</sup> For the other 10% registrations whose date of diagnosis in the NZCR was more than one month different from that in the MLCR, the influence of this discrepancy may be substantial especially when these data are used for survival analysis.

The strengths of this study include that records were reviewed by experienced clinicians to ensure the accuracy of lung cancer registrations, cancer stage and cell type. Both sources of data were combined to explore the tumour characteristics between Māori and non-Māori patients. However, this study has some limitations. In the combined dataset, smoking status was not recorded in 24% of the lung cancer cases, cell type was unknown in 18% of the cases and cancer stage was unavailable in 4% of the cases.

## Conclusion

The MLCR provides excellent clinical data on newly diagnosed lung cancer cases. However, there is some under-reporting compared with the NZCR. Combining the two sources of data gives a more complete picture of the incidence and tumour characteristics of lung cancer in our region. Our combined dataset suggests that Māori patients are more likely to have small cell lung cancer than non-Māori patients.

**Competing interests:**

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# Alcohol consumption in New Zealand women before and during pregnancy: findings from the *Growing Up in New Zealand* study

Fiona Rossen, David Newcombe, Varsha Parag, Lisa Underwood, Samantha Marsh, Sarah Berry, Cameron Grant, Susan Morton, Chris Bullen

## ABSTRACT

**AIM:** To examine alcohol consumption before and during pregnancy in the mothers of a contemporary sample of New Zealand children.

**METHOD:** Analysis of data from the antenatal assessment of 6,822 women enrolled in the *Growing Up in New Zealand* study, using logistic regression models to examine associations between maternal alcohol use and maternal demographics, pregnancy planning and parity.

**RESULTS:** Seventy-one percent of women drank alcohol before becoming pregnant, 23% during and 13% after the first trimester. The odds of drinking alcohol before pregnancy were significantly higher for younger women who were European or Māori with an unplanned pregnancy and in their first pregnancy; during the first trimester, higher for women who were European or Māori with no secondary school qualification, in their first pregnancy, with an unplanned pregnancy; and in the second and third trimesters, higher for European or Māori women aged 30 and over, in their first pregnancy.

**CONCLUSIONS:** Drinking is common in New Zealand women before pregnancy, particularly among European and Māori women. Some women consume small amounts of alcohol and some engage in heavy drinking in pregnancy. Both are a risk for fetal harm. Population-wide and targeted measures are needed to reduce consumption overall and provide support to specific population groups.

Alcohol consumption is common in New Zealanders: 79% of individuals 15 years and over report drinking alcohol in the past 12 months.<sup>1</sup> Women's drinking patterns have increasingly become more like those of men, with drinking to intoxication, binge drinking and consumption of any amount across all ages common, particularly in young women.<sup>2</sup> In 2017, 75% of New Zealand women reported drinking alcohol in the past 12 months, compared with 84% of men.<sup>1</sup>

It is now clear that consumption of any amount of alcohol at any stage of preg-

nancy may lead to fetal physical, cognitive and behavioural impairments collectively known as fetal alcohol spectrum disorder (FASD).<sup>3,4</sup> Some 600–3,000 babies with FASD are thought to be born each year in New Zealand;<sup>5</sup> approximately 1–5% of all live births in 2015.<sup>6</sup> The impacts and costs of this preventable problem to individuals, families and society are significant: Easton et al estimated that the labour force productivity loss due to FASD-attributable morbidity and premature mortality translated to an aggregate loss in 2013 of \$NZ49–200 million, equivalent to 0.03% to 0.09% of annual gross domestic product.<sup>7</sup> Dose and

timing of alcohol exposure are important in determining the extent and nature of the impairments.<sup>8</sup> Heavy drinking—at least four or more standard drinks at a session during early pregnancy, when a woman may not yet be aware she is pregnant—is considered the most harmful pattern.<sup>9,10</sup>

We aimed to identify the prevalence and predictors of alcohol consumption before and during pregnancy in a representative sample of New Zealand mothers.

## Methods

We analysed data collected from pregnant women who enrolled into New Zealand's contemporary child cohort study, *Growing Up in New Zealand* (GUiNZ). Study design and methodology have been reported elsewhere.<sup>11</sup> In brief, all pregnant women residing in the geographical area defined by the contiguous Auckland, Counties-Manukau and Waikato District Health Board regions with an expected delivery date between 25 April 2009 and 25 March 2010 were eligible and invited to participate utilising a multi-modal recruitment strategy.<sup>12</sup> In total, 6,822 pregnant women enrolled, gave informed consent and completed a computer-assisted face-to-face antenatal interview. Instructions were given to interviewers about what constituted a standard drink (in New Zealand, a standard drink contains 10 grams of pure alcohol, equivalent to a small [100ml] glass of wine, a 330ml can of beer or a 30ml shot of spirits<sup>13</sup>) as well as standard show cards to make the meaning clear to participants, who were then asked: "On average how many drinks of alcohol—beer, wine, spirits, did you drink per week: 1) Before becoming pregnant or before you were aware you were pregnant?; 2) In the first three months of pregnancy?; and 3) After the first three months of pregnancy?" Response options for each of these items were: "I did not drink alcohol"; "less than 1 drink per week"; "1 drink per week"; "2 drinks per week"; "3 drinks per week"; "4–6 drinks per week"; "7–9 drinks per week"; "10–14 drinks per week"; "15–19 drinks per week"; "20–39 drinks per week"; and "40 or more drinks per week". Due to limited cell counts, "20–39 drinks per week"; and "40 or more

drinks per week" were combined to form the category "20 or more drinks per week".

Pregnant mothers also provided detailed information about their self-identified ethnic identity. We used Statistics New Zealand's priority coding criteria for self-identified ethnicity and coded responses into six Level 1 categories: Māori; Pacific; Asian; Middle Eastern, Latin American and African (MELAA); Other; and European (Statistics New Zealand, 2005).<sup>14</sup> The categories of MELAA and Other were combined due to small numbers. Socio-economic deprivation was measured using the 2006 New Zealand Deprivation Index (NZDep2006), an area-level (neighbourhood) index constructed from nine Census 2006 variables (means-tested benefits, household income, home ownership, single-parent family, employment, qualifications, household overcrowding, access to a telephone, and access to a car).<sup>15</sup> Summary deprivation scores were grouped into quintiles, 1 being the least deprived and 5 the most deprived neighbourhoods. Data on age, highest level of education attained, parity and planning of pregnancy were also collected. We calculated descriptive statistics and their 95% confidence intervals (95%CI). Logistic regression models were used to examine associations between maternal alcohol use and variables that described maternal demographics, pregnancy planning and parity, using SAS version 9.3 (SAS Institute Inc., 2011). The correlation between SES and education was 0.31, indicating mild correlation, so both variables were retained in the same model without affecting the standard errors. Adjusted odds ratios (OR) and their 95% CIs were calculated. A p-value of 0.05 was used as the cut-off for determining statistical significance. Ethics approval for the GUiNZ study was granted by the Ministry of Health Northern Y Regional Ethics Committee.

## Results

### Participant characteristics

Table 1 shows the participant's sociodemographic characteristics. Only one in twenty were under the age of 20 and 40% of pregnancies were unplanned.

**Table 1:** Participant sociodemographic characteristics.

Maternal characteristic	N	%
<b>Total</b>	<b>6,822</b>	<b>100</b>
<b>Age group (n=6,812)</b>		
19 or less	328	4.8
20–29	2,661	39.0
30–39	3,533	52.0
40 or older	290	4.2
Missing data	10	
<b>Ethnicity (Level 1 prioritised, n=6,807)</b>		
Māori	943	13.8
Pacific	999	14.7
Asian	1,009	14.8
MELAA & Other	167	2.4
European	3,689	54.3
Missing data	15	
<b>Household deprivation (NZDep06, n=6,806)</b>		
5 (most deprived)	1,879	27.6
4	1,423	20.9
3	1,169	17.2
2	1,235	18.1
1 (least deprived)	1,100	16.2
Missing data	16	
<b>Highest education (n=6,802)</b>		
No secondary school qualification	489	7.2
Secondary school/NCEA 1–4	1,625	23.9
Diploma/trade cert/NCEA 5–6	2,077	30.5
Bachelor's degree	1,542	22.7
Higher degree	1,069	15.7
Missing data	20	
<b>Parity (n=6,815)</b>		
First-born	2,852	41.8
Subsequent	3,963	58.2
Missing data	7	
<b>Planned or unplanned pregnancy (n=6,791)</b>		
Planned	4,091	60.2
Unplanned	2,700	39.8
Missing data	31	

### Alcohol use before and during pregnancy

Table 2 shows that 71% of women reported drinking before pregnancy (including before becoming aware of pregnancy), 23% during and 13% after the first trimester, with 29% reporting four or more drinks on average per week before pregnancy, 7% during and 1% after the first trimester.

*Before pregnancy (including before becoming aware of being pregnant):* The odds of drinking any alcohol before pregnancy were almost double for women aged 19 years of under (aOR 1.8, 95%CI 1.2–2.8) compared with women  $\geq 40$  years old; low for women of Pacific (aOR 0.3, 0.2–0.3), Asian (aOR 0.1, 0.1–0.1) or MELAA/Other (aOR 0.2, 0.1–0.2) compared with European

**Table 2:** Mothers' average weekly alcohol consumption before and during pregnancy.<sup>1</sup>

Average weekly maternal alcohol consumption	Before pregnancy (or awareness of pregnancy) (N=6,805)		During the first 3 months (N=6,804)		After the first 3 months (N=6,810)	
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)
Did not drink	1,982	29.1 (28.0–30.2)	5,266	77.4 (76.4–78.4)	5,898	86.6 (85.8–87.4)
Less than 1 drink	1,238	18.2 (17.3–19.1)	613	9.0 (8.3–9.7)	635	9.3 (8.6–10.0)
1–3 drinks	1,602	23.5 (22.5–24.5)	472	6.9 (6.3–7.5)	220	3.2 (2.8–3.7)
4–19 drinks	1,831	26.9 (25.9–28.0)	399	5.9 (5.3–6.4)	47	0.7 (0.5–0.9)
20 or more drinks	152	2.2 (1.9–2.6)	54	0.8 (0.6–1.0)	10	0.1 (0.1–0.2)
Any drinking	4,823	70.9 (69.8–72.0)	1,538	22.6 (21.6–23.6)	912	13.4 (12.6–14.2)

Notes: 1. Relates to the questions “On average how many drinks of alcohol—beer, wine, spirits did you drink per week *before becoming pregnant or before you were aware you were pregnant?*”; “On average how many drinks of alcohol—beer, wine, spirits did you drink per week *in the first 3 months of pregnancy?*”; “On average how many drinks of alcohol—beer, wine, spirits did you drink per week *after the first 3 months of pregnancy?*”

women; and lower for women living in the most (0.7, 0.6–0.9) versus the least deprived quintile of households (Table 3). Women expecting their first child had 60% greater odds of drinking than those with second or subsequent pregnancies (75.3% versus 67.7%, aOR 1.6, 95%CI 1.4–1.9).

*First trimester:* Demographic variables independently associated with drinking any alcohol in the first trimester were ethnicity ( $p < 0.0001$ ) education ( $p = 0.025$ ), parity ( $p = 0.001$ ) and planned or unplanned pregnancy ( $p < 0.0001$ ) (Table 4). The odds of drinking any alcohol during the first trimester of pregnancy were highest for women of Māori ethnicity (aOR 1.3, 1.1–1.5) and far lower for women of Pacific (aOR 0.5, 0.4–0.67), Asian (aOR 0.2, 0.1–0.3) or MELAA/Other (aOR 0.3, 0.2–0.6) ethnicity compared with European ethnicity; and greatest for women with no secondary school education qualifications (aOR 1.4; 95%CI 1.1–1.9). A significantly greater proportion of women expecting their first child drank alcohol during the first trimester (75.9%) than women in their second or subsequent

pregnancies (24.1%) (aOR 1.2, 95%CI 1.1–1.4). Mothers with unplanned pregnancies were twice as likely (aOR 2.2, 95%CI 1.9–2.5) as those who had a planned pregnancy to report alcohol consumption in the first trimester but there was no difference after the first trimester (Table 4).

*Second and third trimesters:* In contrast to the first trimester, the odds of drinking any alcohol after the first trimester of pregnancy were lowest for younger women  $\leq 19$  years old (0.5, 0.3–0.9) and 20–29 years old (0.5, 0.3–0.6) compared with women  $\geq 40$  years old; and lowest for women of Pacific (aOR 0.2, 0.1–0.3), Asian (aOR 0.1, 0.1–0.2) or MELAA/Other ethnicity (aOR 0.4, 0.3–0.8) compared with European ethnicity. Māori women were as likely to be drinking at this time of pregnancy as European women. Unlike the first trimester, a significantly lower proportion of primiparous (11.4%) than multiparous women drank alcohol (14.8%) (aOR 0.8, 0.7–0.9) with no difference in women who had planned or unplanned pregnancies.

**Table 3: Mothers’ average weekly alcohol consumption by demographic characteristics—before pregnancy (N=6,805).<sup>1</sup>**

Demographic characteristics		Average weekly alcohol consumption										Consumed alcohol <sup>2</sup>	
		Did not drink (N=1,982)		Less than 1 drink (N=1,238)		1-3 drinks (N=1,602)		4-19 drinks (N=1,831)		20 or more drinks (N=152)			
		N	% (95% CI)	N	% (95% CI)	n	% (95% CI)	N	% (95% CI)	N	% (95% CI)	Adjusted odds ratio (95% CI)	p-value
Age group	19 or less	61	18.6 (14.4–22.8)	61	18.6 (14.4–22.8)	51	15.5 (11.6–19.5)	127	38.7 (33.4–44.0)	28	8.5 (5.5–11.6)	1.8 (1.2–2.8)	0.0003
	20–29	902	33.9 (32.1–35.7)	505	19.0 (17.5–20.5)	520	19.5 (18.0–21.0)	655	24.6 (23.0–26.3)	79	3.0 (2.3–3.6)	1.1 (0.8–1.5)	
	30–39	930	26.3 (24.9–27.8)	623	17.6 (16.4–18.9)	958	27.1 (25.6–28.6)	980	27.7 (26.3–29.2)	42	1.2 (0.8–1.5)	1.4 (1.0–1.8)	
	40 or older	89	31.4 (26.0–36.9)	49	17.3 (12.9–21.7)	73	25.8 (20.7–30.9)	69	24.4 (19.4–29.4)	<10	-	1.0	
Ethnicity	Māori	200	21.2 (18.6–23.8)	183	19.4 (16.9–21.9)	170	18.0 (15.6–20.5)	319	33.8 (30.8–36.8)	71	7.5 (5.8–9.2)	0.8 (0.6–1.0)	<0.0001
	Pacific	479	47.9 (44.8–51.0)	137	13.7 (11.6–15.8)	155	15.5 (13.3–17.8)	199	19.9 (17.4–22.4)	29	2.9 (1.9–3.9)	0.3 (0.2–0.3)	
	Asian	648	64.6 (61.6–67.6)	205	20.4 (17.9–22.9)	101	10.1 (8.2–11.9)	45	4.5 (3.2–5.8)	<10	-	0.1 (0.1–0.1)	
	MELAA & Other	86	54.4 (46.7–62.2)	27	17.1 (11.2–23.0)	28	17.7 (11.8–23.7)	16	10.1 (5.4–14.8)	<10	-	0.2 (0.1–0.2)	
	European	568	15.4 (14.2–16.6)	681	18.5 (17.2–19.7)	1,145	31.0 (29.5–32.5)	1,248	33.8 (32.3–35.4)	47	1.3 (0.9–1.6)	1.0	
Household deprivation (NZDep06)	5 (most deprived)	711	37.8 (35.6–40.0)	324	17.2 (15.5–19.0)	315	16.8 (15.1–18.5)	439	23.4 (21.4–25.3)	90	4.8 (3.8–5.8)	0.7 (0.6–0.9)	0.010
	4	471	33.1 (30.7–35.5)	264	18.6 (16.5–20.6)	290	20.4 (18.3–22.5)	366	25.7 (23.4–28.0)	32	2.2 (1.5–3.0)	0.8 (0.7–1.0)	
	3	302	25.9 (23.3–28.4)	215	18.4 (16.2–20.6)	307	26.3 (23.8–28.8)	335	28.7 (26.1–31.3)	<10	-	0.9 (0.7–1.1)	
	2	281	22.8 (20.4–25.1)	226	18.3 (16.1–20.5)	359	29.1 (26.5–31.6)	356	28.8 (26.3–31.4)	13	1.1 (0.5–1.6)	0.9 (0.7–1.2)	
	1 (least deprived)	217	19.8 (17.4–22.1)	208	18.9 (16.6–21.3)	331	30.1 (27.4–32.9)	334	30.4 (27.7–33.1)	<10	-	1.0	
Highest education	No sec school qualification	132	27.0 (23.1–30.9)	73	14.9 (11.8–18.1)	67	13.7 (10.7–16.7)	177	36.2 (31.9–40.5)	40	8.2 (5.8–10.6)	0.9 (0.7–1.2)	0.013
	Sec school / NCEA 1–4	568	35.0 (32.6–37.3)	299	18.4 (16.5–20.3)	297	18.3 (16.4–20.2)	426	26.2 (24.1–28.4)	35	2.2 (1.4–2.9)	0.7 (0.6–0.9)	
	Diploma / Trade cert / NCEA 5–6	614	29.6 (27.6–31.5)	377	18.2 (16.5–19.8)	477	23.0 (21.2–24.8)	544	26.2 (24.3–28.1)	65	3.1 (2.4–3.9)	0.9 (0.7–1.1)	
	Bachelor’s degree	416	27.0 (24.8–29.3)	310	20.2 (18.2–22.2)	410	26.7 (24.4–28.9)	396	25.7 (23.6–27.9)	<10	-	1.0 (0.8–1.2)	
	Higher degree	248	23.3 (20.8–25.9)	178	16.7 (14.5–19.0)	348	32.7 (29.9–35.6)	285	26.8 (24.1–29.5)	<10	-	1.0	
Parity	First-born	705	24.7 (23.2–26.3)	464	16.3 (14.9–17.6)	692	24.3 (22.7–25.9)	903	31.7 (30.0–33.4)	85	3.0 (2.4–3.6)	1.6 (1.4–1.9)	<0.0001
	Subsequent	1,277	32.3 (30.8–33.7)	774	19.6 (18.3–20.8)	910	23.0 (21.7–24.3)	928	23.5 (22.1–24.8)	67	1.7 (1.3–2.1)	1.0	
Planned or unplanned pregnancy	Planned	1,147	28.1 (26.7–29.4)	755	18.5 (17.3–19.7)	1,114	27.2 (25.9–28.6)	1,041	25.5 (24.1–26.8)	32	0.8 (0.5–1.1)	1.0 (1.1–1.4)	0.006
	Unplanned	826	30.6 (28.9–32.4)	479	17.8 (16.3–19.2)	484	18.0 (16.5–19.4)	786	29.2 (27.4–30.9)	120	4.5 (3.7–5.2)	1.2	

Notes: 1. Relates to the question “On average how many drinks of alcohol—beer, wine, spirits did you drink per week before becoming pregnant or before you were aware you were pregnant?” 2. Outcome being modelled is ‘Consumed alcohol during pregnancy’, N=6,757.

**Table 4:** Mothers' average weekly alcohol consumption by demographic characteristics—first trimester (N=6,804).<sup>1</sup>

Demographic characteristics		Average weekly alcohol consumption										Consumed alcohol <sup>2</sup>	
		Did not drink (N=5,266)		Less than 1 drink (N=613)		1-3 drinks (N=472)		4-19 drinks (N=399)		20 or more drinks (N=54)			
		N	% (95% CI)	N	% (95% CI)	n	% (95% CI)	n	% (95% CI)	N	% (95% CI)	Adjusted odds ratio (95% CI)	p-value
Age group	19 or less	192	58.7 (53.4-64.1)	37	11.3 (7.9-14.7)	38	11.6 (8.1-15.1)	48	14.7 (10.8-18.5)	12	3.7 (1.6-5.7)	1.3 (0.9-1.9)	0.155
	20-29	2,052	77.1 (75.5-78.7)	205	7.7 (6.7-8.7)	184	6.9 (6.0-7.9)	194	7.3 (6.3-8.3)	25	0.9 (0.6-1.3)	1.0 (0.7-1.4)	
	30-39	2,799	79.2 (77.9-80.5)	346	9.8 (8.8-10.8)	231	6.5 (5.7-7.4)	142	4.0 (3.4-4.7)	16	0.5 (0.2-0.7)	1.1 (0.8-1.5)	
	40 or older	223	78.8 (74.0-83.6)	25	8.8 (5.5-12.1)	19	6.7 (3.8-9.6)	15	5.3 (2.7-7.9)	<10	-	1.0	
Ethnicity	Māori	589	62.1 (59.0-65.2)	99	10.4 (8.5-12.4)	102	10.8 (8.8-12.7)	131	13.8 (11.6-16.0)	27	2.8 (1.8-3.9)	1.3 (1.1-1.5)	<0.0001
	Pacific	812	81.4 (78.9-83.8)	42	4.2 (3.0-5.5)	68	6.8 (5.2-8.4)	63	6.3 (4.8-7.8)	13	1.3 (0.6-2.0)	0.5 (0.4-0.6)	
	Asian	936	93.3 (91.8-94.9)	41	4.1 (2.9-5.3)	22	2.2 (1.3-3.1)	<10	-	<10	-	0.2 (0.1-0.3)	
	MELAA & Other	142	89.9 (85.2-94.6)	<10	-	<10	-	<10	-	<10	-	0.3 (0.2-0.6)	
	European	2,780	75.5 (74.1-76.9)	425	11.5 (10.5-12.6)	269	7.3 (6.5-8.1)	198	5.4 (4.6-6.1)	12	0.3 (0.1-0.5)	1.0	
Household deprivation (NZDep06)	5 (most deprived)	1,407	74.7 (72.8-76.7)	145	7.7 (6.5-8.9)	133	7.1 (5.9-8.2)	159	8.4 (7.2-9.7)	39	2.1 (1.4-2.7)	1.1 (0.9-1.4)	0.807
	4	1,107	77.9 (75.7-80.1)	122	8.6 (7.1-10.0)	96	6.8 (5.5-8.1)	86	6.1 (4.8-7.3)	10	0.7 (0.3-1.1)	1.1 (0.9-1.3)	
	3	923	79.0 (76.7-81.4)	112	9.6 (7.9-11.3)	74	6.3 (4.9-7.7)	56	4.8 (3.6-6.0)	<10	-	1.0 (0.8-1.2)	
	2	963	78.2 (75.9-80.5)	113	9.2 (7.6-10.8)	102	8.3 (6.7-9.8)	52	4.2 (3.1-5.3)	<10	-	1.0 (0.8-1.3)	
	1 (least deprived)	866	78.8 (76.4-81.2)	119	10.8 (9.0-12.7)	67	6.1 (4.7-7.5)	46	4.2 (3.0-5.4)	<10	-	1.0	
Highest education	No sec school qualification	302	61.9 (57.6-66.2)	42	8.6 (6.1-11.1)	56	11.5 (8.6-14.3)	66	13.5 (10.5-16.6)	22	4.5 (2.7-6.3)	1.4 (1.1-1.9)	0.025
	Sec school / NCEA 1-4	1,249	76.9 (74.8-78.9)	137	8.4 (7.1-9.8)	122	7.5 (6.2-8.8)	105	6.5 (5.3-7.7)	12	0.7 (0.3-1.2)	1.0 (0.8-1.3)	
	Diploma / Trade cert / NCEA 5-6	1,602	77.1 (75.3-78.9)	173	8.3 (7.1-9.5)	134	6.4 (5.4-7.5)	151	7.3 (6.2-8.4)	18	0.9 (0.5-1.3)	1.0 (0.8-1.2)	
	Bachelor's degree	1,250	81.3 (79.4-83.3)	146	9.5 (8.0-11.0)	92	6.0 (4.8-7.2)	47	3.1 (2.2-3.9)	<10	-	0.9 (0.8-1.2)	
	Higher degree	856	80.5 (78.1-82.9)	113	10.6 (8.8-12.5)	65	6.1 (4.7-7.6)	29	2.7 (1.7-3.7)	<10	-	1.0	
Parity	First-born	2,161	75.9 (74.4-77.5)	264	9.3 (8.2-10.3)	205	7.2 (6.3-8.2)	189	6.6 (5.7-7.6)	27	0.9 (0.6-1.3)	1.2 (1.1-1.4)	0.001
	Subsequent	3,105	78.4 (77.2-79.7)	349	8.8 (7.9-9.7)	267	6.7 (6.0-7.5)	210	5.3 (4.6-6.0)	27	0.7 (0.4-0.9)	1.0	
Planned or unplanned pregnancy	Planned	3,392	83.0 (81.8-84.1)	360	8.8 (7.9-9.7)	219	5.4 (4.7-6.0)	113	2.8 (2.3-3.3)	<10	-	1.0	<0.0001
	Unplanned	1,861	69.0 (67.3-70.8)	249	9.2 (8.1-10.3)	251	9.3 (8.2-10.4)	284	10.5 (9.4-11.7)	51	1.9 (1.4-2.4)	2.2 (1.9-2.5)	

Notes: 1. Relates to the question "On average how many drinks of alcohol—beer, wine, spirits did you drink per week in the first 3 months of pregnancy?"  
 2. Outcome being modelled is 'Consumed alcohol during pregnancy'; N=6,756.

**Table 5: Mothers’ average weekly alcohol consumption by demographic characteristics—2<sup>nd</sup> and 3<sup>rd</sup> trimesters (N=6,810).<sup>1</sup>**

Demographic characteristics		Average weekly alcohol consumption										Consumed alcohol <sup>2</sup>	
		Did not drink (N=5,898)		Less than 1 drink (N=635)		1-3 drinks (N=220)		4-19 drinks (N=47)		20 or more drinks (N=10)			
		N	% (95% CI)	N	% (95% CI)	n	% (95% CI)	n	% (95% CI)	N	% (95% CI)	Adjusted odds ratio (95% CI)	p-value
Age group	19 or less	293	89.3 (86.0–92.7)	18	5.5 (3.0–8.0)	6	1.8 (0.4–3.3)	<10	-	<10	-	0.5 (0.3–0.9)	<0.0001
	20–29	2,432	91.4 (90.3–92.5)	156	5.9 (5.0–6.8)	48	1.8 (1.3–2.3)	22	0.8 (0.5–1.2)	<10	-	0.5 (0.3–0.6)	
	30–39	2,945	83.2 (82.0–84.5)	427	12.1 (11.0–13.1)	148	4.2 (3.5–4.8)	15	0.4 (0.2–0.6)	<10	-	0.8 (0.6–1.1)	
	40 or older	228	80.6 (76.0–85.2)	34	12.0 (8.2–15.8)	18	6.4 (3.5–9.2)	<10	-	<10	-	1.0	
Ethnicity	Māori	804	84.8 (82.5–87.1)	68	7.2 (5.5–8.8)	40	4.2 (2.9–5.5)	32	3.4 (2.2–4.5)	<10	-	0.9 (0.7–1.1)	<0.0001
	Pacific	958	95.9 (94.7–97.1)	17	1.7 (0.9–2.5)	12	1.2 (0.5–1.9)	<10	-	<10	-	0.2 (0.1–0.3)	
	Asian	976	97.4 (96.4–98.4)	21	2.1 (1.2–3.0)	<10	-	<10	-	<10	-	0.1 (0.1–0.2)	
	MELAA & Other	144	91.1 (86.7–95.6)	10	6.3 (2.5–10.1)	<10	-	<10	-	<10	-	0.4 (0.3–0.8)	
	European	3,004	81.4 (80.2–82.7)	519	14.1 (12.9–15.2)	159	4.3 (3.7–5.0)	<10	-	<10	-	1.0	
Household deprivation (NZDep06)	5 (most deprived)	1,682	89.3 (87.9–90.7)	110	5.8 (4.8–6.9)	49	2.6 (1.9–3.3)	34	1.8 (1.2–2.4)	<10	-	1.1 (0.9–1.5)	0.725
	4	1,263	88.8 (87.1–90.4)	109	7.7 (6.3–9.0)	41	2.9 (2.0–3.8)	<10	-	<10	-	1.0 (0.8–1.3)	
	3	997	85.4 (83.3–87.4)	132	11.3 (9.5–13.1)	37	3.2 (2.2–4.2)	<10	-	<10	-	1.1 (0.9–1.4)	
	2	1,044	84.5 (82.5–86.6)	139	11.3 (9.5–13.0)	50	4.0 (2.9–5.1)	<10	-	<10	-	1.0 (0.8–1.3)	
	1 (least deprived)	911	82.9 (80.7–85.1)	144	13.1 (11.1–15.1)	43	3.9 (2.8–5.1)	<10	-	<10	-	1.0	
Highest education	No sec school qualification	417	85.3 (82.1–88.4)	30	6.1 (4.0–8.3)	24	4.9 (3.0–6.8)	12	2.5 (1.1–3.8)	<10	-	1.0 (0.7–1.4)	0.022
	Sec school / NCEA 1–4	1,458	89.7 (88.2–91.1)	99	6.1 (4.9–7.3)	53	3.3 (2.4–4.1)	14	0.9 (0.4–1.3)	<10	-	0.7 (0.6–1.0)	
	Diploma / Trade cert / NCEA 5–6	1,837	88.3 (86.9–89.7)	171	8.2 (7.0–9.4)	51	2.5 (1.8–3.1)	20	1.0 (0.5–1.4)	<10	-	0.7 (0.6–0.9)	
	Bachelor’s degree	1,303	84.8 (83.0–86.6)	174	11.3 (9.7–12.9)	59	3.8 (2.9–4.8)	<10	-	<10	-	0.9 (0.7–1.1)	
	Higher degree	871	81.9 (79.5–84.2)	160	15.0 (12.9–17.2)	33	3.1 (2.1–4.1)	<10	-	<10	-	1.0	
Parity	First-born	2,523	88.6 (87.4–89.7)	244	8.6 (7.5–9.6)	66	2.3 (1.8–2.9)	11	0.4 (0.2–0.6)	<10	-	0.8 (0.7–0.9)	0.005
	Subsequent	3,375	85.2 (84.1–86.3)	391	9.9 (8.9–10.8)	154	3.9 (3.3–4.5)	36	0.9 (0.6–1.2)	<10	-	1.0	
Planned or unplanned pregnancy	Planned	3,492	85.4 (84.3–86.5)	455	11.1 (10.2–12.1)	134	3.3 (2.7–3.8)	<10	-	<10	-	1.0	0.552
	Unplanned	2,389	88.5 (87.3–89.7)	176	6.5 (5.6–7.5)	86	3.2 (2.5–3.8)	38	1.4 (1.0–1.9)	10	0.4 (0.1–30.9)	1.1 (0.9–1.2)	

Notes: 1. Relates to the question “On average how many drinks of alcohol—beer, wine, spirits did you drink per week after the first 3 months of pregnancy?” 2. Outcome being modelled is ‘Consumed alcohol during pregnancy’, N=6,762.

### Light and heavy drinking

A substantial proportion (38%) of the 2,840 women drinking smaller amounts (ie, <1 drink and 1–3 drinks per week) before becoming pregnant, continued to drink during the first trimester and a quarter (27%) persisted throughout their pregnancy. Of the 1,983 women drinking more heavily before pregnancy (four or more drinks per week), 23% continued drinking in the first trimester, and 3% in subsequent trimesters. Heavier drinking in the first trimester was highest among younger women, and significantly higher in Māori women, women who were the most deprived, without a secondary school education, in their first pregnancy and with an unplanned pregnancy (Table 4).

## Discussion

In this study involving mothers of a representative group of New Zealand children, interviewed when they were pregnant, we found one-third (1,538, 32%) of the 4,823 women who reported drinking alcohol before pregnancy (or before awareness of pregnancy) continued to drink after becoming pregnant (or becoming aware of being pregnant) in the first trimester. Almost one in five (19%) continued to drink throughout the pregnancy. There was, however, a fall in consumption with the stage of pregnancy across all deprivation deciles and ethnic groups, suggesting the abstinence message is influencing the drinking behaviour of a wide cross-section of New Zealand women, albeit later in the pregnancy than is optimal.

This level of alcohol consumption is consistent with findings from cohort studies in Ireland, the UK and Australia<sup>16</sup> and several earlier, smaller New Zealand studies. For example, 28% of 100 post-natal women delivering at Taranaki Base Hospital in 2009 reported consuming alcohol through their pregnancy.<sup>17</sup> In a survey of 723 post-partum women across New Zealand in 2012, Mallard et al found 34% reported drinking at some time during their pregnancy, and 24% continued to drink following confirmation of pregnancy.<sup>18</sup> The New Zealand Health Survey 2012/13 reported one in five women drank alcohol at some time during

their pregnancy, and while the majority either stopped before becoming pregnant or as soon as they learned of their pregnancy, a small proportion persisted.<sup>19</sup> This is despite the first trimester being a critical period for fetal development, when drinking any amount of alcohol may result in harm to the developing fetus.<sup>29</sup>

Our study has a number of strengths. First, it draws on the largest and most current dataset with information on maternal drinking behaviour collected during pregnancy in New Zealand, conferring sufficient power to allow reliable estimates of alcohol consumption for major ethnic groups for the first time. This, together with the robust sampling methodology of the GUiNZ study, means that it is a large representative sample of a major regional proportion of the New Zealand population. Second, the prospective collection of alcohol consumption in pregnancy prior to the birth of the children sets it apart from other cohort studies that have asked women to recall this information *after* birth. A further strength is the collection of information about alcohol consumption in both the first trimester and post-first trimester period. However, there are some limitations: there was no verification of self-reported alcohol consumption and a degree of social desirability bias is probable, whereby participants may have been reluctant to report their true alcohol use, particularly during pregnancy, leading to underestimation of consumption. Furthermore, because of the cross-sectional nature of this analysis it was not possible to investigate possible casual associations between exposure and outcomes. However, as data from subsequent waves of GUiNZ become available there will be an opportunity to examine the links between maternal alcohol consumption in pregnancy and subsequent child health and developmental outcomes.

The harmful effects of alcohol on the fetus have only recently been recognised as a major public health problem. The recent FASD Working Group's FASD Action Plan appropriately recommends a major shift in societal attitudes to alcohol use overall, and specifically in pregnancy.<sup>21</sup> Our findings support the recommendation for

population strategies addressing alcohol marketing, labelling, pricing and availability; clear messages about alcohol and its harms in pregnancy, complemented by targeted messages to specific groups identified in this paper.<sup>2,21,22</sup> The New Zealand Health Promotion Agency's "Don't know? Don't drink" campaign is an example of such a programme.<sup>23</sup> More consistent pregnancy planning, preparation and support are also needed. More than this, however, the evidence we present of high rates of unplanned pregnancies and high levels of alcohol consumption in younger, more deprived, less well-educated groups of women during the critical first trimester adds further weight to the case for a broader public health approach that addresses the structural determinants of health. Our finding that, in general, education was a stronger determinant than socio-economic deprivation in this study suggests that interventions seeking to lift educational attainment may be the priority.

Health professionals involved in maternal and reproductive health should be competent to provide evidence-based, unambiguous messages about the risks of alcohol in pregnancy. Such intervention may

not be as widespread as it should; in 2012/13 only 49% of pregnant women recalled being advised by their GP to have alcohol-free pregnancies.<sup>19</sup> Research is needed to develop a better understanding of the reasons for unplanned pregnancy, about pregnancy preparation and health-related behaviours in general, from adolescence. More evidence is required about "what works" to support women to cease alcohol use when contemplating or first becoming aware of pregnancy. Finally, it will be important to establish the prevalence of FASD in New Zealand to be able to characterise those at greatest risk. Without such information, it will be difficult to plan early intervention support services for affected children and their families when it is most effective.

## Conclusions

A significant proportion of New Zealand women across a range of social and ethnic groups drink alcohol before and during pregnancy, creating risk of fetal harm. Population-wide and targeted measures are urgently needed to reduce alcohol consumption of any amount during pregnancy.

**Competing interests:**

Dr Newcombe reports: a grant was received from the Health Promotion Agency (2015) for an application to the HPA Research Investment for Priorities in Alcohol. Project entitled: Alcohol use across the lifespan and trends in older adulthood. Andy Towers, Janie Sheridan, David Newcombe - \$120,000. Dr Morton reports grants from New Zealand Government during the conduct of the study.

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# How important to dairies is selling tobacco? Views of dairy owners and managers on tobacco retailing

Martin Witt, Amanda Dodd, Heather Kimber, Hannah M Mulrine, Christina K Lewis, Emily Box

## ABSTRACT

**AIM:** Given the Government's commitment to reducing tobacco availability to minimal levels by 2025, finding ways to decrease the number of tobacco retailers is an important task. We assessed the perceived importance of selling tobacco among dairy owners and managers.

**METHOD:** We conducted a face-to-face survey to explore retailers' views on selling tobacco products, tobacco retailer licensing and tobacco-free retailing. Descriptive statistics were used to analyse the data.

**RESULTS:** Of the 112 individuals invited to participate, 62 (55.4%) completed the survey. Most respondents felt that selling tobacco was important for their business, and almost two-thirds had concerns about tobacco products being a security risk. Twice as many respondents thought tobacco retail outlet licensing was a potentially viable option as those who expressed caution. Almost one-third of respondents were potentially interested in becoming a tobacco-free retailer.

**CONCLUSION:** Selling tobacco products is perceived as important for many dairies, and just over half were not interested in becoming a tobacco-free retailer. However, there is some support among dairy owners/managers for tobacco product licensing. These findings strengthen the case for regulatory measures to decrease tobacco availability, as voluntary adoption of tobacco-free retailing is unlikely to result in substantial reductions in outlet numbers.

Smokefree Aotearoa 2025 is a commitment by the New Zealand Government to reduce smoking prevalence and tobacco availability to minimal levels by 2025.<sup>1,2</sup> The New Zealand Health Strategy states that "the Government intends to put a range of measures in place to accelerate New Zealand's progress towards the goal of making New Zealand smokefree".<sup>3</sup> Effective tobacco control requires a number of coordinated evidence-based responses, and several measures have been implemented in recent years, including tobacco excise tax increases, smokefree environment policies and the removal of point-of-sale tobacco displays.<sup>4,5</sup> However, the current 'business-as-usual' approach is likely to be insufficient to meet the Smokefree Aotearoa 2025 goal, particularly for Māori.<sup>6-8</sup>

With this in mind, further strategies to support government action on tobacco control include reducing the number of tobacco retail outlets (including supermarkets, dairies and service stations) to limit the supply of tobacco in the community.<sup>8,9</sup> It is estimated that interventions to reduce the number of tobacco retail outlets in New Zealand could make a crucial contribution to a smokefree Aotearoa by reducing the availability of tobacco, decreasing smoking prevalence, denormalising tobacco and its use, achieving health gains and cost savings for the health system, and decreasing inequities.<sup>10-13</sup> As such, reducing the number of tobacco retail outlets should be pursued as part of a comprehensive public health advocacy strategy in the tobacco control sector.

Retailers choosing not to sell tobacco products (tobacco-free retailing) is gaining momentum in parts of New Zealand<sup>14</sup> and overseas.<sup>15–17</sup> Recently, a Tobacco-free Retailers Toolkit was developed and promoted nationally as a guide to support health promoters and community groups to advocate for tobacco-free retailing in their local areas.<sup>14</sup> Some regions have made good progress; Northland, for example, has at least 18 tobacco-free retailers (mainly dairies, service stations and takeaway food outlets) as of September 2017.<sup>14</sup>

In New Zealand, dairies are the most numerous type of tobacco retail outlet,<sup>18</sup> and previous qualitative research suggests that this particular group of tobacco retailers rely heavily on tobacco sales.<sup>19,20</sup> Therefore it is especially important to understand how potential strategies to reduce the number of tobacco retail outlets may impact this group of retailers. The aim of this exploratory study was to obtain current information on the views of dairy owners/managers regarding tobacco retailing, tobacco outlet licensing and interest in becoming a tobacco-free retailer, to inform national and local smokefree advocacy work.

## Method

### Sample

For this study, the term ‘dairy’ includes small corner stores and larger convenience stores/mini-marts that sell a range of food and household products. These types of premises were the focus of the survey as they are the most common type of tobacco retail outlet in New Zealand,<sup>18</sup> and are reported to rely heavily on tobacco sales.<sup>19</sup> Our sampling frame was all dairies in Christchurch; we focused on Christchurch firstly as a convenience sample, and secondly because we intended for the data to inform future local advocacy strategies. The contact details of dairies known to sell tobacco products in the Christchurch City Territorial Authority were requested from the Smokefree Enforcement Officer at Community & Public Health (the Public Health Unit for the Canterbury District Health Board), who updates and maintains an electronic record of tobacco retail outlets. A total of 165 dairies were included in the list (as of 26 November 2015). Eight dairies were excluded from

the survey as they were on the outskirts of the Territorial Authority where it was considered unfeasible to visit face-to-face given resource constraints. Therefore, a total of 157 dairies were considered eligible to participate in the survey.

### Procedure

The questionnaire was drafted by the project team after initial discussions with two external academic researchers. It included closed-ended questions with fixed response options on business characteristics, customer tobacco-purchasing behaviour, feelings about selling tobacco products, sales and profits from tobacco products, level of concern about tobacco products being a security risk and level of interest in becoming a tobacco-free retailer. Open-ended questions on the perceived need for tobacco licensing, and challenges and benefits of tobacco-free retailing, were also included. The questionnaire was pre-tested at a dairy not eligible to participate.

A notification postcard was sent in advance to all eligible dairies, outlining the purpose of the survey and stating that the dairy may receive a telephone call inviting them to participate. All eligible dairies (n=157) were telephoned, and if contact could not be made after five calls on different occasions, dairies were not pursued any further. On contact, the dairy owner or manager was provided with a description of what the survey involved, and was invited to participate. On agreement to participate, a time for a face-to-face interview was made. Face-to-face interviews were conducted between 1 February and 7 March 2016 by five research assistants. An additional volunteer whose first language was Mandarin provided support to interview Mandarin-speaking dairy owners where language was identified as a barrier to participation.

### Analysis

SPSS® Statistics for Windows (version 22, IBM Corp, NY) was used for the descriptive quantitative analysis of categorical variables. Some respondents did not answer all questions, and percentages were calculated excluding missing responses. Open-ended comments were analysed using a content analysis,<sup>21</sup> where general topic categories/codes were identified from the responses,

and their frequency of use among the respondents counted. The neighbourhood deprivation score (using NZDep2013)<sup>22</sup> of the location of each dairy was determined at 2013 Census mesh block level and decile scores were collapsed into quintiles.

**Ethics**

It was determined that Health and Disability Ethics Committee review was not necessary given that the criteria requiring such review were not met.<sup>23</sup> The study was considered low-risk as responses were confidential and anonymous, and those invited could decline to participate, or choose not to answer any particular question, if they wished.

**Results**

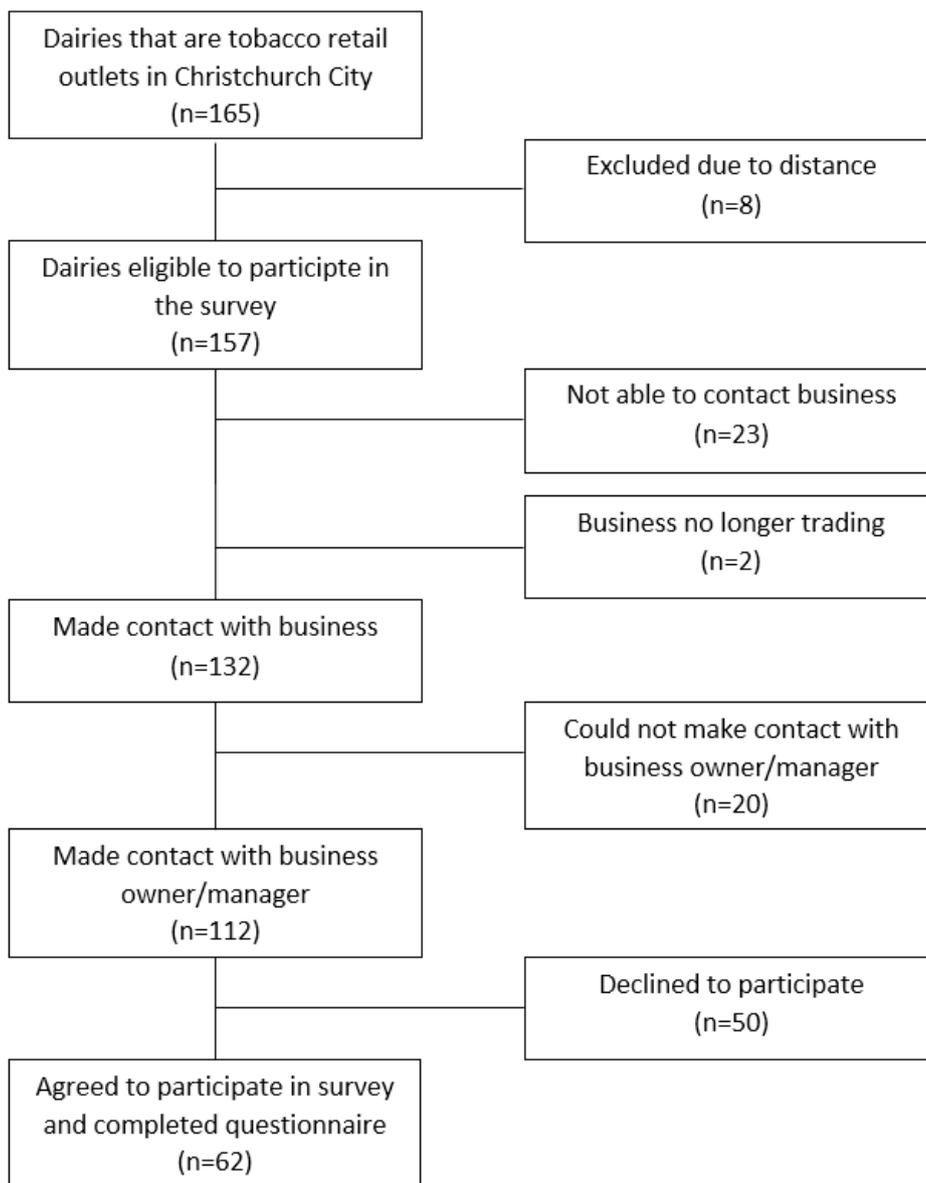
**Survey response**

Of the 157 eligible dairies contacted, there was no response for 23 dairies, the owner/manager was not available for a further 20 dairies, and two dairies were no longer trading (Figure 1). Of the 112 owners/managers of eligible dairies invited to participate in the survey, 62 (55.4%) agreed to participate and completed a questionnaire.

**Respondent characteristics**

Two-thirds of survey respondents were the owner of the dairy, and an additional 27% were the manager (Table 1). All dairies were independently owned, except one, which

**Figure 1:** Sample recruitment process.



**Table 1:** Characteristics of respondents and their business (n=62).

Characteristics		% (n)
Respondent's position in business	Owner	66.1 (41)
	Manager	27.4 (17)
	Other <sup>†</sup>	6.5 (4)
Dairy ownership status	Independently-owned	98.4 (61)
	Locally-owned franchise	1.6 (1)
Dairy neighbourhood deprivation score*	Quintile 1	6.5 (4)
	Quintile 2	16.1 (10)
	Quintile 3	25.8 (16)
	Quintile 4	29.0 (18)
	Quintile 5	22.6 (14)
Dairy has staff who smoke	Yes	19.4 (12)
	No	79.0 (49)
	Don't know	1.6 (1)

<sup>†</sup>Other respondents were employees or family members who were delegated by the dairy owner/manager to participate in the survey.

\*Using NZDep2013, where quintile 1 represents areas with the lowest deprivation scores and quintile 5 represents areas with the highest deprivation scores.

was a locally-owned franchise. Participating dairies were located across Christchurch, predominantly in neighbourhoods with moderate-to-high deprivation scores. Most dairies did not have any staff (ie, the respondent and/or other staff members) who were current smokers.

### Views on tobacco retailing (closed-ended questions)

Respondents were asked how they felt about selling tobacco products, and half (50.8%, n=31) chose the statement "I feel OK about selling tobacco products", while 18% (n=11) chose "I would prefer not to sell tobacco products" (Table 2). Almost one-third of respondents (31.1%, n=19) selected the statement "I don't really think about it".

When asked to indicate how important selling tobacco products was to their business, a small number of respondents (12.9%, n=8) felt it was "not important" (Table 2). The remaining respondents felt that selling tobacco products was "somewhat important" (17.7%, n=11), "important" (46.8%, n=11) or "very important" (22.6%, n=14) to their business.

Respondents were asked if they had any concerns about selling tobacco products being a security risk, and just over one-third (35.5%, n=22) had "no concerns" (Table 2). However, the same percentage of respondents (35.5%, n=22) had "some concerns", and a further 29% (n=18) had "a lot of concerns". Twenty dairies (32.3%) reported that they had been broken into in the previous year and had tobacco products stolen.

**Table 2:** Views on tobacco retailing.

Questions	Response options	% (n)
What phrase best describes how you feel about selling tobacco products?	I feel OK about selling tobacco products	50.8 (31)
	I don't really think about it	31.1 (19)
	I would prefer not to sell tobacco products	18.0 (11)
How important to your business is selling tobacco products?	Not important	12.9 (8)
	Somewhat important	17.7 (11)
	Important	46.8 (29)
	Very important	22.6 (14)
Do you have any concerns about selling tobacco products being a security risk?	No concerns	35.5 (22)
	Some concerns	35.5 (22)
	A lot of concerns	29.0 (18)
Are you interested in becoming a tobacco-free retailer?	Yes	4.8 (3)
	No	56.5 (35)
	Maybe	25.8 (16)
	Don't know	12.9 (8)

### Tobacco product sales (closed-ended questions)

Respondents were asked to indicate approximately what percentage of their customers purchased tobacco products (from pre-defined categories). Eighteen percent of respondents (n=11) indicated less than one quarter, and almost half of respondents (47.5%, n=29) thought that 25–50% of their customers purchased tobacco products (Table 3). Approximately one in five respondents (19.7%, n=12) thought that more than half of their customers purchased tobacco products, and nine respondents did not know.

Participants were asked to indicate what percentage of their sales and profits came from tobacco products (from pre-defined categories). While 18% of respondents (n=11) thought that more than half of their sales came from tobacco products, more than one-third of respondents (34.4%, n=21) thought this figure was more like 31–50%. Approximately one-quarter of participants (26.6%, n=16) thought that approximately 10–30% of their sales came from tobacco products, and four respondents (6.6%) thought it was less than 10%. Several respondents (14.8%, n=9) did not know.

Fifty-five percent of respondents (n=33) thought that less than 10% of their profit came from the sale of tobacco products. In addition, 10% of respondents (n=6) estimated that 10–15% of profit was from tobacco product sales, and 22% (n=13) estimated that the profit was more than 15%. Eight respondents (13.0%) did not know.

### Interest in tobacco-free retailing (closed-ended questions)

When asked if they were interested in becoming a tobacco-free retailer, more than half of respondents (56.5%, n=35) indicated that “no”, they were not interested (Table 2). One-quarter of respondents (25.8%, n=16) were “maybe” interested, and three respondents (4.8%) stated that “yes”, they were interested in becoming a tobacco-free retailer.

Respondents were asked whether several different factors might encourage them to become a tobacco-free retailer. Approximately 40% of respondents stated that “support from the local council” (n=25), “positive feedback from other tobacco-free dairies” (n=24), “other dairies also becoming tobacco-free” (n=24) and “support from customers and the community” (n=24)

**Table 3:** Tobacco product sales.

Questions	Response options	% (n)
How many of your customers buy tobacco products?	<25%	18.0 (11)
	25–50%	47.5 (29)
	>50%	19.7 (12)
	Don't know	14.8 (9)
Approximately what percentage of your sales comes from tobacco products?	<10%	6.6 (4)
	10–30%	26.2 (16)
	31–50%	34.4 (21)
	>50%	18.0 (11)
	Don't know	14.8 (9)
Approximately what percentage of your profit comes from the sale of tobacco products?	<5%	11.7 (7)
	5–10%	43.3 (26)
	11–15%	10.0 (6)
	>15%	21.7 (13)
	Don't know	13.3 (8)

would encourage them to become a tobacco-free retailer. Fewer respondents thought that having “clear signage made available to dairies” (16.4%, n=10) or “positive media coverage” (16.4%, n=10) would encourage them to become a tobacco-free retailer.

### Perceived challenges and benefits of tobacco-free retailing (open-ended questions)

When asked for comments on what challenges there might be in becoming a tobacco-free retailer, many respondents (n=41) reported the potential loss of profits and a negative impact on business. It was mentioned that there was strong competition from supermarkets, and customers often bought other items when they came in to purchase tobacco products. Nine respondents felt that their dairy “could not survive” without selling tobacco products, and some (n=18) thought that they may lose customers who would go elsewhere to buy tobacco products and other items instead.

When asked what benefits there might be in becoming a tobacco-free retailer, comments included improving the health of customers and/or the community (n=11) by decreasing the smoking rate and helping smoking cessation. Four respondents thought that customers may also benefit by saving money they would otherwise spend

on tobacco products. It was mentioned that health and economic benefits would particularly impact children and young people (n=3). Respondents also mentioned positive safety-related aspects to not selling tobacco products (n=6), such as being safer for staff, and decreasing the risk of burglary and crime. Half of the respondents (n=31) thought that there were no benefits to becoming a tobacco-free retailer, or benefits would only be for customers and not their business (n=2).

### Views on tobacco licensing (open-ended questions)

When asked to provide a comment about the possibility of requiring retailers to have a licence to sell tobacco products, some respondents thought that this was a “good idea” (n=12), and could work in a similar way to alcohol licensing. A similar number of respondents did not support the idea of a tobacco licence (n=12), as they thought it would incur extra costs, and may negatively impact their business. Several respondents felt that this type of licence was “unnecessary” (n=6), and “wouldn't make a difference” (n=5). Some respondents thought that the introduction of a tobacco licence might be “OK” (n=13), but only if it were “necessary”. Four respondents did not know what they thought about retailers needing to have a licence to sell tobacco products.

## Discussion

The dairy owners and managers interviewed perceived tobacco as an established, even normal, part of their business. Most of those surveyed were either “OK” about selling tobacco or gave little thought to its sale. If regularly bought with bread, milk and other staples, then this arguably reinforces the normalcy of tobacco in the community. The majority reported that tobacco was important to their livelihood; half of all respondents estimated that between a quarter and half of their customers buy tobacco, and half believed that tobacco contributed to at least 30% of store sales. Despite the significance placed on tobacco by businesses, it is interesting to note that the prevailing view is that it yields little profit, with three-quarters of respondents estimating this to be 15% or less. From this observation, it is the purchase of other items along with tobacco products that leads dairy owners and managers to view tobacco as important to business. These findings resonate with other local qualitative studies citing tobacco products as important for enticing custom and maintaining the viability of tobacco retail outlets.<sup>19,20</sup> However, findings from two studies of tobacco consumer purchasing behaviour challenge this assumption. A study of observed purchases in 120 urban corner stores in Philadelphia, Pennsylvania over a six-month period found that only 5% of purchases included both tobacco and non-tobacco products.<sup>24</sup> In an analysis of electronic point-of-sales data from 1,416 convenience stores in the UK over one week in September 2015, 13% of purchases included both tobacco and non-tobacco products.<sup>25</sup> In both studies, 8% of purchases were for tobacco products alone. Further, after removing the cost of tobacco products, customers who purchased tobacco products did not spend significantly more than those who do not purchase tobacco products.<sup>24,25</sup> While it may not be possible to directly extrapolate these findings to a New Zealand setting, it highlights the need for local quantitative data on tobacco purchasing behaviours to inform the debate on the future of tobacco retailing. The apparent lack of support for tobacco-free retailing from dairy owners and managers in Christchurch also reflects the view that unless some form of regulatory framework is introduced, any voluntary

reductions in retailer numbers is unlikely to be sufficient to achieve reductions in local supply.<sup>10</sup> Other studies of tobacco retailers carried out in New Zealand support this viewpoint, and also suggest that retailers are not completely resistant to making the move to a more regulated approach such as tobacco retail outlet licensing.<sup>19,20,26</sup>

This study provides several implications at both local and national level. Firstly, although there was little support identified among respondents for tobacco-free retailing, one-quarter of businesses indicated that they might be interested, thereby raising the question as how best to motivate those who could be persuaded to stop selling tobacco. From factors identified in this study, it is argued that customer (smokers’) purchasing behaviour, and views of the public and retailers on tobacco regulation, all need to be better understood. In doing so, the understandable caution displayed by many retailers around the risks of not selling tobacco might be better addressed. As tobacco-free retailing is a relatively new area of focus for tobacco control in New Zealand, there is a lack of local published evidence of its impact on business outcomes, such as profits and customer numbers, with which to inform tobacco retail outlet owners. In addition, business owners may be reluctant to share this commercially sensitive data. Case studies included in the Tobacco-free Retailers Toolkit provide feedback from three dairies that stopped selling tobacco products.<sup>14</sup> These dairy owners found that support from the community have been positive overall, profits have remained the same, and they would recommend tobacco-free retailing to other retailers. Qualitative studies of tobacco retailers in New South Wales<sup>16</sup> and California<sup>15,17</sup> who voluntarily stopped selling tobacco also reported a positive customer response, as well as no overall change in customer numbers. Most respondents had no major concern about loss of profits, but some mentioned that they could be losing incidental sales. In addition, there is public support for introducing tobacco retailer licensing, and reducing the number of tobacco retail outlets in New Zealand, specifically near schools.<sup>27,28</sup> This community support and preliminary feedback from case studies of tobacco-free retailers could be employed by smokefree advocates to

encourage retailers to take the step and become tobacco-free, and may also be important in helping to support the case for regulation to central government.

At the time of carrying out this study, the increasing incidence of dairy burglaries was considered to justify exploration of security issues. While no published studies can be found to substantiate links between the rising cost of tobacco and its value as a black-market commodity, the role of excise tax on the rising cost of tobacco has been documented.<sup>29</sup> Although there is no indication that security concerns are encouraging retailers to stop selling tobacco at present, this study suggests that in the future there might be some appetite if support were seen to be forthcoming from customers, local authorities or other retailers who have decided to become tobacco free. Here, the role of regulation is cited as being important, along with responding to changing public attitudes, where tobacco is increasingly seen in negative terms and inconsistent with other products sold.<sup>15-17</sup> Proposals to regulate tobacco to date have acknowledged the need to create “level playing fields” for businesses in the same way that smokefree environment legislation ensured all hospitality venues became smokefree indoors. This study points to the conclusion that unless consistency across all types of

tobacco retail outlets is adopted and the sale of tobacco is regulated further, any progress in tobacco-free retailing is likely to be slow and piecemeal.

This study is limited to a small sample of dairy owners and managers in Christchurch who agreed to participate in the survey, and was developed specifically to inform local smokefree advocacy work. As such, the views described here do not necessarily reflect the views of all dairy owners and managers in New Zealand, and may not necessarily be able to be generalised to larger retail outlets (for example, supermarkets and service stations). However, respondents’ views do align with other New Zealand research with a wider range of tobacco retailers.<sup>19,20,26</sup>

In conclusion, this study poses a number of questions that must be better understood if New Zealand is to see a significant reduction in the supply of tobacco over the coming few years. To date, much of the advocacy undertaken has been focused on reducing the demand for tobacco and as such those working in tobacco control face arguably the greatest challenge to date to reorient the debate to include tobacco supply. Uniting growing public opinion around regulation with business attitudes and a willingness to see change will be essential if New Zealand is to achieve the Smokefree Aotearoa 2025 goal.

**Competing interests:**

Nil.

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# The New Zealand Surgical Site Infection Improvement (SSII) Programme: a national quality improvement programme reducing orthopaedic surgical site infections

Arthur J Morris, Sally A Roberts, Nikki Grae, Richard Hamblin, Carl Shuker, Alan F Merry

## ABSTRACT

**AIMS:** The New Zealand Surgical Site Infection Improvement (SSII) Programme was established in 2013 to reduce the incidence of surgical site infections (SSI) in publicly funded hip and knee arthroplasties in New Zealand hospitals.

**METHODS:** The programme pursued a three-pronged strategy:

1. Surveillance of SSI with a nationwide system
2. Promotion of consistent adherence to evidence-based practices proven to reduce SSI
3. Monitoring and publicly reporting changed practice and outcome data.

**RESULTS:** Between quarter 3 2013 and quarter 4 2016 there has been a nationwide increase in compliance with all process measures: correct timing for antibiotic prophylaxis; use of the recommended antibiotic in the recommended dose and alcohol-based skin antiseptics.

The SSI rate in hip and knee arthroplasties has shown a significant improvement. The nationwide median rate has fallen to 0.91% since June 2015, compared with 1.36% during the baseline period of April 2013 to March 2014 ( $p < 0.01$ ). This equates to approximately 55 fewer infections between August 2015 and June 2017, savings of NZD\$2.2 million in avoided treatment and avoided disability-adjusted life years (DALYs) of NZD\$5 million.

**CONCLUSIONS:** The introduction of a nationwide SSI reduction programme for hip and knee arthroplasties resulted in an increase in compliance across the country with best practice that was associated with a reduction in incidence of SSI since June 2015 from the baseline period of April 2013 to March 2014, sustained to June 2017.

Healthcare-associated infections (HAI) are associated with significant morbidity and mortality.<sup>1,2</sup> Surgical site infections (SSI) are the second most frequent type of HAI in European countries, the US and other similar high-income countries

such as New Zealand.<sup>3</sup> Patients experiencing an SSI have longer stays in hospital, increased mortality and higher healthcare-related costs when compared to those without SSI.<sup>4</sup> Patients exposed to surgery carry twice the overall HAI burden compared to those

patients not exposed to surgery; almost half attributable to SSI.<sup>5</sup> Local Auckland data from the late 1990s estimated that the annual cost of HAI for surgical and medical admissions to all hospitals in New Zealand was NZD\$137 million.<sup>4</sup> Active surveillance and reporting of HAI is associated with a significant reduction in HAI events.<sup>6</sup> Moreover, surveillance and reporting of SSI leads to a mean reduction in their incidence.<sup>7-18</sup> An independent cost-benefit analysis conducted in 2011 suggested a contemporary surveillance programme and dissemination of the results was highly likely to lead to significant reductions in SSI rates in New Zealand, and that a reduction in rates of approximately 8% a year was possible.<sup>19</sup>

Due to the evidence for significant patient benefit and reduced healthcare costs, a national SSI surveillance programme was established in 2013. As described previously in this journal, the New Zealand Surgical Site Infection Improvement Programme, known as the SSII Programme, was instituted by the Health Quality & Safety Commission (the Commission) with an initial focus on hip and knee arthroplasties, now expanded to cardiac procedures.<sup>20</sup> The programme adopted an evidence-based three-pronged approach to reduce the incidence of surgical site infections in New Zealand, consisting of surveillance of surgical site infections via a nationwide surveillance system and data warehouse called National Monitor; promotion of nationwide adherence to specific evidence-based practices proven to reduce the incidence of SSI; and monitoring and reporting of changed practice and its effects on outcomes.

This study set out to determine the magnitude of improvement, if any, since institution of the programme. We report results from July 2013 until June 2017.

## Method

The purpose, background, structure and rationale for the NZ SSII Programme have been described previously in this journal.<sup>20</sup> Full details of the methods, data collection forms, definitions and interventions are available on the Commission's website.<sup>21</sup>

The SSII Programme is ongoing and has a three-pronged approach to reduce the incidence of SSI in New Zealand. In summary, these are:<sup>20</sup>

1. *Surveillance*: establishing a nationwide surveillance system and data warehouse called National Monitor, hosted by Canterbury DHB, initially targeting hip and knee arthroplasties, and expanded since 2015 to include selected cardiac surgery procedures;
2. *Practice change*: promoting consistent adherence to evidence-based practices proven to reduce the incidence of SSI; and,
3. *Monitoring changed practice and its effects*: measuring and providing feedback on the implementation of these best practices, and their effects on the rate of SSI. This includes an estimate of the value to the system, and to patients, due to effects on outcomes.

We briefly consider each of these strategies in turn.

### Surveillance

SSI surveillance for publicly funded hip and knee arthroplasty in New Zealand hospitals utilises National Monitor, a data warehouse developed by ICNet, provider of infection prevention and control surveillance software to surveillance programmes in the UK, the US, Australia, Scotland and Wales.<sup>22</sup> Trialled with eight DHBs in a development phase in early 2013, National Monitor was rolled out to remaining DHBs in July 2013.<sup>20</sup>

Only DHB-funded procedures, performed in either the DHB or other facility on a DHB contract, are included. Privately funded procedures performed in private surgical hospitals are not included in the surveillance. The US Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN) definitions for SSI are used.<sup>20,23</sup> These provide precise definitions of a surgical site infection and their classifications (superficial, deep and organ space) and make clear appropriate exclusions.<sup>21,24</sup>

Due to the availability of different systems in DHBs, some DHBs use an electronic surveillance system for case identification, but the majority of DHBs use either a manual or hybrid system containing both electronic and manual components. To ensure that all eligible procedures are included in the surveillance, multiple

sources of data are reviewed, including patient management systems, operating theatre records and emergency theatre records. Potential SSI cases are identified by surveillance of readmissions within 30 and 90 days after any specified hip and knee arthroplasty procedures funded by the DHB (including those in a private setting). Data capture takes place via hospital patient management systems using New Zealand's unique patient identifier, the national health index (NHI) number, as well as review of microbiology results, and liaison with operating room and ward staff, infectious disease physicians and microbiologists. Some DHBs also have the ability to run reports identifying patients that have admissions longer than the average length of stay to further review for infection.

The NHI allows linkage of all encounters with a health provider, including inpatient, outpatient and community-based care as well as readmissions.

Patient records of all potential cases are reviewed to determine if NHSN SSI definitions are met. Bacteraemia cases, for example, are also reviewed to determine if cases meet SSI criteria. Precision in definition is essential to having a consistent dataset that can allow comparison over time. Cellulitis, for example, does not in itself count as an SSI, and SSIs following manipulation of the operative site (such as aspiration of a hematoma, for example) are excluded from the definition of SSIs, as the course of infection is no longer clear. In situations of uncertainty the SSII Programme clinical lead or infection prevention and control (IPC) nurse specialist seeks further information from the operating surgeon. SSIs resulting from procedures performed at other hospitals are communicated by IPC staff for appropriate attribution and learning for quality improvement.<sup>24</sup> The SSII minimum dataset is completed for procedures that fulfil the NHSN criteria for SSI and are uploaded onto the online form in National Monitor by the data transfer team member. SSI data are submitted by DHBs each quarter, and independent data checks are made by the national SSII Programme team for anomalies and/or incomplete information to increase comprehensiveness of the database. Any additional information needed is requested from IPC staff at DHBs.

Training on application of the NHSN definitions included formal training at programme outset, as well as ongoing regular case review sessions at regional meetings and direct support from project team members. DHB IPC staff work with multidisciplinary teams at their organisations to ensure SSI case review is thorough and in line with definitions.

The feedback portion of surveillance results is crucial to reducing SSI rates. Surveillance reports subsequently generated are disseminated widely, to the expert faculty group, heads of orthopaedic departments, IPC staff and senior leadership at all DHBs, and published on the Commission's website.

Data elements recorded within National Monitor and detailed information on definitions, data collection, validation and quality assurance protocols are available in the Orthopaedics Surgery Implementation Manual (<http://www.hqsc.govt.nz/assets/Infection-Prevention/Surgical-Site-Infection-Surveillance/SSII-implementation-manual-Apr-2016.pdf>).<sup>25</sup>

### Practice change

A three-fold package of evidence-based interventions was implemented by the programme.

1. Administration of the right antibiotic in the right dose at the right time—evidence recommends  $\geq 2\text{g}$  of cefazolin intravenously for routine antibiotic prophylaxis for hip and knee replacements ( $\geq 1.5\text{g}$  dose of cefuroxime is an acceptable alternative).<sup>25</sup> For primary procedures prophylaxis should be administered as a single dose within 60 minutes before the initial incision (“knife to skin”) is made.<sup>20</sup> This is in line with the World Health Organization (WHO) Surgical Safety Checklist<sup>26</sup> item that checks if antibiotic prophylaxis has been given within the 60 minutes before knife to skin.
2. Skin antisepsis—ensuring that appropriate skin antisepsis before incision takes place: evidence recommends a preparation including 70% alcohol (eg, chlorhexidine gluconate/alcohol or povidone-iodine/alcohol solution).<sup>27</sup>
3. Clipping not shaving—ensuring that clipping of hair overlying surgical wound sites is standard practice, avoiding shaving.<sup>20</sup>

## Supporting practice change

To improve staff uptake, engagement and awareness, we implemented multi-pronged approaches to engage healthcare workers and encourage their active participation in surveillance and quality improvement activities.

A clinician with expertise in IPC was appointed as the national clinical lead of the SSII Programme to facilitate progress of the programme and provide regular updates to various stakeholders. Expert faculty groups were formed; these are multi-disciplinary teams comprised of surgeons, anaesthetists, perioperative nurses and IPC nurses from across New Zealand. The clinical lead also participates in peer-to-peer conversations with doctors around the country, via grand rounds, for example, and by invitation.

We conducted a national campaign around SSI prevention, including provision of a series of webinars focused on surveillance methods, quality improvement interventions and engaging consumers. This campaign also developed and distributed posters, patient education brochures and videos.

A quality improvement advisor was designated as a resource for the national SSII Programme to work with individual DHBs to progress quality improvement activities. A 12-month Quality Improvement Facilitator course was offered to an IPC nurse from each DHB with a specific focus on SSI reduction. This course included face-to-face learning sessions, regional meetings and monthly webinars that provide training in quality-improvement methodologies and tools. Each participant conducted an SSI-related project at their DHB and learnings and ideas were shared among this group throughout the course.

## Monitoring changed practice and its effects

The programme measures and reports the effects of compliance with the process measures below on one outcome measure: surgical site infections per 100 hip and knee procedures for orthopaedic surgery. Compliance with process measures is calculated from the National Monitor dataset, and collectively these measures are known as a Quality and Safety Marker (QSM)<sup>28</sup> and are publicly reported quarterly by DHB on the Commission's website.<sup>29</sup>

## Process measures

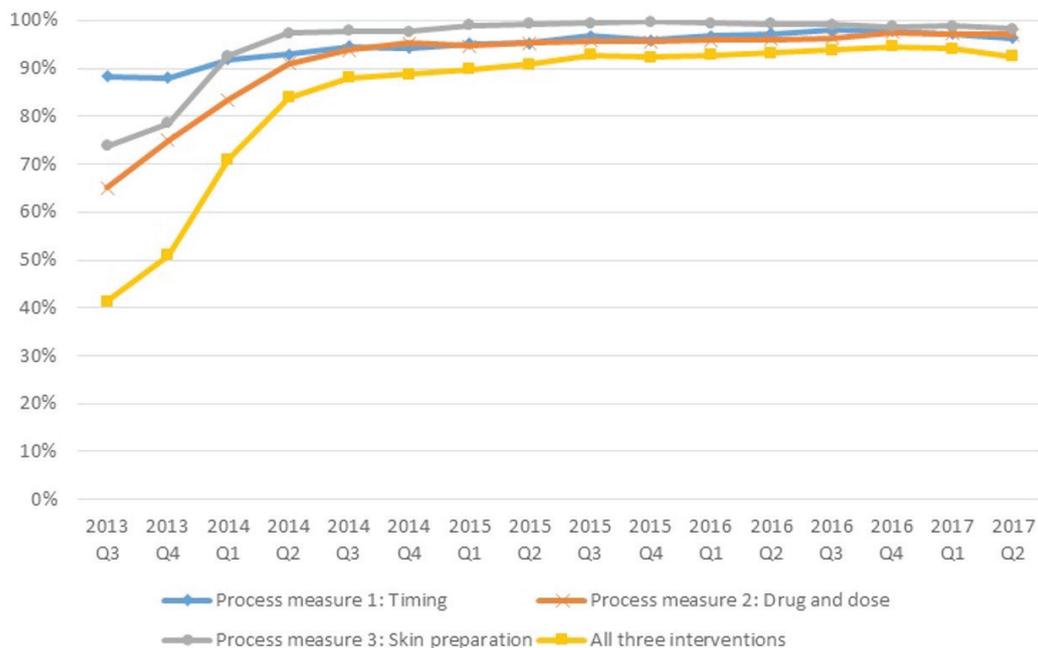
1. Correct timing for antibiotic prophylaxis—was the antibiotic given within 60 minutes before knife to skin in all primary procedures? The QSM target is 100%.
2. Right antibiotic in the right dose—was cefazolin  $\geq 2\text{g}$  used? (Cefuroxime  $\geq 1.5\text{g}$  is also acceptable). To allow for instances of beta-lactam allergy, the QSM threshold is 95%.
3. Appropriate skin antisepsis—has a 70% alcohol/chlorhexidine or 70% alcohol/povidone-iodine solution been used? This should always occur, so the QSM target is 100%. (Due to continual high compliance with 99% or more procedures meeting the threshold every surveillance quarter, this measure was retired in the last quarter of 2016).<sup>30</sup>

## Outcome measure

The main outcome measure collected and monitored by the programme is proportion of SSI per 100 procedures for total hip and total knee arthroplasties, including revision procedures, where the SSI is defined as superficial, deep incisional or joint space, occurring in hospital (in hospital refers to an infection occurring during the initial admission or requiring readmission within 30 days (superficial) or within 90 days (deep and organ space) post-operation). Infection rates are monitored using statistical process control (SPC) and results presented as run charts, or run charts with limits, known as control charts.<sup>31,32</sup>

Estimates of the value of reducing SSI are part of the Commission's measurement of this programme. The additional cost of treating an SSI in hip and knee replacements has been estimated at between NZD\$40,000 and NZD\$112,000.<sup>4,20,33</sup> Quantification of the value of an avoided SSI to the patient is necessarily approximate. However, SSI have been estimated to cost the patient 0.5 disability-adjusted life years (DALYs).<sup>34</sup> (The DALY combines the likely shortening of life (years of life lost) with the loss of quality of life (years of life disabled) to measure the effect on individuals and populations of specific illnesses and harms.<sup>35,36</sup>) The current New Zealand estimate of the Value of a Statistical Life (VoSL) is \$4 million (based on what New

**Figure 1:** Compliance with the three SSI prevention interventions for publicly funded hip and knee replacement procedures, by quarter (Q), 2013 to 2017.



Zealanders state they are willing to pay in improving roads to save a life). Using methodology from the Accident Compensation Corporation (ACC) to calculate the value of a year of healthy life (or avoided DALY) from this figure, each avoided DALY provides NZD\$181,000 worth of value.<sup>37</sup> Hence each avoided surgical site infection provides approximately NZD\$90,000 of value for each patient.

More detailed results covering these and other aspects of the programme are published in quarterly reports, the most recent covering the programme through to September 2017.<sup>38</sup>

## Results

### Change in practice

The QSM indicators show that for all three process measures there has been an increase in compliance between quarter 3 2013 and quarter 4 2016 (see Figure 1). Currently, more than 90% of hip and knee replacement patients receive all three interventions, up from 40% at the commencement of the programme.

Documentation of the right antibiotic in the right dose was, at greater than 98%, high

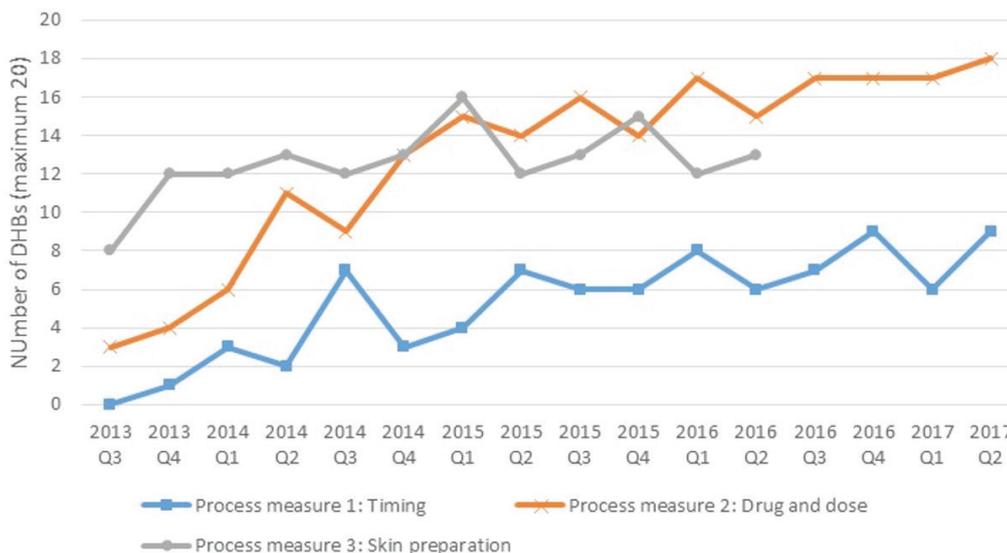
from programme outset, and the majority of improvement was due to improved compliance. While non-documentation of timing was higher initially at 8%, this fell significantly over the first five quarters to 2.5%. Failure to document the use of skin preparation fell in the first five quarters from 1.3% to 0.2%. From then improvement in compliance was due to increasing intervention adherence.

The number of DHBs achieving the nationally mandated thresholds for the three QSM process measures have increased over the period of the study (see Figure 2).

### Change in outcome measure: reduction in SSI rate over time

The median surgical site infection rate has shown a significant improvement, dropping to 0.91% since June 2015, compared with 1.36% during the baseline period of April 2013 to March 2014. Figure 3 shows the change in SSI rate in “p chart” format. There is a shift in overall rate from the third quarter 2015, ie, from August 2015, identified by a run of six consecutive points below the initial median rate.<sup>39,40</sup> This special cause variation in the infection rate was sustained from June 2015 to March 2017. The likelihood of this occurring by chance is <0.01.

**Figure 2:** Number of DHBs (maximum 20) achieving nationally mandated thresholds for achievement of the three QSM process measures, by quarter, 2013 to 2017.



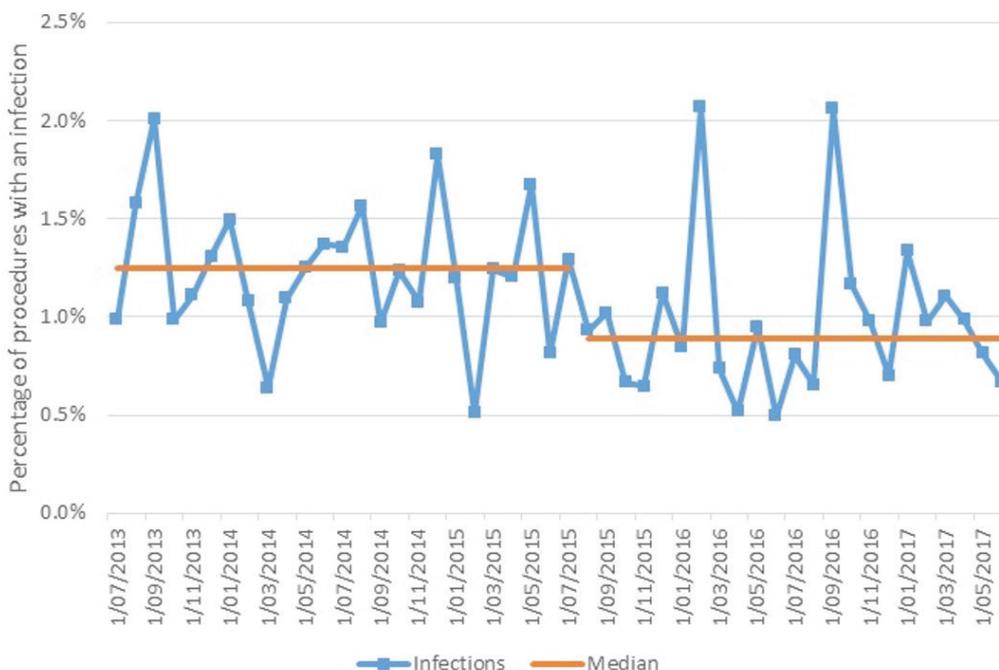
The majority—approximately 66%—of SSIs in the data were deep and organ space.

The two “spikes” in February and September 2016 are higher outliers, which indicate one-time occurrences of a special cause (more than three standard deviations from the mean). The reasons for these two special cause variations are difficult to ascertain, but examination of the September

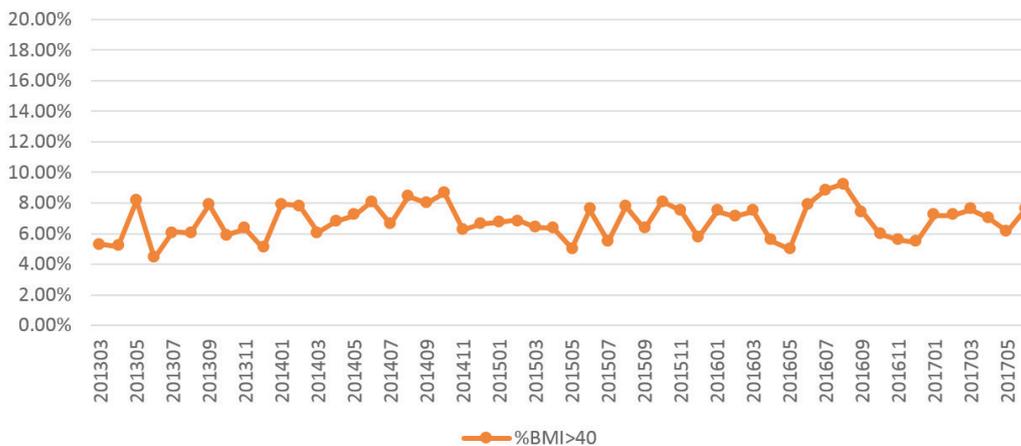
DHB-level data shows the number of SSI increased by one or two cases in seven DHBs compared with their baseline levels of zero or one case per month.

During the period of the study there was no reduction in the proportion of patients included in the analysis who were identified as morbidly obese (body mass index (BMI)  $\geq 40$ ) (see Figure 4).

**Figure 3:** Run chart showing proportion of hip and knee replacement surgeries which had a surgical site infection by month, New Zealand, 2013–16.



**Figure 4:** Proportion of patients with BMI ≥40, by quarter, March 2013–June 2017.



The reduction in the SSI rate to 0.91% equates to approximately 55 fewer infections between August 2015 and June 2017. There were 30 fewer observed SSI in the 2015/2016 financial year than we would expect from the baseline data (a 24% reduction), and 25 fewer observed SSI in the 2016/2017 financial year (a 19% reduction on baseline data). This reduction equates to, conservatively, savings of NZD\$2.2 million in avoided treatment for the period,<sup>4</sup> and avoided DALYs of NZD\$5 million.

To further test this apparent shift, a difference in proportion test on the SSI rate pre- and post- the shift point in August 2017 was conducted and showed a statistically significant reduction (odds ratio 0.78, 95% confidence interval 0.65–0.94, p=0.01) (see Table 1).

## Discussion

The introduction of the SSII Programme has resulted in an increase in compliance with three key process measures, associated with a reduction in the proportion of hip and knee replacement surgeries that had an SSI from August 2015. This reduction has been sustained to June 2017. The median SSI rate has shown a significant improvement,

dropping to 0.91% since June 2015, compared with 1.36% during the baseline period of April 2013 to March 2014 (p<0.01).

This result is in line with international findings. SSI surveillance involves the collection and provision of reliable data allowing clinicians to make meaningful comparisons between local incidence rates and national benchmarks, and to monitor changes in local rates over time. Strong international evidence from the Netherlands, Germany and France among others has shown that the monitoring and reporting of SSIs is associated with a mean reduction in their incidence.<sup>7–18</sup> As Krukowski and Bruce concluded in 2008, “it has been clear for almost three decades that the routine collection and dissemination of rates of surgical site infection results indirectly in a worthwhile reduction.”<sup>17</sup> Surveillance serves to inform and prompt the needed actions, but these actions must be implemented for improvement to occur. The universal, standardised application of practices proven to reduce the incidence of SSIs is required to see nationwide improvement in infection rates. Before promotion of the interventions of the SSII Programme there had been inconsistent

**Table 1:** Surgical site infection rates before and after run chart shift point (August 2017).

	Number of SSI	Number of operations	% SSI	Odds ratio (95% confidence interval) Before =1.0	p value
Before	252	20,536	1.23%		
After	195	20,352	0.96%	0.78 (0.65-0.94)	0.01

implementation of clinical practices associated with a reduction in SSI throughout New Zealand—eliminating unjustified variation in practice is a key element of quality improvement.<sup>41,42</sup> The QSM indicators show that for all process measures there has been an increase in compliance with expected best practice to the extent that this is now nearly universal across public hospitals in New Zealand. Further, in excess of 90% of hip and knee replacement patients now receive all three interventions, an increase from 40% in the third quarter of 2013. The use of these best practice interventions has effectively been undertaken as a “bundle”<sup>43</sup> by New Zealand hospitals. The increasing proportions of local units meeting these performance thresholds demonstrates that this improving compliance with good practice was seen across the country as unwarranted variation decreased.

Estimates of value are always approximate but using conservative estimates from the literature suggests the reduced number of approximately 55 SSI cases in hip and knee arthroplasty in New Zealand between August 2015 and June 2017 has contributed to savings of NZD\$2.2 million in avoided treatment. However, as Grimer and colleagues note, deep infection following an arthroplasty is not only expensive to manage, it is a “disaster for the patient”.<sup>44</sup> Understanding the financial benefits of avoiding infection is important but can obscure the harm and trauma caused to the individual if this is not quantified as well. Estimates using VoSL and ACC methodologies of reduced SSI in New Zealand hip and knee arthroplasty patients yields an estimate of avoided DALYs of NZD\$5 million between August 2015 and June 2017.

## Limitations

Infection rates have been analysed using statistical process control (SPC) approaches. SPC is a statistical technique with origins in manufacturing and industry, developed from the work of Walter Shewhart and W Edwards Deming from the 1920s onwards.<sup>45</sup> These approaches are now widely used in healthcare,<sup>39,40,46</sup> quality improvement projects,<sup>31,32,47</sup> IPC<sup>48,49</sup> and SSI reduction.<sup>50,51,52</sup> SPC is a useful approach to monitoring the effects of improvement interventions and has the advantages in allowing quicker iden-

tification of trends and more timely decision making.<sup>31,32</sup> Subsidiary before-and-after analyses support the reduction in SSI rate (see Table 1).

Not all the reduction in the SSI rate may be due to the greatly improved compliance with best practice. Other changes in practice following dissemination and discussion of local SSI surveillance data may have occurred, such as improved patient temperature control, theatre clothing, control of theatre traffic, wound dressing policy, weight reduction before surgery and health practitioner hand hygiene, all of which have the potential to reduce SSI. The potential effects of changes in casemix and proportion of patients presenting with higher BMI over the period of the study was examined in light of recent findings of a statistically significant association between higher patient BMI and early periprosthetic joint infection following total hip and knee arthroplasty (BMI  $\geq 40\text{kg/m}^2$  odds ratio 5.62, 95% CI 2.25-14.0).<sup>53</sup> Figure 4 shows that there has been no decrease in the proportion of patients with BMI  $\geq 40\text{kg/m}^2$ , indicating that the reduction in SSI is not a reflection of reduced risk.

The reasons for the two special cause variations are difficult to ascertain, but examination of the September DHB-level data shows the number of SSI increased by one or two cases in seven DHBs compared with their baseline levels of zero or one case per month. Closer examination of the SSIs in these outlier months does not point to any obvious reason for the two peaks. There do not appear to be more high-risk patients in these months, and the relative proportions of the type of SSI (superficial, deep, organ space) are identical to the period as a whole. Revision procedures accounted for 8% of all procedures included in the analysis.

## Strengths

The NHI linkage across all encounters with a health provider, including inpatient, outpatient and readmissions, has strengthened our ability to capture cases.

## Where to next?

The data showing a 24% reduction in observed SSI in the 2015/2016 financial year, and the 19% reduction in the 2016/2017 financial year, compare favourably with

the 2011 cost-benefit analysis finding that a reduction in rates of approximately 8% a year was possible.<sup>19</sup> This is an ongoing programme and the challenge now is to maintain these gains. New Zealand SSI rates are still double those seen in the UK and we need to consolidate and build on this initial success.<sup>54</sup> The most commonly isolated pathogen and cause of SSI globally and in New Zealand is *Staphylococcus aureus*,<sup>55,56</sup> accounting for about 30% of orthopaedic SSI identified in New Zealand patients, and coagulase-negative staphylococci about 13%.<sup>57,58</sup> The SSII Programme is currently working on nationwide implementation of a standardised anti-staphylococcal bundle derived from a Royal Australasian College of Surgeons (RACS) systematic review and meta-analysis<sup>59</sup> and endorsed by the Strategic Infection Prevention & Control Advisory Group (SIPACAG).<sup>60</sup>

The SSII Cardiac Programme has also observed opportunities to improve prophylaxis, particularly timing. *S. aureus* is also

the common pathogen isolated and interventions to reduce *S. aureus* infections will also benefit cardiac patients. It is probable that the orthopaedic and cardiac findings on prophylaxis and skin preparations are occurring in other surgical specialties. Our hope is that, by showing how practice can change and result in better patient outcomes, other surgical teams will utilise the methods proven to work here to reduce the risk of SSI in their patients.

## Conclusion

These data show that the introduction of a nationwide SSI reduction programme for primary hip and knee arthroplasties in New Zealand resulted in an increase in compliance across the country with expected best practice, that was associated with a reduction in incidence of SSI from a median of 1.36% during the baseline period of April 2013 to March 2014 to 0.91% since June 2015; a reduction sustained to June 2017.

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### Competing interests:

Richard Hamblin and Carl Shuker report affiliation with Health Quality & Safety Commission during the conduct of the study. Arthur Morris states that he is the Clinical Lead for the NZ Surgical Site Infection Improvement Programme. Sally Roberts is the National Clinical Lead for Health Quality and Safety Commission Infection Prevention and Control Programme. Alan Merry reports affiliation with Safer Sleep LLC, from null, outside the submitted work; and is Chair of Board of Health Quality and Safety Commission in New Zealand.

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# Counting the costs of major trauma in a provincial trauma centre

Helena Lee, Rowan Croft, Olivia Monos, Christopher Harmston

## ABSTRACT

**AIMS:** Trauma is an important cause of morbidity and mortality in New Zealand, and also represents a significant financial and resource burden on the healthcare system. Understanding local costs and factors that affect them is important for planning of trauma services and obtaining funding for quality improvement projects. The aim of this study was to assess actual costs and influencing factors in patients treated for major trauma in Northland, New Zealand.

**METHODS:** Adult patients admitted to Whangarei Hospital suffering from major trauma for three years from 1 January 2015 to 31 December 2017 were identified from the hospital's prospectively maintained trauma database. Major trauma was defined as an Injury Severity Score (ISS)>12, admission to intensive care or death secondary to trauma. Patients >50 years old with isolated neck of femur fractures, hangings, poisonings and drownings were excluded. Immediate or early (<24hours) transfers to tertiary hospitals were excluded from costing analysis.

Actual costs were calculated using in-house, patient-level costing utilising CostPro software. Case-weight costs, based on DRG codes used nationally, were also calculated using standard techniques. Factors affecting costs were analysed.

**RESULTS:** Two hundred and sixty-one patients suffering from major trauma were identified, 62 patients were transferred early leaving 199 patients for analysis. The mean ISS was 18 (IQR=14–22) and average length of stay was 8.5 days. Fifty-one percent of the cohort required intensive care and 36% underwent operative intervention in Whangarei Hospital.

Total actual cost was NZ\$4,614,652 with an average cost of NZ\$23,189 per patient. There was a significant difference in actual vs case-weight cost for the patients in the ISS 13–24 group who formed the bulk of the cohort. There was also extremely significant difference between the costs for patients requiring either intensive care or operative intervention versus those who did not ( $p=0.0001$ ).

**CONCLUSIONS:** This is the first study in New Zealand describing actual costs in patients suffering from major trauma and variation to case-weight costs. Intensive care admission and operative intervention have been identified as the two main drivers of cost.

Further studies are needed in New Zealand, particularly in major trauma centres, to better understand the true cost of major trauma within the country.

Morbidity and mortality due to major trauma is an important health problem worldwide, with the World Health Organization (WHO) estimating that 5.8 million individuals die each year with injuries, accounting for approximately 10% of the world deaths.<sup>1</sup> In New Zealand, approximately 27,000 people are admitted to public hospitals due to trauma and roughly 270 people die in hospital each year.<sup>2</sup> Data from the New Zealand trauma registry suggests that around 8% of patients admitted to

hospital with injuries have suffered major trauma, and the mortality in this group is 9%. There is, however, variation in the rate of major trauma between regions, and hospitals, within New Zealand.<sup>3</sup>

The economic burden of trauma is also significant with the WHO estimating that US\$518 billion is spent treating patients suffering from trauma.<sup>4</sup> Costs associated with major trauma have been reported in Europe, the US and Australia, with common

drivers of cost emerging.<sup>5-9</sup> No previous studies reporting costing of major trauma in New Zealand have been published.

Accurate data on costs in public hospitals in New Zealand is essential in guiding quality improvement initiatives as well as ensuring appropriate allocation of resources in the face of increasing demands. This is particularly important in assessment of trauma, which is potentially preventable and in the face of health budget constraints. The aim of this study is to assess costs and factors influencing costs in patients treated for major trauma in Northland, New Zealand.

## Methods

All adult patients admitted to Whangarei Hospital with major trauma between 1 January 2015 and 31 Dec 2017 were included for analysis. Adult major trauma patients were defined as those aged 16 or over with an Injury Severity Score<sup>10</sup> (ISS)>12, intensive care (ICU) admission or death secondary to trauma. In line with the national trauma registry, injury secondary to hangings, poisonings and drownings were excluded.<sup>11</sup> Immediate or early (<24 hours) transfers to other hospitals were excluded from costing analysis.

The primary cohort was identified from a prospectively maintained trauma database generated weekly by a trauma coordinator. Using the 2008 revision of the 2005 edition of the Abbreviated Injury Scale (AIS08),<sup>12</sup> AIS08 were calculated for all the patients, using coding and the patient clinical notes. The three most severely injured body regions have their scores squared and added together to retrospectively produce the ISS score.

Further information on the primary cohort was obtained from the hospital's clinical results reporting system, CONCERTO; including outcomes of pathological and radiological investigations as well as operative interventions. Patient demographics including ethnicity and residence data were obtained from the hospital data warehouse, along with length of stay and readmission rates. Patients were defined as residents if their primary residence was within Northland and non-residents if their primary residence was outside Northland.

Actual patient level costs in this study use New Zealand Common Costing Standards Version 17.<sup>13</sup> The standards have been developed for use in the public health sector to provide common standards for the costing of DHB services. Actual costs were calculated using in-house, patient-level costing utilising *CostPro* software with adjustment for nursing cost-acuity based on data from *TrendCare*. Specialty-specific costs were used for physician contact times and overhead and allied health costs were included as an average of overall throughput.

Diagnosis Related Groups (DRG) case-weight costs, based on DRG codes used nationally, were also calculated using standard techniques.

After testing for normality, Mann-Whitney U tests were conducted to compare the patient-level and case-weight costs calculated for patients in different ISS groups, those admitted to intensive care and those requiring operative intervention against those who did not.

The study was performed as part of a review of major trauma at Northland District Health Board. Health and Disability Ethics Committee opinion was sought via the HDEC scope of review process and ethical approval was deemed unnecessary.

## Results

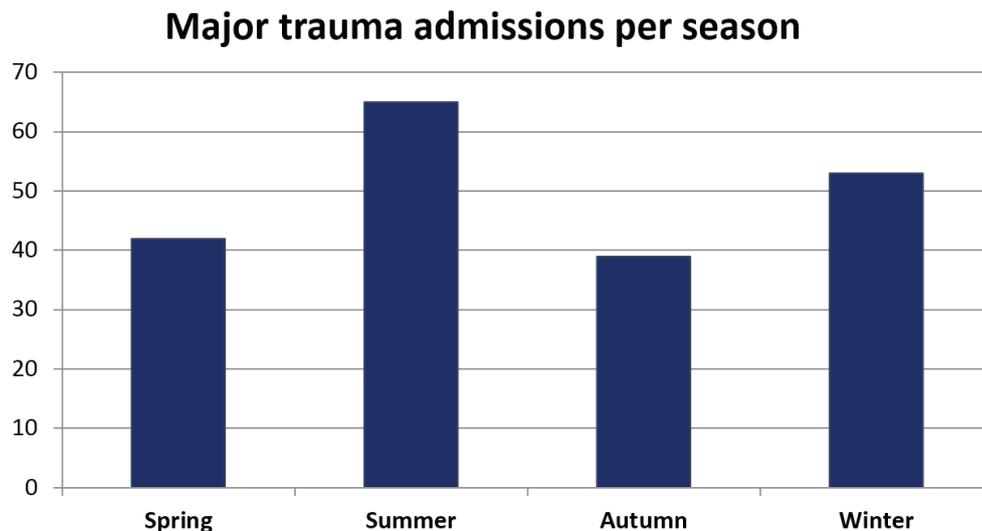
### Basic demographics

Two hundred and sixty-one patients were identified as suffering from major trauma, 62 patients (24%) had an early transfer to a tertiary centre. One hundred and ninety-nine patients therefore formed the primary cohort. Median age was 45 years (Range: 16–89 years); male to female ratio was 2.4. Thirty-three percent of patients identified as Māori, which is slightly higher compared to the 2013 census data of 29.6% Māori.<sup>14</sup>

Eighty-eight (44%) of patients resided in Whangarei, 82 (41%) resided in a rural area in Northland and 29 (15%) from outside the DHB catchment.

Total number of admissions in each season and mechanism of injury are outlined in Figures 1 and 2 respectively.

Figure 1: Total admissions per season over the three-year study period.



Clinical characteristics and outcomes

One hundred and eighty-three patients had an ISS>12, 85 (46%) of whom needed ICU admission. Sixteen patients with an ISS≤12 were included due to ICU admission alone. Overall 101 (51%) of the total cohort required intensive care.

Mean ISS was 18 with interquartile range (IQR) of 14 to 22. Average length of stay (LOS) was 8.5 days (IQR: 2.8–10.8 days), total number of bed days was 1,676.

Admitting teams are outlined in Figure 3, with most patients being admitted primarily under the care of a general surgeon.

Seventy-one (36%) of patients required operative intervention in Whangarei.

Overall mortality was 25 patients (12.5% of cohort).

Costs

Total actual cost was NZ\$4,614,652, with a mean of NZ\$23,189 per patient (IQR: \$5,597–\$31,082).

Total case-weight costs were NZ\$3,391,350, with mean of NZ\$17,042 per patient (IQR: \$6,021–\$25,371). The deviation of total actual cost to total case-weight cost was NZ\$1,223,302. There was no significant difference between actual cost and case-weight costs. Costs per ISS group are outlined in Table 1.

Costs, both actual and case-weight, were significantly higher in patients requiring operative intervention, regardless of ISS. Actual costs were significantly higher in patients requiring ICU admission than those not. There was a significant increase in LOS in both patients requiring ICU admission and operative intervention compared to those who did not (Table 2).

Figure 2: Mechanism of injury.

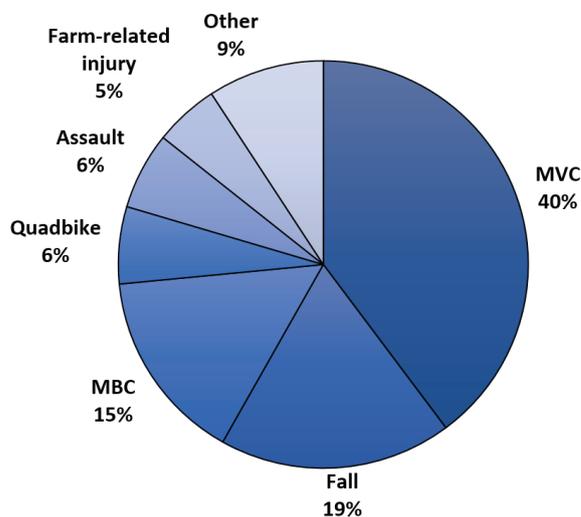


Figure 3: Major trauma admissions per speciality.

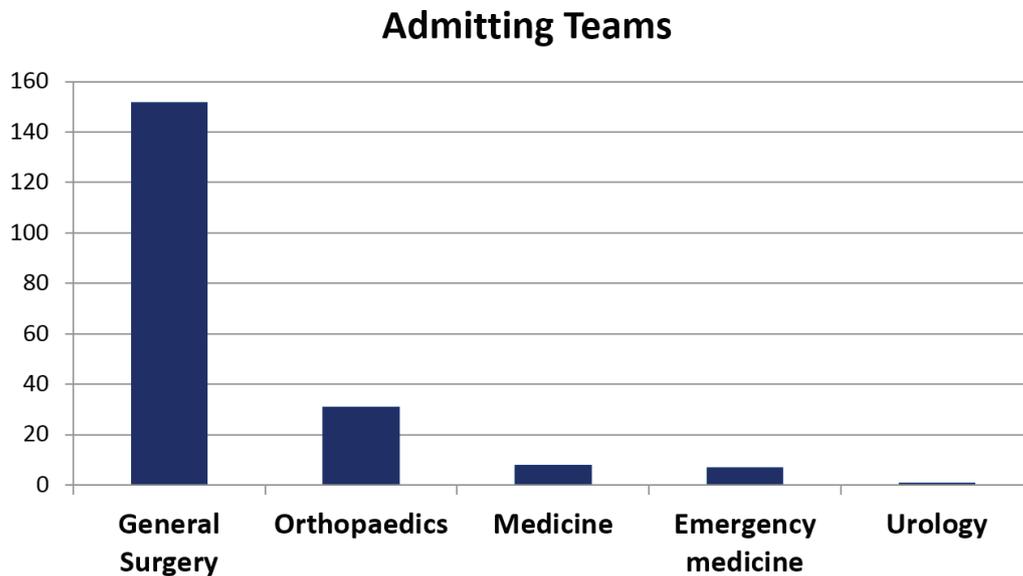


Table 1: Mean actual costs, case-weight costs and deviation based on ISS groups.

ISS group	n	Ave. length of stay (LOS) (Days)	Mean actual cost (NZ\$)	Mean case-weight cost (NZ\$)	Mean deviation from case-weight cost (NZ\$)	p
<13	16	9.2	\$24,629	\$15,605	-\$9,024	0.936
13–24	155	8.6	\$22,684	\$16,538	-\$6,146	0.144
25–40	22	8.1	\$29,466	\$23,654	-\$5,812	0.960
40+	6	1.1	\$9,379	\$9,654	\$275	0.928

Table 2: Mean costs based on ICU admission and operative intervention.

Intervention		Ave. LOS (Days)	Mean ISS (IQR)	Mean actual cost (NZ\$)	Mean case-weight cost (NZ\$)	Mean deviation from case-weight cost (NZ\$)
ICU	Yes	10.4	18.6 (13–22)	\$32,584	\$22,801	-\$9,782
	No	6.4	17.6 (13–18)	\$13,507	\$11,106	-\$2,401
p		0.0004	0.038	0.008	0.294	
Operation	Yes	12.2	18.8 (14–22)	\$38,839	\$28,066	-\$10,774
	No	6.2	17.9 (13–21)	\$14,508	\$10,927	-\$3,581
p		<.00001	0.171	0.001	0.007	

## Discussion

This study has outlined the actual and case weight costs of patients suffering major trauma treated in a provincial trauma centre and identified drivers of costs within this cohort. ICU stay and operative intervention were associated with a significant increase in costs.

In the New Zealand healthcare system, costs are estimated using either Diagnosis Related Groups (DRG) case-weights or by using patient-level costing. DRG case-weights are calculated using hospital coding to give DRGs for each condition or procedure for that patient. The weaknesses of this system, including inaccuracy in cost calculation for rarer delivered hospital services,<sup>15</sup> are well recognised; and this has stimulated a shift to patient-level costing in public health systems. There is also a lack of codes specifically designed for major trauma.

Actual patient-level costing aims to directly measure costs associated with a specific patient or patient-care episode. Costs are allocated by measuring actual resources used for the patient. The objective is to provide a more accurate estimate of cost for each patient.

Several previous studies have investigated costs in patients suffering from trauma in high-income countries, including major trauma patients. Most of these studies have been discussed in two systematic reviews.<sup>16,17</sup> Several themes emerged. Firstly, there is a wide variation in the costs of trauma worldwide, probably due to difference in index costs between different healthcare economies. Secondly, the most important cost drivers are likely to be ICU care, operative intervention and injury severity. Thirdly, there is discrepancy between actual, patient-level costs and those calculated using DRG codes.<sup>8,9,18,19</sup>

The findings in our study mirror those outlined above. The strongest predictor of costs in our study was ICU care and operative intervention. Costs did increase with increasing injury severity, but the most severely injured patients had a paradoxical decrease in costs due to the high early death rate. The actual costs we found are comparable with the recently published data from Australia, with major trauma patients in our study costing NZ\$23,189 compared to

AU\$28,584 per patient in Australia. If these costs are standardised to the US dollar 2017, then New Zealand major trauma cost are US\$16,511 per patient and Australian costs US\$22,181 per patient.

Although our study found no significant difference between the actual costs and case-weight costs for the different ISS groups, there was an overall marked deviation of total actual to total case-weight cost of NZ\$1,223,302.

As New Zealand uses the same DRG system to estimate costs it is unsurprising that there is a similar discrepancy between actual and DRG calculated costs in our study due to lack of codes specifically designed for major trauma. It is interesting that the largest discrepancy occurred in the least injured patients, who required intensive care. The corollary of this is that patients with an ISS<13 included in this study due to ICU admission had similar actual costs to those with an ISS≥13, but with lower DRG costs.

Although retrospective in nature, this study examined a three-year cohort of patients in a single, provincial institution in New Zealand. This allowed robust examination of costing and injury characteristics along with accurate assessment and calculation of injury severity. The data is likely to be applicable to other hospitals in the country fulfilling a similar role, but its applicability to larger major tertiary-level trauma centres is unclear. It is likely that, due to the differences in the case-mix seen in provincial vs major trauma centres, average actual costs are likely to be higher in larger centres. Though, the exact figures are yet unknown in New Zealand.

It is important to note that the New Zealand Major Trauma National Clinical Network has defined major trauma as death secondary to injuries sustained and an Injury ISS> 12, using AIS08.<sup>11</sup> In this study, we also included trauma patients who required intensive care as this was deemed a good reflection of injury severity necessitating higher level of care.

The authors accept the limitation of this study. The absolute number of patients is relatively small, especially within sub-groups; therefore, strong conclusions cannot be drawn. Furthermore, this study excluded patients who needed urgent

transfer to a tertiary centre and therefore, the calculated costs are presumably less on average compared to the whole cohort of patients initially admitted to our centre. Calculated costs for those who did require later, subsequent transfer will also not reflect the entire cost of their care. Finally, this study has only taken into consideration each patient's principal admission and not considered the cost of longer-term follow-up care required by a proportion of major trauma patients.

Despite these limitations, this is the first study in New Zealand to examine costs associated with care of major trauma patients

and has identified important drivers of costs, namely intensive care admission and operative management. We have also highlighted substantial variation of actual costs to case-weight costs. Importantly, this data can help guide quality improvement projects to reduce the financial burden of major trauma on the New Zealand Healthcare system. Due to the way healthcare is funded in New Zealand, it should also enable debate about appropriate funding for major trauma due to the different burden experienced by diverse trauma centres. Further studies are needed in New Zealand, particularly in major tertiary-level trauma centres, with larger numbers of patients.

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#### Competing interests:

Nil.

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# Improving quality of clinical coding of post-partum haemorrhage: the process and its effects on reported incidence rates in a New Zealand hospital maternity service

Geetha Galgali, Kim Fong, Karen Bissell, Delwyn Armstrong, Gyl Humphrey

## ABSTRACT

**AIM:** The Waitemata District Health Board (DHB) aimed to investigate and improve the accuracy of its reporting of post-partum haemorrhage (PPH), to understand its true incidence.

**METHOD:** The quality improvement project included multidisciplinary collaboration between maternity clinicians and clinical coders, substantive redesign of the Waitemata DHB's birth documentation form, systematic auditing and follow-up of clinical documentation by a dedicated quality midwife, linking of maternity clinicians to a key designated senior coder and ongoing PPH incidence monitoring and staff education.

**RESULTS:** The coded rate of PPH has risen dramatically and is now in line with expected Australasian incidence levels. A corresponding increase in the value of cost-weighted discharges (estimated at \$544,000 for the 2015/16 financial year) was realised as a result of the more accurate reported incidence.

**CONCLUSION:** This case illustrates the value of coding to a clinical service and the importance of clinical leadership and engagement in achieving successful and sustainable service redesign initiatives. It provides an example of how to evaluate and update coding and a process for changing the way clinicians and coders work that could benefit other services in Waitemata DHB as well as in other New Zealand district health boards.

Postpartum haemorrhage (PPH) is considered the leading cause of maternal mortality worldwide<sup>1</sup> and remains one of the major causes of pregnancy-related death and morbidity in the Western world. Definitions of PPH around the world vary, as do methods of calculating blood loss. In Australia and New Zealand, PPH is commonly defined as blood loss of 500 millilitres (mL) or more following vaginal delivery, or 750mL or more following caesarean section.

'Primary PPH' occurs within the first 24 hours after delivery, while 'secondary PPH' describes blood loss occurring between 24 hours and six weeks post-partum. Although the majority of PPH is caused by uterine atony and is often unpredictable, a past history of PPH is a risk factor. An Australian study<sup>2</sup> of 125,295 women found that women who have had one PPH have a three-fold increased risk of PPH in their next pregnancy. After two consecutive PPHs, the risk

climbs to four-fold for a third consecutive PPH. Even women who have PPH in a first pregnancy followed by a second pregnancy without PPH, have approximately double the risk of PPH for their third pregnancy. Thus, it is important to document and code PPH accurately, so that staff can put into place preventive measures for those at risk and manage patients accordingly. At a national level, accurate coding ensures quality information is available for casemix, research, health service planning, evaluation and funding.

Every inpatient and day stay patient discharged from a New Zealand public hospital has their clinical notes coded and recorded in the hospital's patient management system. Coding is performed by the district health board's (DHB) clinical coding team, who read the patient's hospital record from admission through to discharge and translate the diagnoses, injuries, procedures and treatments received into health classification codes. Whether the coded summary is an accurate reflection of the patient's hospital admission depends on the accuracy of documentation in the hospital notes by the patient's clinicians. Clinical coders cannot infer diagnoses from the clinical notes. Certain conditions, including PPH, require particular terminology to have been documented by the clinician in order for the condition to be coded. For example, a coder cannot independently assign a code for PPH unless a clinician has documented the term "PPH" in the notes. This principle applies regardless of whether the coder can see documentation of an estimated blood loss at delivery of more than the cut-off levels for PPH.

Each birth event is coded to a Diagnosis Related Group (DRG) which, in the case of maternity, groups by delivery method (prefix) and level of comorbidities and complications (CCL)—indicated by A, B or C suffix where A indicates severe or catastrophic CCL and C indicates moderate levels. The greater the CCL, the higher the costweight (known as Weighted Inlier Equivalent Separation or WIES) value. Coding of PPH can move the costweight of a birth event from a C level to a B level, or from B to an A. A potential problem with PPH incidence rates at the Waitemata District Health Board (Waitemata DHB) hospitals was detected in April 2013.

At a workshop run by the Health Roundtable (HRT),<sup>3</sup> Waitemata DHB presented their rate of PPH as 4–6%. This was significantly lower than the average rate of 12% for other services represented at the HRT (including the HRT data for WDHB). An investigation of the discrepancy between PPH rates in the clinical documentation and coded data indicated under-coding. A process of operational research and quality improvement was launched. It aimed to investigate and improve the accuracy of documentation and coding of PPH in the maternity service at Waitemata DHB. Specific objectives were to: a) audit the standard coding practice; b) audit clinical documentation; c) develop and implement a new process for documenting and coding PPH; d) determine whether the intervention had an effect on reported rates and on funding received; and e) describe the process and record the lessons learned.

## Methods

### Setting

The majority of deliveries at Waitemata DHB are performed by independent Lead Maternity Carers (LMCs) rather than WDHB staff midwives or doctors. Prior to August 2014, the clinical documentation of a woman's labour and delivery was completed by hand by the clinician facilitating birth using Waitemata DHB standard Labour and Birth Summary form. Information contained on the form was then entered into Waitemata DHB's Healthware programme, an electronic patient record platform, by an administrative staff member. The Healthware records are then used by clinical coders to assign the relevant clinical codes.

### Audit design and analysis

The audit was conducted in early 2014 by a public health physician and quality improvement midwife. They compared the two sources of data (clinical information collected in Healthware a clinical management system and the coded data captured in the patient management system (iPM)) related to PPH for the period July to December 2013. From Healthware's clinical information, the following variables were audited: estimated blood loss; postpartum haemorrhage; PPH prophylaxis; timing of blood loss; and risk factors. From the coded data in iPM, we ascertained the percentage

Figure 1: New Labour and Birth Summary form, incorporating PPH data.

**Waitemata**  
District Health Board  
Best Care for Everyone

First Name: \_\_\_\_\_ Gender: \_\_\_\_\_  
Surname: \_\_\_\_\_  
Address: \_\_\_\_\_  
Date of Birth: \_\_\_\_\_ NMR: \_\_\_\_\_  
Ward/Clinic: \_\_\_\_\_ Consultant: \_\_\_\_\_

**Maternity Services**

**Labour & Birth Summary 2**

Place of birth: \_\_\_\_\_ BSA   
Clinician facilitating birth: \_\_\_\_\_ VBAO   
Other clinicians present: \_\_\_\_\_ (List names)

**Birth Presentation**  
Vertex OA  Birth Position: \_\_\_\_\_  
Vertex OT  Vertex CP   
Vertex with hand  Breech extended   
Breech footling  Breech flexed   
Face  Shoulder  Other

**Birth Method**  
Spontaneous  Forceps  Vacuum   
Caesarean elective  Caesarean emergency

**Fetal Monitoring**  
Autocutout  Cont. CTG  FSE

**Placenta and Cord**  
Delayed cord clamping   
Placenta Birth Method: \_\_\_\_\_  
Inspection: \_\_\_\_\_  
Placenta: Complete  Membranes: Complete   
Cord vessels: \_\_\_\_\_  
Appearance/description: \_\_\_\_\_  
Management of placenta: Discarded  Given to: \_\_\_\_\_  
Discard after examination: Yes  No

**PPH Prophylaxis** Prescribe in maternal medications chart  
None  Syntometrine 5iu IM   
Syntocinon 10iu IM  3iu IV  5iu IV   
40iu infus. (theatre only)

**Est. Blood Loss (at birth)** \_\_\_\_\_  
+ additional \_\_\_\_\_  
**Postpartum Haemorrhage** Yes  No   
Primary PPH in <24hrs

**PPH Treatment**  
Syntocinon 10iu IM  Syntometrine 5iu IM   
Carboprost Intrauterine  IM  Doses \_\_\_\_\_  
Misoprostol PR  Buccal

**PPH Management** \_\_\_\_\_

of women who were coded as having had a PPH out of those who gave birth in this six-month period.

**The change process and measure of effects**

The process for changing the way of working on PPH documentation and coding was initiated in February 2014. The process was led by the public health physician and involved the quality improvement midwives, senior medical officers, clinical midwives and coding staff.

The group identified deficiencies in the existing Labour and Birth Summary form and clinical documentation. The group redesigned the form to incorporate a separate section for PPH in line with the coding requirements for the condition. This new section definitively identifies PPH, preventive interventions and treatments (Figure 1). The new form was implemented in August 2014.

A list of changes achieved and the innovations developed and successfully implemented are presented in Table 1.

**Table 1:** Innovations in the new processes related to coding of postpartum haemorrhage at the Waitemata District Health Board.

<b>Change achieved</b>	<b>Innovations in the new PPH process</b>
<b>Redesign of the Labour and Birth Summary form</b>	<ul style="list-style-type: none"> <li>• A six-month collaborative process between clinicians and coders produced a new form which requires the clinician to tick a Yes or No as to whether a primary “postpartum haemorrhage” occurred, and to record “PPH Treatment” and “PPH management” in a separate section on the form, distinct from “PPH prophylaxis” (refer to Figure 1 above).</li> <li>• The change in documentation was accompanied by extensive education of LMCs, staff midwives and clerks by the Waitemata Quality Midwives.</li> </ul>
<b>Strengthened clinical accountability for documentation</b>	<ul style="list-style-type: none"> <li>• Labour &amp; Birth Summary forms are audited by a dedicated quality midwife and senior doctors.</li> <li>• Any incorrect or incomplete forms are sent back to the clinician responsible for completion and educative feedback is given.</li> </ul>
<b>Improved accuracy of PPH diagnosis by clinicians</b>	<ul style="list-style-type: none"> <li>• Delivery suite recommendations are made to LMCs to bag and weigh all sheets and liners in order to estimate blood loss more objectively.</li> <li>• Scales are now available in every delivery room along with information on the dry weights of linen and disposable sheets to facilitate weighing blood loss.</li> </ul>
<b>Improved identification of women at future risk of PPH</b>	<ul style="list-style-type: none"> <li>• Diagnostic coding of PPH creates an alert on the patient’s electronic medical record should she re-present to maternity services for subsequent pregnancies.</li> </ul>
<b>Ongoing education and communication established</b>	<ul style="list-style-type: none"> <li>• A one page information newsletter is sent out electronically to all clinicians and LMCs at WDHB. It reaches people who may not learn of new procedures otherwise. For example, resident medical officers, and private LMCs.</li> </ul>
<b>Ongoing monitoring by a maternity public health physician</b>	<ul style="list-style-type: none"> <li>• HRT Australasian Healthcare Evaluation Data is used as a benchmark for monthly monitoring of WDHB PPH rates. Monthly feedback is provided to clinicians and coders.</li> </ul>
<b>Two-way communication established between coders and clinicians</b>	<ul style="list-style-type: none"> <li>• One advanced coder is assigned as the key link for maternity clinicians. Regular feedback is provided.</li> </ul>

In conjunction with the review of the data capture processes and form redesign, an initial analysis of cost weights was also undertaken to determine whether there had been an increase in the funding that is based on the percentage of PPH per total births. The percentage of PPH events, stratified by type of delivery, was calculated for the

financial years 2013/14 (pre-intervention) and 2015/2016 (post-intervention). The proportion of birth events in higher cost-weight DRGs was calculated. The value of the increase in costweight was estimated by applying the 2015/2016 national price (dollar value) to the increase between the two periods.

## Results

### 2013 audit of PPH rates and standard birth form design

The audit identified PPH rates of 16% in Healthware and 4–6% in iPM. Analysis of the Labour and Birth Summary forms revealed major issues with the way the forms were being completed by the LMCs.

Key diagnostic terminology was often missing from many women’s clinical records, making it impossible for clinical coders to code for PPH. Specifically, many Labour and Birth Summary forms recorded large amounts of estimated blood loss but did not document the term ‘PPH’.

### Rates of PPH before and after new process implemented

The new Labour and Birth Summary form was launched in August 2014 and new ways of working between coders and the maternity service were implemented from then on. From August 2014 to March 2017, the coded rates of PPH ranged from 5.5% to 13.7%, with a mean of 12%. The rates rose sharply in the months following the form change and plateaued at rates in line with the expected Health Round Table rates as illustrated in Figure 2.

### Comparison of cost weights before and after implementation of the new process

The analysis of birth events by DRG showed a substantial increase in the ‘A’ (highest weighted) DRGs between the pre-intervention (2013/14) and the post-intervention (2015/16) financial years; 17% (10%–11.7%) for vaginal deliveries, 65% (13.8%–22.8%) for vaginal deliveries with operating room procedures and 24% (3.3%–4.1%) for caesarean births. There was also an increase in the B DRGs, to a lesser extent: 5% (64.2%–67.3%) for vaginal deliveries and 22% (17.8%–21.7%) for caesarean births. The annual value increase in the financial year 2015/16 was estimated at \$543,933—the additional nominal revenue earned as a result of the higher weighting of cases (Table 2).

## Discussion

This paper has described the process of investigating the problem of unusually low coded rates of PPH at the Waitemata DHB, and the process of developing and implementing a quality improvement process in a busy maternity service that relies on independent LMCs. Important changes were identified following the implementation of

Figure 2: Postpartum haemorrhage rate January 2013–March 2017.

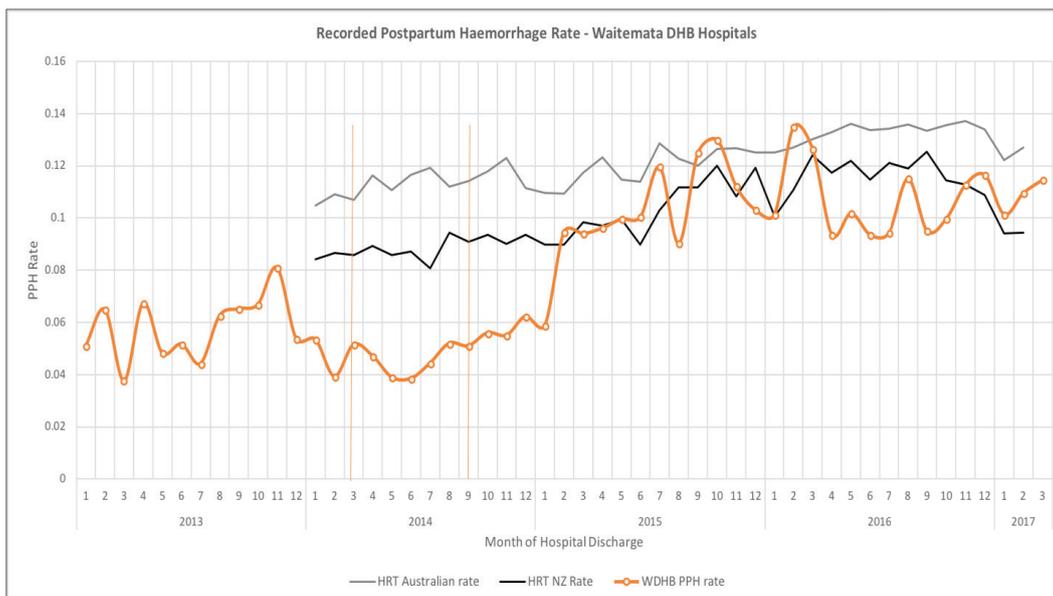


Table 2: Cost weights.

Measure	DRG Family	O60 Vaginal delivery		O02 Vaginal delivery with OR proc+		O01 Caesarean		Total	
		2013/14	2015/16	2013/14	2015/16	2013/14	2015/16	2013/14	2015/16
Births		4,596	4,603	138	123	1,941	1,905	6,675	6,631
PPH %		5.9%	11.5%	18.1%	29.3%	3.1%	9.0%	5.3%	11.1%
A DRGs	% of cases	10.0%	11.7%	13.8%	22.8%	3.3%	4.1%		
	% increase		1.7%		9.0%		0.8%		
	Avg WIES gain B -> A		0.43		0.46		1.10		
	Increase in value of events*		157,665		24,391		84,288		
B DRGs	% of cases	64.2%	67.3%	N/A		17.8%	21.7%		
	% increase		3.1%			3.9%			
	Avg WIES gain C -> B		0.22			0.36			
	Increase in value of events*		150,439			126,890			
Increase in value of birth events (at national price \$4,751.58)			328,364		24,391		211,178		543,933

\*at 2015/16 national price \$4,751.58.  
 +Operating room procedure.

a new form to capture and communicate procedures and outcomes. In particular, the reported rate of incidence of PPH rose dramatically. This means that funding will be allocated appropriately to the service, according to the casemix of events as calculated by DRG costweights.

The solution involved improving data validity at its source; that is, ensuring the right data is collected from the clinicians, and documented in the right place for the clinical coders. The adage applied “*if it’s not written down you never assume that it happened.*”<sup>4</sup>

### Implications of improved discharge data for PPH

There are many reasons why accurate documentation and coding of PPH is important. The changes achieved in the WDHb maternity service mean that it is contributing improved quality of data for national level processes as well as at its own DHB level.

In New Zealand, hospital discharge data is forwarded to the Ministry of Health where it is stored in the national collection National Minimum Data Set. The accuracy and quality are important attributes as these data contribute to an array of significant outputs, such as:

- Improving patient care;
- National and regional morbidity and mortality analysis;
- Contract monitoring and payments—in New Zealand, DHBs are funded on a population-based-funding- formula (PBFF) which aims to fairly distribute available funding between DHBs according to the relative needs of their populations and the cost of providing health and disability services—as shown by WIES<sup>5</sup> data (derived from discharge clinical coding data);
- Research into diseases, injuries and patient outcomes;
- Benchmarking of clinical practice between hospitals; and
- Improving hospital practices and resource allocation—detecting where clinical problems are that need addressing at a public health level.

At a DHB level, accurate PPH coding is essential to meet a number of important outcomes and actions. For example an accurate discharge record is important for continuity of care between different providers and to facilitate future care episodes. The correct coding of PPH on a woman’s clinical record should facilitate a heightened alert to her carers that she is at

increased risk of further PPH in her subsequent pregnancies and require preventative treatment.

Accurate data capture and coding is essential for DHB planning purposes. These data provide the basis for decisions on the allocation of resources (human and plant) at a local level as well as a national level. They are important in discussions about population-based funding and increase of funding requests as they provide tangible evidence and compelling justification of the need.

Finally these data contribute to the routine audit and quality monitoring processes within a DHB and can provide early indicators of change. These early indicators can then play a role in signaling a need for research or for generating new questions that can add to new knowledge that improve the care of women during and after their delivery.

### Lessons learned and other qualitative outcomes for the maternity service

A number of positive changes in the maternity service were also anecdotally observed and reported. Maternity Service providers at WDHB speak of having greater trust in the coded data for PPH. Clinicians appear to have greater awareness and interest in clinical documentation and an understanding of the coding process. It is likely that this is a result of their involvement in developing the new Labour and Birth Summary form.

A new and valuable relationship between WDHB clinicians and coders has developed as a natural result of their collaboration redesigning the birth summary form and procedure. The maternity services also now have a direct line of communication with their key maternity coder. The monthly meeting between clinical service and the coders is an innovation unique to the maternity service. Clinical coders have been empowered by the maternity service to identify areas of concern, such as those they believe may be leading to under-coding, and to communicate these directly with clinicians. There is a sense of clinicians taking their concerns seriously, probably since the value of the coder's role has been made clear to the service through the recent process. Clinicians are reported to be enthusiastic and interested in this

monthly feedback on PPH rates and appear interested to hear how well they have been completing the documentation.

A key challenge to implementing a new process for PPH was buy-in from clinicians, who were not initially convinced that low recorded rates of PPH were a problem. There was mistrust of the data, blame placed on the coders and a sense that this would be a waste of time for already overburdened clinicians. The key to bring staff on board as part of the change was the presentation of unequivocal evidence from the audits that the 4–6% coded rates for PPH were in fact invalid. Clinicians were educated about the link between the importance of appropriate documentation around PPH to enable accurate coding, which in turn impacts the amount of funding received by the maternity service.

It became clear during this process that the precise terminology required of clinicians for coding purposes is not something that is taught at medical, nursing or midwifery school and many clinicians were unaware of the downstream effects of their documentation on their clinical service. However, once staff members understood the value of clinical coding and the role they each played in the “big picture”, they were eager to collaborate.

### Extension of the approach to other innovation projects

The successful clinical engagement achieved through this project has already led to further projects aimed at improving the quality of clinical documentation for other important conditions which have resource implications from accurate coding. Key conditions identified for maternity services include post-caesarean wound infection, anaemia, gestational diabetes mellitus and hypertension. Waitemata DHB is also looking to commence the same process in other services including Paediatrics and Gynaecology.

On reflection, the key elements that made the process and the outcome so successful and transferable were:

1. Use Health Round Table data as a starting point to detect discrepancies and pick one or few conditions. Do not be complacent about apparently low rates of morbidity at your institution.

2. A dedicated resource team is essential. It should comprise a public health physician, quality midwife and a decision support team.
3. Seek to improve data validity at source.
4. Clinical ownership of the redesign process and collaborative involvement with senior clinicians and coding team is crucial.
5. Sustaining interest is difficult but essential.
6. Changing mind sets, processes and actual practices takes time. Don't lose patience!

## Conclusion

We have been able to highlight improvements in the quality of clinical coding as a consequence of an innovative process implemented in the maternity service at the WDHB. A process of operational research and quality improvement, with new forms and a new collaboration between clinicians and clinical coders, has improved accuracy of documentation and coding, and successfully changed practices. This paper provides an example of how to evaluate and update coding as well as a process for changing the way clinicians and coders work that could benefit other services in WDHB as well as in other New Zealand district health boards.

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### Competing interests:

Nil.

### Acknowledgements:

We acknowledge and thank the Health Round Table for their information and note, as per their policy that: *“Health Roundtable reports are reliant on the accuracy of data provided by each of its members, and are intended only to supplement each organisation’s own risk identification and management practices as a catalyst for further inquiry. Historical results may not be a reliable indicator of future performance”*. Policy #07: Publishing your health roundtable results. p. 3

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# Media portrayal of Māori and bariatric surgery in Aotearoa/New Zealand

Jamie-Lee Rahiri, Ashlea Gillon, Sai Furukawa, Andrew Donald MacCormick, Andrew Graham Hill, Matire Louise Ngarongoa Harwood

## ABSTRACT

**AIM:** Media constructs in Aotearoa, New Zealand naturalise the dominant Western culture. Conversely, mainstream news about Māori is rare and prioritises negative stereotypical constructs that are often centred on Māori as economic threats via resource control and political activism. These narratives influence continued discrimination against Māori in New Zealand. Media representations of bariatric surgery in New Zealand are not widely understood. We explored the portrayal of Māori and bariatric surgery in print and online news media articles in New Zealand using an inductive approach to thematic analysis.

**METHOD:** An electronic search of two databases (Proquest Australia/ New Zealand Newsstream and Newztext) and two New Zealand news media websites (Stuff and the New Zealand Herald) was performed to retrieve news articles reporting stories, opinion pieces or editorials concerning Māori and bariatric surgery published between January 2007 to June 2017. Articles were scored using a five-point scale to assess the level of reporting as either very negative, negative, neutral, positive or very positive. Included articles were then subjected to inductive thematic analysis using the NVIVO 11 to identify and explore common themes surrounding Māori and bariatric surgery.

**RESULTS:** Of 246 articles related to bariatric surgery over the 10-year study period, 31 (13%) were representative of Māori. Articles were scored as 'neutral' to 'positive' with a mean reporting score of 3.7 (Kappa score of 0.72 [95% CI, 0.66–0.78,  $p < 0.0001$ ]). Five main themes were identified, these were: Attitudes towards bariatric surgery; complexity of obesity and weight loss; access to bariatric surgery; Māori advocacy and framing of Māori. Of the five themes, access to bariatric surgery and attitudes towards bariatric surgery were most prevalent. Māori advocacy was another common theme that arose largely due to the support of public funding of bariatric surgery championed by Dame Tariana Turia. Aside from this, narratives describing equity of bariatric surgery provision and equitable outcomes following bariatric surgery for Māori were sparse.

**CONCLUSION:** There was limited reporting on Māori health inequalities and equitable access to publicly funded bariatric surgery in New Zealand. We argue that this lack of coverage may work against addressing disparities in obesity prevalence and access to publicly funded bariatric surgery for Māori in New Zealand.

Bariatric surgery is currently the most effective treatment for severe obesity and obesity-related disease.<sup>1–3</sup> Public funding for bariatric surgery in New Zealand has increased in the last decade. Dame Tariana Turia, a retired member of New Zealand parliament, advocated for increased awareness and funding of bariatric surgery following her own experience of bariatric surgery.<sup>4</sup> Bariatric surgery is in high demand but remains elusive due to the cost of private surgery and limited public funding available in New Zealand.

Māori are the Indigenous peoples of New Zealand and have higher rates of obesity and obesity-related disease burden compared to non-Māori.<sup>5</sup> The most recent New Zealand health survey reported that 30.5% of European adults and 50.32% of Māori adults in New Zealand were obese.<sup>6</sup> Despite this, Māori appear to have reduced access to publicly funded bariatric surgery in New Zealand.<sup>7</sup> Equitable access to publicly funded bariatric surgery is dependent on many factors, including adequate funding and resources, referrals from primary care, patient and wider societal attitudes towards bariatric surgery.<sup>8</sup>

Media portrayals of health issues impact perspectives of health and wellbeing and can ultimately undermine the fundamentals of health equity and justice.<sup>9-10</sup> Māori representation in the New Zealand media often involves a blend of ethnic labelling practices and frequent positioning as economic threats via resource control and political activism, all of which influences discrimination against Māori in New Zealand.<sup>11</sup> Obesity is often negatively stigmatised through notions of laziness and lacking discipline.<sup>12</sup> Bariatric surgery can therefore be a contentious topic under discourses of resource scarcity, unfair distribution and public healthcare spending.<sup>13</sup>

Research critiquing the media surrounding the portrayal of bariatric surgery in New Zealand is limited. To our knowledge, this is the first study that seeks to investigate media portrayals of Māori and bariatric surgery in New Zealand. Given the intersectional tensions that exist within this space, we felt this was a worthy topic of research. The aim of this paper was to explore print and online news media articles portraying Māori in the context of bariatric surgery using an inductive approach to thematic analysis.

## Methods

An electronic search of two New Zealand news media websites (Stuff and the New Zealand Herald) and two databases (Proquest Australia/ New Zealand Newsstream and Newztext) was performed from retrieve articles published between January 2007 and June 2017. Full texts were obtained to identify news articles reporting stories, opinion pieces or editorials concerning Māori and bariatric surgery. Two reviewers (JR and SF) independently performed the searches and examined and excluded irrelevant articles in an iterative process. Searches were last performed June 26, 2017 (Table 1).

## News article ratings

Included articles were scored by two reviewers (JR and SF) using a five-point scale reported by Williamson et al to assess the level of reporting.<sup>14</sup> This scale aims to provide a subjective opinion of the article as a whole with a specific focus on the portrayal of bariatric surgery. A score of 1 was ‘very negative’, 2 ‘negative’, 3 ‘neutral’, 4 ‘positive’ and 5 ‘very positive’. Overall scores of 3.5–5 were considered ‘positive’ and scores of 1–2.5 negative.

## Thematic analysis

A thematic analysis using the NVIVO 11 was performed to identify common themes. A general inductive approach was used as described by Braun and Clarke.<sup>15</sup> Articles were read through several times to find meaningful patterns leading to the formation of codes. Initial codes generated throughout the texts were revised, inspected and grouped appropriately into themes. Themes were named and defined, then compared for significant connections, both within and across the themes. Final readings of all articles were performed to contextualise the developed themes and to ensure study relevance and applicability. Two reviewers (JR and AG) independently performed the analysis and met to compare codes and finalise themes. Where consensus was not met, the senior author (MH) was consulted.

## Results

The initial search yielded 1,138 print online news articles of which 246 (202 newspaper; 44 online) articles were relevant to bariatric surgery in New Zealand. Of these, a final 31 articles portrayed Māori and bariatric surgery and were included for final analysis (Figure 1).

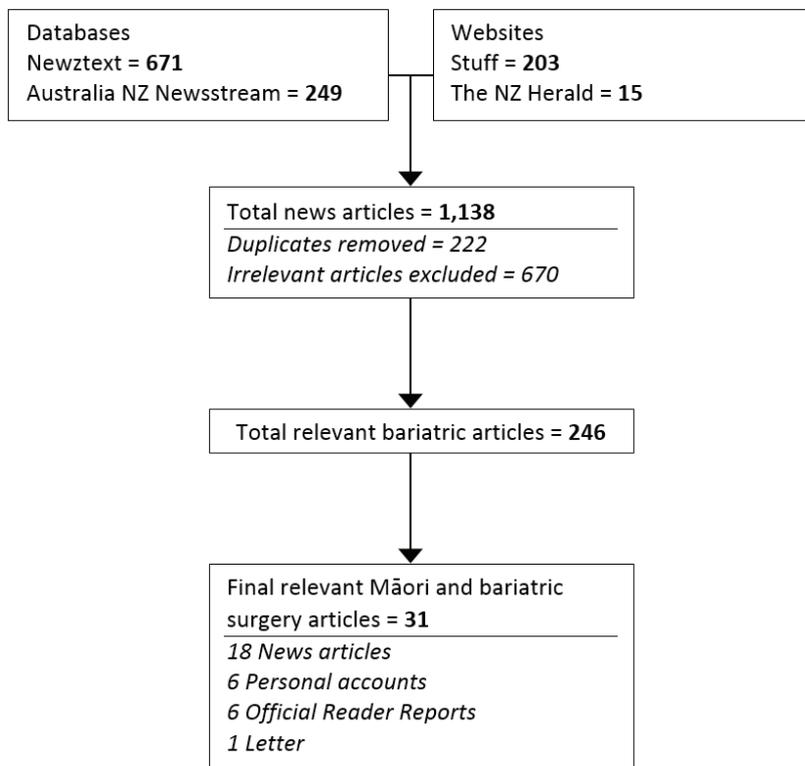
## News article ratings

The mean score of all news articles was 3.7, indicating neutral to slightly positive

**Table 1:** Key search terms for each database and online news website.

Newztext	Proquest Australia and New Zealand Newsstream	Stuff/The New Zealand Herald
1. bariatric	5. bariatric	8. bariatric
2. “weight loss surgery”	6. morbid obesity	9. morbid obese
3. “morbid obese”	7. New Zealand	10. morbid obesity
4. “morbid obesity”		

**Figure 1:** Flow diagram depicting the selection process of relevant news articles.



reporting. Two articles (6.5%) were negatively framed (mean score = 2), 21 (67.7%) were positive (mean score = 4.3) and eight (25.8%) were neutral (mean score = 3). Scores between the independent assessors were highly correlated with a Kappa score of 0.72 (95% CI, 0.66–0.78,  $p < 0.0001$ ).

**Thematic analysis**

A mind map of the coding tree used to discern the major themes and discourses is presented in Figure 2.

**Access to bariatric surgery**

The theme of access was dominant and largely underpinned by rhetoric regarding the exclusivity of bariatric surgery in New Zealand. Majority of articles (N=20, 65%) suggested this was attributable to high cost of surgery and lack of public funding. Arguments of cost-effectiveness and efficacy of bariatric surgery attempted to justify the need for more public bariatric procedures considering the demand:

*“One of the more remarkable features of bariatric surgery and certainly of gastric bypass is the almost immediate end of diabetes, high-blood pressure and high cholesterol... for every patient funded for the surgery, at least another two, whose health would benefit from the procedure, are referred.”<sup>16</sup>*

This dialogue often urged the New Zealand Government to fund more procedures due to the strain obesity and obesity-related diseases places on precious health resources.

Another perceived access barrier was lack of education and understanding of bariatric surgery. This was highlighted within primary healthcare. The common belief that diet and exercise form the best methods for treating obesity was challenged and it was suggested in two articles that general practitioners (GPs) generally lacked understanding of bariatric surgery:

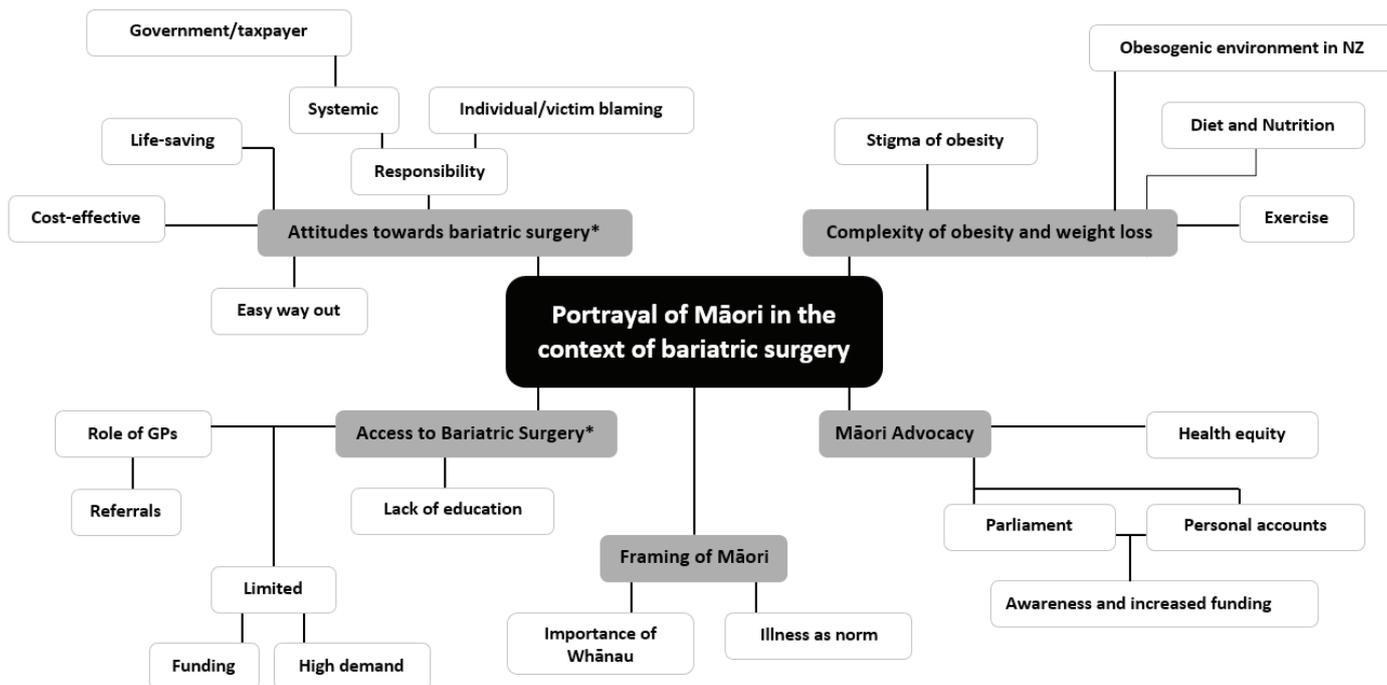
*“One of the most effective long-term forms of treatment for obesity is being denied to thousands of New Zealanders because of a lack of understanding among family doctors about the procedures available.”<sup>17</sup>*

The notion of ‘gatekeeping’ was identified in relation to care being restricted and bariatric surgery framed negatively:

*“I have been concerned at the complaints I have received from those needing surgery who have had to put up with negative attitudes towards bariatric surgery from some GPs.”<sup>18</sup>*

A personal account from a Māori man implied a need to ‘persuade’ his GP to consider referring him for bariatric surgery:

Figure 2: Coding tree leading to the development of overarching themes following thematic analysis.



\*Indicates main themes; GPs, general practitioners; whānau, family.

“...for the sake of his health he needed to have bariatric surgery and persuaded his GP to refer him...”<sup>19</sup>

### Attitudes towards bariatric surgery

Most articles (N=21) were positively graded due to positive attestations of bariatric surgery from both healthcare providers’ and patients’ perspectives. Six articles were personal accounts, of which five were from Māori. All patients described an overwhelmingly positive journey. These articles served as platforms for healthcare providers to advocate for bariatric surgery and their patients. Much of the narrative was formed in response to the negative stigma bariatric patients often face through their bariatric journeys:

“There is still huge prejudice against it. The belief that people that have bariatric surgery should be exercising, that they’re lazy and stupid.”<sup>20</sup>

Despite overall positivity in the reporting of the articles, an undeniable debate surrounding social justice and responsibility emerged. Two clear threads were observed. The first challenged the responsibility of the government and healthcare providers to support more bariatric procedures due to the potential cost-saving benefits long-term:

“If you look at the risks of heart attacks, diabetes, high blood pressure, strokes and joint replacements, the cost of not performing bariatric surgery may be greater than performing it.”<sup>21</sup>

The second argued individual responsibility of weight loss and challenged ‘taxpayer funding’ of bariatric surgery. The notion of bariatric surgery being an ‘easy way out’ arose several times and was equally contested by clinicians:

“Another myth... is it is the ‘easy way out’ for people too lazy to diet or exercise. Having much of your stomach removed with all the attendant possible risks is hardly a soft option.”<sup>22</sup>

It was also suggested that public funding of bariatric surgery is a ‘privilege’ granted by taxpayers. This elevated to suggest that taxpayers were being generous and that this generosity could run its course:

“The public health system already picks up the tab for some operations, and the argument has now shifted to how many more are taxpayers... willing to pay for.”<sup>23</sup>

Excerpts like this provided a platform for victim-blaming analyses against obese individuals who undergo publicly funded bariatric surgery. This further perpetuated perceptions of laziness and lack of control. A follow-on pattern from this was patient insecurity in admitting to having bariatric surgery. It was suggested that there was also a discernible difference between public and private bariatric patients in disclosing whether they had bariatric surgery:

“Poorer folk who’ve experienced this massive change will shout it from the rooftops... but richer folk will often tell their friends ‘I’m just exercising and eating well.’”<sup>24</sup>

### Complexity of obesity and weight loss

Efforts to assist readers to better understand obesity and the experience of obese individuals in New Zealand were observed. Binary explanations of obesity were dismissed whereas complex descriptions of obesity were promoted. Negative stereotypes of bariatric surgery certainly arose from those associated with obesity. These stereotypes tended to oversimplify obesity in suggesting that obesity was a personal choice:

*“Most of the public think being grossly overweight is simply a personal choice... They think it is down to a chips versus veges mentality.”<sup>22</sup>*

Personal accounts of bariatric surgery revealed significant psychosocial stressors associated with obesity. Such reflections spoke to feelings of shame and the subsequent responses like binge eating that created never-ending cycles of depression. The excerpt below described the powerlessness of being obese:

*“If you’ve never had to survive in this society at over 200kg you don’t understand... how powerless you feel.”<sup>19</sup>*

### Framing of Māori

The dominant theme focusing closely on Māori within the obesity-bariatric surgery context was the importance of whānau. Whānau was key in the decision and motivation to opt for bariatric surgery and to maintain a healthy lifestyle afterwards:

*“And so, after talking with all our whānau, investigating all the options... I underwent gastric bypass surgery.”<sup>25</sup>*

A small number of articles described the disproportionately higher rates of obesity and obesity-related disease in Māori compared with non-Māori in New Zealand. An emergent theme was that obesity and comorbidity burden was a ‘normal’ experience for Māori:

*“He knew obesity was in the family, as well as heart disease and diabetes... This was perhaps a ‘typical Māori story’...”<sup>24</sup>*

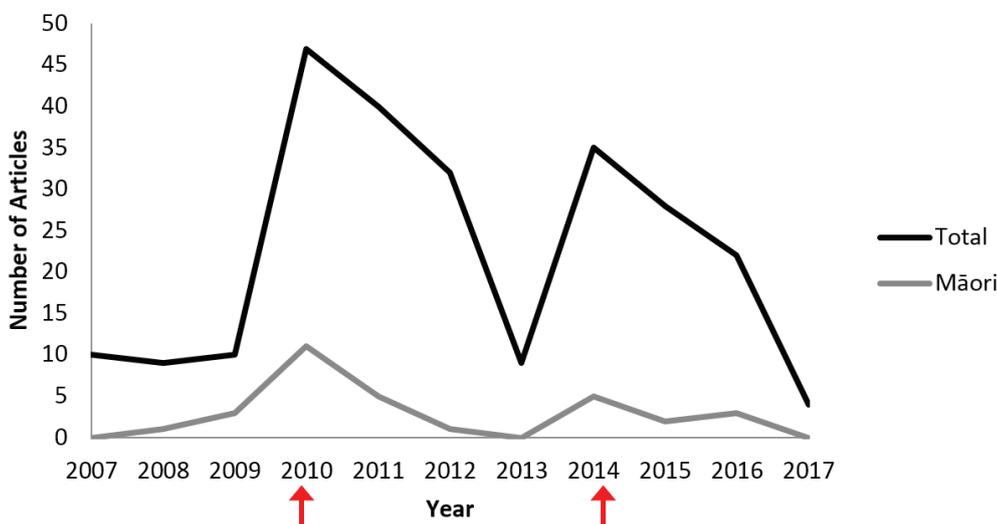
This excerpt was taken from an article that covered a New Zealand documentary series that followed several patients on their bariatric journeys. A sense of stereotypical reinforcement towards Polynesian communities in New Zealand was reported:

*“...I think it reinforced some stereotypes: South Auckland; probably Polynesian; poor—there were people living in tents and caravans; maybe a bit lazy, or a bit crazy.”<sup>24</sup>*

### Māori advocacy

This last theme developed from an overwhelming presence of Māori advocacy for bariatric surgery. Dame Tariana Turia was present in 22 news articles (71%) where she promoted and endorsed additional government funding of bariatric surgery. Over the course of the 10-year study period, news article publications peaked in 2010 and 2014 following announcements by Dame Tariana regarding public funding for bariatric surgery (Figure 3). The need to address health inequalities in obesity and obesity-related disease for Māori and to ensure equitable access to publicly funded bariatric surgery was also emphasised:

**Figure 3:** Proportion of bariatric and Māori articles in relation to the total number of bariatric news articles.



\*arrows indicate New Zealand Government announcements for additional public funding of bariatric surgery.

*“... We know that obesity, diabetes, heart disease and cancer are the most serious conditions affecting Māori... Investing in bariatric surgery for 1,000 of our peoples a year will have huge long-term savings in health.”<sup>26</sup>*

Through personal accounts in five articles, Māori patients also supported the need for more public funding, having themselves experienced the positive life-changing benefits of bariatric surgery.

## Discussion

Only a small proportion of articles (N=31, 13%) related to bariatric surgery in the New Zealand context discussed Māori individuals, peoples, contexts or spaces. The most dominant themes centralised on access and attitudes towards bariatric surgery. The overall rating of articles was neutral to slightly positive (mean score 3.7) due to high coverage on the benefits of bariatric surgery. Māori advocacy promoted awareness and public funding of bariatric surgery, but this did not appear to transpire into themes of health equity in terms of access to or outcomes following bariatric surgery for Māori. Negative stereotypical constructs of obesity emerged and most of the articles served as rebuttals to these narratives.

Obesity has been widely dissected in the media. Researchers have debated socio-medical and scientific discourses of obesity, fatness and weight loss in the media in an attempt to explore impacts on patient care.<sup>28–30</sup> Negative stigma associated with obesity includes laziness, gluttony and even stupidity.<sup>31</sup> These characteristics arose within the included articles and were applied to both the obese and bariatric recipients. These narratives contribute to socio-cultural constructions of ‘fatness’ that in turn impact understandings and management of obesity. Weight-based discrimination is real and directly impacts quality of life, stress and risk of depression.<sup>32</sup> This, aside from the perpetuation of the Obesogenic environment, perhaps plays an important role as to why the obesity epidemic is so difficult to address in contemporary New Zealand society.

As a result of framing obesity as a self-inflicted phenomenon, bariatric surgery has struggled to acquire social acceptance as an effective treatment for obesity and obesi-

ty-related disease. Glenn et al critiqued news media coverage of a single, publicly funded bariatric clinic in Canada and deduced that obesity needed to be positioned as a medical condition in order to justify bariatric surgery as a necessary medical treatment.<sup>13</sup> They also found that bariatric surgery was framed as lifesaving as opposed to cosmetic in order to justify government expenditure in the Canadian healthcare system. This was also found to be true in the majority of articles in this study where the justification or defence of bariatric surgery due to its efficacy and high demand were common.

It has long been reported that Māori suffer higher rates of obesity and obesity-related disease.<sup>5,33</sup> However, the narrative of health equity for Māori was scarce over the included articles. This was surprising given the significant role Māori have played in championing increased public funding for bariatric surgery in New Zealand over the last decade.<sup>34</sup> The New Zealand Ministry of Health states that national prioritisation criteria for bariatric surgery is “fair, transparent and equitable”.<sup>35</sup> Although, no explicit targets for ethnicity were set as it may “give the appearance of one patient being favoured over another”.<sup>35</sup> This statement perhaps alludes to a fear of inciting societal angst around unfairness in distribution of public resources through ‘race-based’ policies. It is a common occurrence that issues of concern to Māori are often minimised or silenced in mainstream media as a result of the normalisation of dominant Western views.<sup>36–37</sup> The near absence in the media of the issue of equity for Māori in the obesity-bariatric context could indicate this issue is irrelevant and unimportant to wider New Zealand.

The media bridges the gap between the medical community and the general public.<sup>38</sup> It presents issues and determines the level of importance attached to them, thereby influencing public understanding and awareness.<sup>39</sup> News articles will focus on subjects that are prevalent, relevant and of interest to the public.<sup>40</sup> Our analysis of print and online news articles related to Māori and bariatric surgery in New Zealand over 10 years shows that increasing wider societal acceptance and promoting further funding for bariatric surgery in New Zealand takes priority over addressing long-

standing health inequities for Māori. The small number of articles that were related to Māori perhaps reflects the level of importance in the media.

A limitation we encountered in performing this study arose in our application of Williamson's rating scale for scoring bariatric news items.<sup>14</sup> This scale could be easily applied to determine whether the bariatric surgery component of the articles was framed as positive or negative. However, this scoring tool was originally used in a study based in the UK and as such it did not have the sensitivity to pick up the nuance of media bias against Māori in New Zealand. In staying true to this scale, we declared that media portrayals of Māori in the context of bariatric surgery were 'positive'. However, several studies have shown the New Zealand media to be largely biased against Māori where Māori are often constructed as 'inferior' or 'lazy' (or both).<sup>36-37,41</sup> Therefore, while the Williamson scale may have allowed for articles to be scored positively overall, given the deficit positioning of Māori in the New Zealand media, stories related to Māori and bariatric surgery are at risk of being read through uncritical lenses that may reinforce

negative stereotypes against Māori. As such, neutral to positively scored articles related to Māori and bariatric surgery do not necessarily take into account the entrenched negative positions Māori occupy in the New Zealand media. To combat this, we critiqued the articles closely in our analysis to allow for the identification of discriminatory discourses against Māori in relation to bariatric surgery.

This study cannot determine the general attitudes and beliefs of New Zealand society, Māori, bariatric or other communities present in the included articles. However, examining the position of the media is important in monitoring what messages are being emitted and how this could guide policy-makers' and healthcare providers' decisions. The media is a source of health information and is therefore critical in shaping public opinion regarding health equity, obesity and bariatric surgery. Health equity between Māori and non-Māori in the context of bariatric surgery in New Zealand has not yet been explored in depth. Our analysis of the media provides one method of understanding how this important issue is perceived in the media and the wider New Zealand context.

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# Time to stop making things worse: an imperative focus for healthcare student bullying research

Althea Gamble Blakey, Lynley Anderson, Kelby Smith-Han, Tim Wilkinson, Emma Collins, Elizabeth Berryman

## ABSTRACT

Student bullying in clinical practice remains a concern, and evidence regarding what works to specifically help the student appears rather piecemeal. At the same time, emergent literature indicates that some bullying interventions can be ineffective for behaviour change, or even deleterious to the staff which they target. Considering the potentially sizeable financial and personal costs associated with continued bullying and undertaking an intervention, it would seem sensible that any selected intervention method avoids those shown to be potentially ineffective or deleterious. Such avoidance would likely help to move the student bullying research forward, prevent further suffering and reduce the waste of valuable taxpayer resources.

**H**aving designed, implemented and evaluated an anti-bullying intervention for the clinical workplace over the last three years, we have come to better understand the current situation regarding student bullying in healthcare. This article reflects our understanding of the literature and what we have learned in practice.

Recent statistics and meta-analyses indicate that student bullying in the clinical workplace is an ongoing concern.<sup>1-3</sup> Substantial media and academic attention has been paid to various aspects of student bullying, which both indicate that this issue remains a problem. One worldwide study shows that 59.4% of medical students will experience bullying during their training;<sup>2</sup> in New Zealand, a similar level of bullying is at 54%.<sup>4</sup> These levels of bullying have been described as an “unspoken emergency”,<sup>5</sup> and similar concerns are expressed about students of nursing<sup>6</sup> and the allied health professions.<sup>7</sup> These concerns have now been played out in recent memoranda of understanding between several New Zealand district health boards (DHBs) and Australasian professional bodies, eg, the Royal Australasian College of Surgeons (RACS).<sup>5</sup>

Empirical research into healthcare student bullying reveals several important facts: that the commonest perpetrator is the senior male staff member, and that the most frequent bullying acts are general harassment, verbal abuse, gender and racial discrimination.<sup>2</sup> While any student can suffer bullying, those of a minority race, the female gender or who identify as LGBTQ+ are most likely to experience it.<sup>2</sup> The consequences of bullying are reported to potentially comprise issues such as disengagement from learning and academic failure,<sup>7</sup> acute and chronic mental health issues, to include self-harm and suicide.<sup>9-13</sup> More broadly, bullying of students (and staff) can cause and contribute to team dysfunction, systemic medical error and avoidable adverse health outcomes. Therefore, any bullying in the clinical workplace can place our patients at risk.<sup>14,15</sup>

Of importance to health systems more broadly is that the effects of bullying can have substantial negative financial implications.<sup>14</sup> Because most of New Zealand’s DHBs already work against considerable resource constraints, student bullying can thus be understood to seriously impact an organisation’s bottom line and detract from many of its primary aims.<sup>14</sup>

In the literature it has been established that policy about behaviour is necessary, but not sufficient to change behaviour.<sup>16</sup> We also find that literature regarding bullying interventions implemented specifically to help the student is comparatively less informative than that aimed at clinical staff.<sup>17</sup> What exists is also piecemeal, and unclear in terms of ‘what helps what’. This lack of apparent knowledge is in itself concerning, but also worrisome because students occupy a vulnerable position within the health workforce.<sup>14</sup> This position is one in which a student is concomitantly subject to power differences, bullying that can occur specifically at the teacher-learner interface,<sup>17</sup> and also likely to have limited or emergent resilience.

Mavis<sup>18</sup> suggests the following definition of bullying/mistreatment, which acknowledges the unique position of a student within the clinical workplace:

“Mistreatment, either intentional or unintentional occurs when behaviour shows disrespect for the dignity of others and unreasonably interferes with the learning process. Examples of mistreatment include sexual harassment; discrimination or harassment based on race, religion, ethnicity, gender or sexual orientation; humiliation; psychological or physical punishment; and the use of grading and other forms of assessment in a punitive manner.”

While evidence from the literature suggests that there is no ‘magic bullet’ to solve the student bullying issue, some reports have begun to explain why some intervention attempts might fail to be wholly effective. For example, failure may be due to the potentially varied cause of each bullying act, which might emanate from a person’s beliefs, a

personality conflict or catalysed by environmental influences in the workplace<sup>2,17,18</sup> (eg, an unreasonable workload); underreporting of bullying also makes it difficult to understand what exactly is happening, and can create difficulties in understanding what might best be done to help. There are also concerns that bullying can be reluctantly or inexpertly addressed, the former being especially likely where an accused possesses clinical expertise which is desirable or rare.<sup>20</sup> Because a bullying intervention might also compete financially with the provision of clinical services, it is also possible that a type of intervention is selected for perceived value-for-money rather than quality, relevance<sup>14</sup> or efficacy, such as that required for staff to genuinely change or develop their values.<sup>29</sup> An intervention might seem appropriate, but be incongruent with effective learning or what might actually help. In Table 1, we list some reasons why a bullying intervention may be ineffective.

While the fundamental effectiveness of a bullying intervention appears to be based on the successful negotiation of several complex factors, some emergent and potentially deleterious ‘side effects’ of bullying interventions give us more information about how to better implement an intervention, and thus now require consideration. For example, it is now noted that some methods of delivering interventions to staff may induce feelings of being ‘targeted’, ‘at fault’ and perhaps being bullied themselves, if content is ‘aimed’ at certain negative behaviours, say ‘anger management,’ or staff groups, say ‘the doctors’.<sup>20,21</sup> It also seems that negative feelings (eg, anger, inadequacy) can be engendered by other delivery methods,

**Table 1:** Possible reasons why a bullying intervention might be ineffective.

- possibly complex or varied origins of bullying;<sup>2</sup>
- environmental influences on workplace behaviour;<sup>19,20</sup>
- underreporting that prevents identification of origin or type of bullying;<sup>2</sup>
- management reluctance to address bullying;<sup>20,21</sup>
- lack of available expertise for handling complaints;<sup>18,19</sup>
- lack of available expertise for intervention delivery;<sup>18,19</sup>
- selection of ineffective or inappropriate mode of intervention delivery or topic, eg, based on the preclusive costs or unavailability of another;<sup>14</sup>
- learning challenges associated with the cultivation of values.<sup>29</sup>

such as the use of posters. At one New Zealand site, posters about appropriate and acceptable workplace behaviour were reportedly torn down by staff, apparently because of feelings of frustration. Most of these problems are reported to have a deleterious effect on staff engagement and how well they might ultimately learn from an intervention.<sup>20,21</sup>

Similarly, there are emergent findings about some reporting procedures, which rarely lead to positive behaviour change<sup>22-26</sup> but have now also been shown to be potentially deleterious because aspects of the reporting procedures might themselves be *experienced as bullying*. For example, where an accused is 'isolated' from communicating about a complaint with other staff, which is usually undertaken to prevent others 'taking sides' or skewing information. While a laudable goal, such an act can be experienced as kind of marginalisation, in itself a harmful practice<sup>21</sup> which is understood by some to indicate management's complicity with bullying acts. We also understand that values education, where not done well (eg, by lecture), can cause a person to disengage from learning because it can imply 'fault' or 'lack' in a person.<sup>28,29</sup> In summary, a growing body of literature about student bullying intervention now provides specific evidence that some might be harmful, as listed in Table 2.

**Table 2:** Possible reasons why a bullying intervention might be deleterious.

- a perpetrator feels personally targeted (eg, by professional group or behaviour);<sup>20,21</sup>
- marginalisation of an accused, imposed as part of an incident investigation;<sup>20</sup>
- ineffective or inappropriate methods of cultivating values.<sup>20,28,29</sup>

## Summary

The focus of bullying interventions to help our students needs to change. We need a specific focus on interventions, with more in-depth and considered practices than has hitherto been the case, together with a significant amount of expert guidance and support for *all* who work and teach in the clinical workplace. While such options might be rare or financially prohibitive, without these, it might be that the values and behaviours required for better practice are not cultivated as we would wish.<sup>20</sup> We need to undertake such a quest now: to ameliorate continued negative financial implications of bullying on our students, staff, patients and institutions.<sup>14</sup> Some health providers (eg, DHBs in New Zealand) are now required, by law, to ensure that bullying is *effectively* tackled, as part of a duty of care to *each student, staff, victim or protagonist*.<sup>21,27</sup> We are thus required both morally and legislatively to move from just 'doing something,' to 'doing it right.'

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# Topiramate induced renal tubular acidosis

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**T**opiramate is a drug used for the treatment of generalised tonic-clonic seizures, migraine prophylaxis and many other off-label indications<sup>1</sup> such as bipolar disorder<sup>2</sup> and post-traumatic stress disorder.<sup>3</sup> With increasing use of topiramate, reports have emerged of biochemical derangements attributable to this medication which may preclude or limit its use. We report a case of a 51-year-old female found to have incidental hypokalaemia and on further investigation, renal tubular acidosis (RTA) for which searches incriminated topiramate as the likely cause. Biochemical abnormalities normalised following drug cessation.

## Case report

A 51-year-old female was incidentally found to have mild hypokalaemia on a routine insurance medical, with potassium 3.4mmol/L, bicarbonate 18mmol/L [reference 22–28] and raised chloride at 117mmol/L [reference 95–110]. Venous blood gases showed a low normal pH of 7.39 [reference 7.34–7.44], bicarbonate low at 16.3mmol/L, base excess -8mmol/L [reference -3 to +3] and confirmed chloride of 117mmol/L. Urine anion gap was positive, in this context supportive of a distal as opposed to proximal RTA. Urine citrate was low with a ratio of 0.03 [reference >0.15], also consistent with distal [or type 1] RTA. Searches for possible drug-related causes implicated topiramate, which she had been taking as a potential cause. Biochemical abnormalities normalised following cessation of this drug.

## Discussion

The biochemical picture was consistent with mild type 1 distal RTA with a positive urine anion gap and low urine citrate supportive of a distal tubular mechanism. Urine anion gap is calculated as [(sodium

+ potassium) – chloride] and a value greater than zero is positive and supportive of distal RTA.<sup>4</sup> Conversely, in proximal or type 2 RTA, renal tubular ammonia production is increased to buffer the excess hydrogen ions, chloride production is increased and hence urine anion gap is negative.<sup>4</sup> Topiramate is a classic cause of this biochemical disorder with studies suggesting that up to 30% of outpatients on topiramate had low serum bicarbonate concentrations.<sup>5</sup> The mechanism, however, is thought to involve both proximal tubular mechanisms with impaired reabsorption of filtered bicarbonate and distal tubular mechanisms with impaired hydrogen ion secretion.<sup>5</sup> Inhibition of carbonic anhydrase activity, that catalyses the conversion of carbon dioxide to bicarbonate and hydrogen ions is thought to underlie the proximal tubular effects. Classical hypokalaemic distal RTA has a very broad differential diagnosis, including hereditary, sporadic, auto-immune diseases such as Sjogren's syndrome and many drugs<sup>4</sup> including topiramate.<sup>5</sup>

The hypokalaemia in our case was mild and asymptomatic. The *caveat*, however, is that this may become more severe with any intercurrent illness that may involve diarrhoea or vomiting. There are also potential adverse effects of long-term acidosis on reducing bone density and increasing the risk of renal calculi. Topiramate is associated with increased risk of nephrolithiasis. Compared with an expected incidence of stone formation in the general population of around 0.2%, this may be increased up to 1.5% on topiramate.<sup>6</sup> Urinary citrate is a recognised inhibitor of urolithiasis, and its deficiency, along with decreased acidification of urine, may contribute to an environment that supports calcium phosphate stone formation. Importantly, the biochemical abnormalities are completely reversible on discontinuing topiramate, as was observed in our case.

This case was triggered by the discovery of incidental and asymptomatic hypokalaemia. The cause was identified through further investigations of acid base status, indicating a hyperchloraemic normal anion gap acidosis followed by a literature search

of possible offending drugs that implicated topiramate. There were 810 patients receiving topiramate in Canterbury in 2016, which reinforces the need for clinicians using this agent to be vigilant for possible adverse metabolic effects.

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**Competing interests:**

Nil.

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# Enough doctors support the End of Life Choice Bill to make it operable

Jack Havill, Miles Williams, Jay Kuten, Frank Kueppers, Alistair Macdonald, Gary Payinda, Stanley Koshy, Alison Glover, Jonathon Baskett, James Davidson, Margaret Sparrow, Rowan Stephens, Libby Smales, Lannes Johnson, Carol Shand, John Musgrove

In March 2018, the *NZ Doctor* publication commissioned an 'End of Life Choice' survey by Horizon Research using their subscriber email contacts.<sup>1</sup> The survey was sent to 1,540 doctor subscribers and 545 responded (35% response rate) The responders included 73.7% general practitioners (GPs), 17.5% GP registrars, 3.9% GP locums and a small number of other doctors.

The object of the questions was to evaluate general practitioner (GP) support for aspects of the current End of Life Choice Bill (EOLC Bill) being considered by the Justice Select Committee. The questions considered included:

1. Do you support or oppose a law change to allow medical practitioners to assist people to die, where such a request has come from a mentally competent patient, 18 years and over, who has end-stage terminal disease, and is in advanced state of irreversible decline with unbearable suffering; eg, cancer?  
Results: support (37%); neither support or oppose or don't know (11%); oppose (52%).
2. Do you support or oppose a law change to allow medical practitioners to assist people to die, where such a request has come from a mentally competent patient, 18 years or over, who has unbearable suffering, is in an advanced state of irreversible decline, but the disease may not cause death in the immediate future eg, motor neurone disease?  
Results: support (31%); neither support or oppose or don't know (13%); oppose (56%).
3. Would you support a law change to allow a legally enforceable and binding specific request for assistance to die (an End of Life Choice Directive) written in advance by a competent patient in the event of a situation such as severe dementia. The example shown was "*if I develop severe dementia from Alzheimer's disease or other degenerative brain disease, and my mental competence has deteriorated to a state that I am no longer able to recognise close relatives or friends; am totally dependent on others for basic physical needs, eg, feeding and drinking, and need to have spoon feeding by others; need toileting for incontinence, and have to be dressed by others—I request that I be given medical assistance to die*".  
Results: support (30%); neither support or oppose (14%); oppose (56%). (Comment by authors of letter: although this sort of assisted death is not allowed for in the present EOLC Bill, there have been submissions to include it).
4. If medical practitioners were able to legally give assistance to die, would you be prepared to write a prescription for a drug to allow the patient to self-ingest the drug causing their death?  
Results: yes (24%); not sure (18%); no (57%).
5. If medical practitioners were able to legally give assistance to die, would you be prepared to give a drug intravenously causing the patient's death?  
Results: yes (15%); not sure (17%); no (68%).

These results show that the number of doctors supporting law change, who although in a minority, actually form a substantial group. A similar study by Oliver et al<sup>2</sup> in 2017 showed that 37% of New Zealand doctors supported medical aid in dying (MAID). Only 40% of those were GPs, meaning that the remaining respondents were from other specialities.

In New Zealand we have about 14,000 medical doctors in total, of which about 4,000 are GPs. In this particular survey, involving mostly GPs, the percentages supporting change in the law in questions 1–3 above were 30–37%. Extrapolating the figures using the lowest percentage of 30%, that means that at least 1,200 GPs are supportive to all questions. In addition, the undecided GPs were 11–14%, suggesting that further GPs could possibly be involved. These figures make it clear that there are enough GPs alone to make a law such as that proposed to function adequately. These numbers of course do not include the other 10,000 medical practitioners, which could possibly add at least 3,000 extra supporters of law change.

With regards to those willing to write a prescription or give an intravenous drug to cause death, the numbers are much smaller but still allow for enough doctors to make the EOLC law workable. The 24% willing to write a prescription represent almost 1,000 GPs. Again, the 15% of GPs willing to give an intravenous injection causing death represents 600 GPs. Neither of these figures count the other 10,000 doctors who are not GPs—extrapolating using the same percentages as above, there could be a further 2,400 prescription writers and 1,500 intravenous givers.

Use of MAID in legalised jurisdictions across the world varies from 0.3–4.6% of all deaths.<sup>3</sup> New Zealand had 33,000 deaths in 2017 so one might expect somewhere between 100 and 1,500 patients who would use MAID each year. As has happened in other places there would be fewer initially.

In summary, there are substantial numbers of doctors in favour of legalised MAID, which suggests that the challenge of operationalising the EOLC Law is surmountable.

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**Competing interests:**

Nil.

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 James Davidson, Retired Pathologist, Auckland; Margaret Sparrow, Retired Sexual Health Physician, Wellington; Rowan Stephens, Retired General Practitioner, Auckland;  
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# A response to *Primum non nocere*: first do no harm

Phillida Bunkle

Professor Linda Bryder<sup>1</sup> argues that the decades of limited or withheld treatment of CIS (CIN3) of the cervix at National Women's Hospital which ended with the Cartwright Inquiry of 1988 has been retrospectively justified by recent new research which once again blurs the boundary between CIN 2 and CIN 3. I argue, however, that Bryder's criticism of the Cartwright Inquiry misses the key issue. The inquiry found evidence of significant scientific misconduct in the research which justified the hospital's limited approach.

The primary finding investigated by the Cartwright Inquiry was that information generated by Associate Professor Green and propagated by National Women's Hospital about CIS of the cervix was, at best, erroneous and much of the treatment based on it was harmful.

The focus should not, therefore, be on Green as an individual. The impropriety involved in the "Unfortunate Experiment" as outlined in Dame Sylvia Cartwright's Report was systematic scientific misconduct.<sup>2</sup> It is the duty of research institutions to uphold scientific principles and ethical standards and to enforce rigorous scientific process. The outstanding lesson of the "Unfortunate Experiment" was the failure of the institutions (which employed and protected Green) to fulfil their professional, academic and intellectual responsibilities.

Green maintained that CIS and invasive cervical cancer were separate conditions; one did not progress to the other. A single instance of progression should have been enough to invalidate his hypothesis and end the investigation. Instead, when examples of progression occurred, Green was allowed to change some and ignore other cases. It is worth recalling how a number of scientific principles were violated: attempted tampering with the labels on the smears

and slides; retrospectively changing some diagnoses, claiming that they had been invasive all along (the so called "colposcopic misses"); reclassifying cases; and publishing these unscientific, erroneous results. In doing so, Green delayed and compromised treatment—sometimes fatally—and he and his team and the responsible institution failed to inform the women at risk.

Hospital specialists McIndoe and McLean, who recorded and analysed Green's activities, accumulated case notes of an increasing number of cases of invasion and documented the consequences of extended and extreme treatment—and even death—which resulted.

They submitted their findings to those in positions of responsibility for management at the hospital and the University of Auckland. Hospital management avoided the issue and the university was slow to react, putting more women at risk for longer. Appropriate scientific principles to investigate and analyse these cases were not used: the selected time frame was arbitrary; no inclusion/exclusion criteria were established or applied to the review; only a part of the available evidence was examined; and the significance of the remaining cases were minimised. There was no action resulting from either the clinical or scientific issues raised. Rather, those who raised them paid a heavy professional price and were marginalised within the institution.<sup>3,4</sup>

The judicial nature of the Cartwright Inquiry allowed access to the original primary research data for examination. Its conclusions rested upon analysis of these data. In stark contrast, Bryder, unlike some scientists,<sup>5</sup> did not access or examine the original case files on which the inquiry findings depended and she is therefore not in a well-informed position to rigorously evaluate either the evidence presented to

the inquiry or the conclusions which flowed from it.

The Cartwright Inquiry showed that independent oversight can safeguard the public interest. It is a safeguard that may be needed in the future. Most scientific research data are today generated by commercial interests or under contract and protected from disclosure.

Commercialised, corporatised science is thus responsive to the market but imperious to the voice of concerned or damaged consumers. One effect of Bryder's continued condemnation of the inquiry is to invalidate much needed processes of independent, external evaluation.

In addition, critics of Bryder's work have found academic avenues for open debate and questioning inaccessible.<sup>6</sup> Good Science

arises from reasoned critique. It sometimes takes a judicial process to police Bad Science and in this the Cartwright Inquiry was important. The problem is not just that patients are not told, it is that what they are told may not be scientifically valid. Valid information is a prior, necessary condition for informed consent.

The strength of the Cartwright Inquiry was that it showed, on careful evaluation of the evidence, that patients were given inadequate information. It set out to analyse why this had occurred and it recommended changes to ensure that it would never happen again. In this way it provided a touchstone for the better in the relationship between patients and medical staff in New Zealand and drew attention to *primum non nocere*: first do no harm.

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**Competing interests:**

Nil.

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# A response to: Characteristics of lung cancers and accuracy and completeness of registration in the New Zealand Cancer Registry

Vanessa James, Christine Fowler

Professor Ross Lawrenson's paper<sup>1</sup> highlights the value of the New Zealand Cancer Registry (NZCR), which has been in existence since 1948, as the most complete record of cancer diagnoses in New Zealand. The paper also provides clear evidence for improvements: in particular, collecting clinically diagnosed cancer and clinical group stage through the NZCR. The American Joint Committee on Cancer (AJCC)'s international staging guidance highlights that clinical group stage should be assigned by the clinician managing a patient's care and treatment.

Reporting to the NZCR is mandated under the Cancer Registry Act 1993 (the Act) and registrations are made in accordance with International Agency for Research on Cancer (IARC) guidelines. The Act requires a report to be made when a laboratory test indicates the presence of cancer. It does not enable reporting from other medical practitioners, such as radiation oncologists, and NZCR staff only have access to coded hospital discharge summaries, pathology reports and death certificates.

Lawrenson et al identifies that the NZCR is population-based, focusing on incidence data, and states the purposes of the NZCR from the Act (information on incidence and mortality, and informing survival studies and research). His point that "[the NZCR's] completeness and accuracy are vital for cancer control in New Zealand" implies his research revealed a lack of completeness and accuracy. However, the NZCR is complete and accurate to the extent its enabling legislation allows. There is no

ability in the Act or accompanying Cancer Registry Regulations 1994 for NZCR staff to require further or more information. As a population-based registry operating in accordance with international rules, the focus on incidence is appropriate.

Analysis of the NZCR's lung cancer data from 2011–2015 by the Ministry demonstrates that the under-reporting of lung cancers in the NZCR for this study were approximately 1% of cases, rather than the 4% reported in the paper. Reasons for the variation include:

- Differences in coding rules—IARC classifies carcinoid tumours as malignant unless specified as benign. This accounts for a significant proportion of the registrations deemed by the research group as 'not lung cancer'
- Differences in defining 'date of diagnosis'—NZCR is a dynamic registry that is updated as new information is received. Some of the 'missing in NZCR' lung cancers were registered in NZCR after the study data was extracted, and others had registration dates before or after the study period
- Duplicates versus two distinct primary tumours in the same individual—if the morphological type of a second cancer is different to that of the first cancer then both are registered (in accordance with the Berg Group rule).

The Ministry of Health Cancer Services team has a focus on enabling quality

improvement that supports nationally consistent access to treatment and equity of outcomes across population groups and geographical boundaries. National administrative service delivery data can be linked to population-based registries such as NZCR data to report on system-wide performance measures. The Lawrenson et al audit highlights some of the limitations of this approach.

Roder et al<sup>2</sup> identify strengths of population-based registries and their corresponding limitations for driving quality improvement in service delivery. There is a clear need for data such as clinical group cancer stage and other prognostic

indicators to be added to the NZCR. More detailed information necessary to drive quality includes surgery, pathology, chemotherapy treatment regimes, radiology, multidisciplinary meetings and clinical trial participation.

We consider that a more flexible, responsive approach is required to meet the needs of our rapidly changing health environment. This includes reviewing the Act and developing and agreeing structured reporting with service providers. We are mindful that any change needs to take into account the availability of data in patient management systems, and readiness of providers to contribute additional data.

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**Competing interests:**

Nil.

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# Misuse/prescribing controlled and recreational drugs

## Med16/358P

### Charge

On 13 to 15 March 2017 the Health Practitioners Disciplinary Tribunal considered two charges of professional misconduct laid by a Professional Conduct Committee (PCC) appointed by the Medical Council of New Zealand against Dr Lynda Marie Emmerson of Whangarei (the Doctor).

Charge 1 alleged that:

1. Between 1 September 2013 and 23 April 2015, the Doctor prescribed drugs of dependence to family members and a friend/colleague;
2. The drugs were prescribed without appropriate monitoring or oversight;
3. The medicines prescribed by the Doctor included Class B and Class C controlled drugs;
4. The Doctor's conduct was in breach of her legal and ethical obligations under the Misuse of Drugs Regulations 1977, the Medicines Regulations 1984 and/or the Medical Council's statements.

Charge 2 alleged that:

1. While registered as a medical practitioner practising as a psychiatric registrar the Doctor engaged in recreational drug use, in particular:
  - a) Used cannabis on a number of occasions, including in late November or early December 2015; and
  - b) Between January 2013 and April 2015 the Doctor used methamphetamine on approximately six occasions.
2. In December 2015 the Doctor misled or attempted to mislead the PCC in relation to the full extent of her methamphetamine use in that she stated she has used methamphetamine only once at the end of 2014.

### Background

The parties attempted to agree on a statement of facts but were unable to do so. However, the Doctor filed a formal admission which significantly reduced the scope of what was in issue.

The Doctor admitted that she did write the prescriptions as alleged in the first charge. She also admitted the first particular of the second charge in regard to the use of cannabis and methamphetamine but denied the second particular of the charge relating to misleading the PCC about the extent of her methamphetamine use.

### Finding

The Tribunal had no difficulty in finding the first charge established in all of its particulars and that the circumstances in which the Doctor prescribed for family members and her colleague contravened Medical Council of New Zealand guidelines as the Doctor acknowledged.

The Tribunal found the first particular of the second charge to be established. The precise number of occasions on which methamphetamine was used was not considered to be especially important. Methamphetamine is a class A and cannabis a class C controlled drug. Possession and use of either is a criminal offence punishable by imprisonment. Use of either drug during a period when a doctor is practising unquestionably brings the profession into disrepute and is extremely serious.

Finally, the Tribunal concluded the second particular of the second charge to be established.

### Penalty

Submissions on penalty from the PCC did not seek an order for deregistration. However, given the seriousness of the conduct established, the Tribunal advised both parties that it was considering the full range of penalties available to it under

s. 101 of the HPCA Act, including an order for cancellation.

Following receipt of further submissions from the parties in light of the Tribunal's advice, the Tribunal censured the Doctor and cancelled her registration.

The Tribunal directed publication of its decision and a summary.

The Doctor appealed the decision of the Tribunal to the High Court. The High Court dismissed the appeal *Emmerson v PCC* [2017] NZHC 2847.

A full copy of the decision can be viewed at: <http://www.hpdt.org.nz/ChargeDetails.aspx?file=Med16/358P>

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## Once-daily single-inhaler triple versus dual therapy in patients with COPD

Triple inhaled therapy for chronic obstructive pulmonary disease (COPD) comprises an inhaled glucocorticoid, a long-acting muscarinic antagonist (LAMA), and a long-acting  $\beta_2$ -antagonist (LABA). Such treatment has shown considerable benefits in several trials. However, it means that patients have to use multiple inhalers several times per day.

This report is of a trial in which a combination of the three drugs in a single inhaler is used once daily. Over 10,000 patients were randomised to treatment with the triple therapy or treatment with a LABA-LAMA or steroid-LABA combination.

The results of the trial demonstrated that the triple therapy resulted in a lower rate of moderate or severe COPD exacerbations than either of the other two treatments.

**N Engl J Med 2018; 378:1671–80**

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## Adherence to medication, glycaemic control and hospital attendance in young adults with type 2 diabetes

This important matter is reviewed in this paper which reports on data from the Greenlane Diabetes Clinic.

Information about medication adherence and glycaemic control has been correlated in 266 type 2 diabetics aged between 18 and 39 years. Adherence was assessed by documentation of drugs collected from pharmacies. Forty-seven percent were found to have good adherence and 21% of the group had very poor adherence. The mean HbA1c was 70mmol/mol in the good adherent group and 97 in the poorly adherent. There were more hospital admissions among those with very poor adherence ( $p=0.03$ ).

It was concluded that this emphasises the need to assess adherence and try to understand the barriers patients face.

**Internal Medicine Journal 2018; 48:728–31**

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## UK COPD treatment: failing to progress

Recently the Royal College of Physicians has published reports on this matter which are relevant as it is estimated that there are more than a million COPD patients in the UK.

Pulmonary rehabilitation, a treatment combining an exercise regimen and education about self-care, is widely acknowledged as an effective and high-value intervention for people with COPD. However, the College reports notes that only 60% of COPD subjects are enrolled within 90 days of referral and 38% of these did not complete the treatment. Smoking cessation is known to reduce mortality in COPD patients. However, the College reports notes that only 54% of hospitals offer smoking cessation services.

An editorial writer suggests that the UK National Health Service needs to do better to provide access to these services.

**Lancet 2018; 391:1550**

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# General Education

June 1918

**A**t the conference of secondary school teachers recently held in Christchurch the following resolution was passed: "That this conference recommends the University Senate to make Latin optional and not compulsory for the medical examination, thus following the reform instituted in Britain." We recommend the conference to take to heart Cromwell's advice to the Presbyterians and think that peradventure they may be mistaken. There is more reason to exclude mathematics, and many reasons why neither should be excluded or made merely optional. We want doctors to have a wide general education and culture and not to be mere craftsmen. How are we to have a good understanding of our mother tongue if Latin is to be denied us? In the terms of the resolution of the conference every word of two syllables or more, save one, is borrowed

from the Latin. We observe that recently a conference of medical professors and lecturers in Edinburgh came to the conclusion that scientific subjects should not be taught in secondary schools, but only at a University. A grounding in science at a secondary school is of material assistance to students in the science classes of a University, or, at least, so it always appeared to us. If Latin is to be banned and science is to be banned at the High Schools, we fear that an attack may be next made upon the inner citadel of football and athletics generally, and unfortunate youths will have nothing to train their brains but pedagogics. Let us bear in mind that change is not always reform, that striving after paradox may lead to absurdity, and that ideas may come out of the brains even of educationalists tail-first.

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# Proceedings of the Waikato Clinical Campus Biannual Research Seminar

11 April 2018

## Closing the loop: post-operative dual antiplatelet therapy following coronary artery bypass grafting

Josephine HY Mak,<sup>1</sup> Sinthuri Raveendran,<sup>2</sup> Rory J Kelleher,<sup>3</sup> Paul Conaglen,<sup>1</sup> Zaw Lin,<sup>1</sup> Nand Kejriwal,<sup>1</sup> Nick Odom,<sup>1</sup> Grant Parkinson,<sup>1</sup> David J McCormack,<sup>1,4</sup> Adam El-Gamel<sup>1,4</sup>

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### Purpose

Dual antiplatelet therapy (DAPT) improves outcomes following coronary artery bypass grafting (CABG). Recent guidelines stipulate that DAPT should be continued for one year post-operatively in those presenting with ACS (Level 1) and considered in those with stable ischaemic heart disease (Level 2b). An audit previously conducted at a single centre showed 17 different regimens of antiplatelet prescribing post-CABG with no clear pattern. Following this, new departmental guidelines were established. Registrars checked discharge summaries for DAPT instructions. CABG patients received DAPT cards highlighting their indication for DAPT to other healthcare professionals. We present a closed-loop audit to assess for improvement in our practice.

### Methodology

A retrospective analysis was conducted. We analysed discharge summaries of those patients discharged post-CABG in the three months of October

to December 2017. The type and duration of antiplatelet regimen in each discharge summary was recorded. Patients with contraindications for DAPT were excluded.

### Results

Seventy-one patients were discharged post CABG in the specified three months. Eight patients were excluded as they received anticoagulation. DAPT was thus indicated in 63 patients. 93.7% (n=59) of these patients had an appropriate dual antiplatelet regime documented at discharge.

### Conclusion

We demonstrate an improvement in post-operative DAPT prescribing and documentation after our quality improvement initiative. Future directions include auditing whether cardiologists and general practitioners are continuing to prescribe the DAPT in the community and whether patients are taking their medications as prescribed.

## Factors associated with the prescription of antipsychotic medication in secure dementia units in the Waikato

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<sup>1</sup>University of Otago, Dunedin;

<sup>2</sup>Mental Health Services for Older People, Waikato District Health Board, Hamilton.

### Aim

Behavioural and psychological symptoms of dementia (BPSD) will affect ~90% of people with dementia at some point in the disease process. Antipsychotic or sedative

medications have been a popular choice for first-line management of BPSD, but clinical trials suggest the benefit of antipsychotics, at best, is small.<sup>1</sup> Furthermore, long-term use of antipsychotic medication is associated with increased morbidity and mortality.<sup>2</sup> The aim of this study was to determine the proportion and characteristics of antipsychotic and sedative use in dementia patients resident in secure dementia units in the Waikato.

### Method

The medication chart and residential care files of 280 residents from 14 secure dementia units in the Waikato were reviewed to determine the prevalence of antipsychotic and sedative use, and the factors associated with their prescription.

### Results

Antipsychotic medications were prescribed to 140 (50%) residents, with a mean duration of 394 days since the medication was last prescribed. Being prescribed an antipsychotic was associated with male gender (57.1% vs 44.1%,  $p=.031$ ), being in psychogeriatric level care (63.3% vs 42.9%,  $p=.002$ ), and having at least one incident form in the preceding six months (60.5% vs 46.4%,  $p=.039$ ). Following regression analysis, only level of care ( $p=.007$ ) and not age ( $p=.600$ ), gender ( $p=.163$ ) or incident forms ( $p=.111$ ) predicted antipsychotic prescription, with those in psychogeriatric care 2.04 (95% CI 1.14–3.63) times as likely to be on an antipsychotic compared to those in dementia units.

**Conclusion**

The prevalence of antipsychotic medication prescribing in secure dementia units is high and increases with higher levels of care. Duration since an antipsychotic prescription was last altered suggests these medications are not being reviewed in line with best practice guidelines.

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**Early discharge from intensive care after cardiac surgery is feasible with an adequate fast track, stepdown unit: Waikato experience**

Damian Gimpel,<sup>1</sup> Satya Shanbhag,<sup>1</sup> Tushar Srivastava,<sup>2</sup> Melanie MacLeod,<sup>4</sup> Paul Conaglen,<sup>1</sup> Nand Kerjiwal,<sup>1</sup> Nicholas Odom,<sup>1</sup> Zaw Lin,<sup>1</sup> David J McCormack,<sup>1,2</sup> A El-Gamel<sup>1,2</sup>

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**Purpose**

Enhanced recovery programmes within cardiothoracic surgery are a well-described benefit to patient post-operative outcomes. We describe our Australasian unit's experience of a day 0 discharge enhanced recovery unit from the intensive care department.

**Methods**

Retrospective study from July 2014 till November 2017 with 1,804 patients undergoing

cardiac surgery. The primary end point was non-inferiority in 30-day mortality in the day 0 cohort when compared to >1 day discharge from ICU cohort. The secondary outcomes were non-inferiority in 30-day morbidity in the day 0 cohort.

**Results**

One hundred and sixty-three patients were discharge to the ERU day 0. Mean number of hours spent in ICU for day 0 cohort was 7.1 (+/-1.1). Mean Age 62.52 (+/-11.25), M:F 3.03:1. Patients were more likely to be discharged day 0 if they had a lower Euroscore 1.58 (+/1.67), lower preoperative creatinine 88.48 (+/-27.2), determined non-critical and required less PRBC during ICU stay. Those admitted to the ERU on day 0 post-operatively were more likely to be discharged with a lower creatinine level, a higher Hb level, discharged directly to home and have less readmissions per 30 days (p<0.05).

**Conclusion**

The utilisation of an enhanced recovery unit in appropriately selected patients is not detrimental to patient care. It enhances the efficiency of a cardiac ICU and decreases costs associated with ICU stay. There is also an ability to utilise pre-operative risk stratification in order to highlight those patients likely to be discharged on day 0 from ICU in order to further enhance the efficiency of a cardiac ICU and hospital management planning.

**The pain buster study: Low volume local anaesthetic infusion via an elastometric pump for analgesia following laparotomy**

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This study investigated the benefit of low-volume infusion of local anaesthetic into rectus sheath using an elasto-metric

pump following midline laparotomy. This device has advantages of being portable as well as needing less nursing input in the ward setting.

Inclusion criteria were patients aged 18–85 having mid-line laparotomies with the ability to consent to the trial and be available for follow up, and no contraindications to the placement of the catheters or infusion of local anaesthetic. All patients received an initial bolus of 40ml of 0.2% Ropivacaine at time of catheter placement. The elastometric pump was connected post-operatively and the patients were allocated to one of three groups: Normal Saline, 0.2% Ropivacaine or 0.5% Ropivacaine. The contents were drawn up by the anaesthetic technician outside of theatre so all staff involved in patient care were blinded to treatment allocation. To show a 30% reduction in pain scores or opiate use, it was calculated that we needed to recruit 120 patients, 40 in each group. Due to slow recruitment the study was truncated at 110 patients.

The primary end point was average pain score and opiate use for the four days following surgery. Secondary end-points were patient rating of analgesia, patient satisfaction and measures of functional recovery.

The patients in the treatment groups had lower pain scores at rest and on movement, with the difference being larger on movement. These differences were significant on days 1 and 2 but not on days 3 and 4. There was no statistically significant difference in opiate requirement for the duration of the study. No differences seen in functional measures such as time to mobilisation, oral intake or return of bowel function.

The elastometric infusion device seems to show a modest benefit in reducing pain scores for people having laparotomies. There was no additional benefit to using 0.5% Ropivacaine compared to 0.2% Ropivacaine.

## EuroSCORE II cardiac surgical risk scoring system—the Waikato experience

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EuroSCORE II is a well-established cardiac surgery risk scoring tool. This risk stratification system was derived from a predominantly international patient cohort. No calibration analysis of this operative risk model has been undertaken for New Zealand cardiac surgery patients. We aim to assess the efficacy of EuroSCORE II to the Waikato population.

### Methods

A retrospective study was carried out to include patients undergoing cardiac surgery at the Waikato Cardiothoracic Unit from September 2014 to September 2017. Patients received either isolated first-time coronary artery bypass grafting (CABG), isolated valve surgery, isolated aortic surgery or a combination of these procedures. Patient demographic information and preoperative medical risk factors were obtained from review of patient records. The primary outcome was the correlation of predicted EuroSCORE II risk scores for 30-day mortality in cardiac surgery patients compared with observed mortality events.

### Results

One thousand six hundred and sixty-six cardiac surgery patients were included during the study period. Nine hundred and thirty-three patients underwent isolated CABG, 384 underwent isolated valve surgery, 48 received isolated aortic surgery and 301 received combination procedures. Thirty-day mortality events in each of these groups was 7, 4, 2 and 13 deaths respectively. Receiver operating characteristic curve analysis demonstrated the area under the curve (representing average predictive sensitivity and specificity) of EuroSCORE II in each of these groups as 93.4% (95% confidence interval: 91.6–94.9), 66.3% (95% confidence interval: 61.3–71.0), 37.2% (95%

confidence interval: 23.9–52.2) and 74.8% (95% confidence interval: 69.5–79.6) respectively.

### Discussion

EuroSCORE II showed a strong predictive ability for isolated first-time CABG 30-day mortality in a Waikato patient cohort. However, EuroSCORE II performed poorly across non-coronary or combination cardiac surgical procedures. There is an importance to adapt this internationally-derived risk scoring system to our local patient cohort for non-coronary and combination surgery.

## Measuring the change in interstitial glucose concentration after feeding in the first five days after birth

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### Background

Continuous interstitial glucose monitoring may present an opportunity to explore changes in tissue glucose delivery after feeding in newborns. However, suitable metrics are needed to quantify these changes, and to assess factors that may influence them.

### Method

Data from the Sugar Babies Study were reviewed and included in this analysis if 90–180min of interstitial glucose concentrations were available from the start of a feeding in the first five days after birth. Interstitial glucose concentration metrics assessed were: maximum deviation from baseline (MD), area under the curve per hour (AUC) and time to peak (TTP) for those feedings with a peak concentration, which was a turning point. Metrics were developed using Stata version 14.2.

### Results

Data were available for 4,014 feedings in 367 babies with mean gestation 37.6 weeks (range 34.9–42.7 weeks). Both MD and AUC were positive (mean (95% confidence interval): MD 0.12mmol/l (0.10, 0.14),  $p < 0.001$ , AUC: 0.06mmol.hr/L (0.05, 0.07),  $p < 0.001$ ).

TTP was available for 46% of feedings and occurred at (median, range) 80 minutes (0 to 175) after the beginning of the feed.

### Conclusions

Changes in interstitial glucose concentrations after feeding in the first five days can be identified and quantified. These metrics may be useful in future analyses to determine factors that influence glucose responses to feeding and other interventions in newborn babies.

## Quality of life after prostate cancer treatment

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Prostate cancer is the most commonly diagnosed male cancer in New Zealand, and 2.7% of men in general practice over age 40 have had a previous prostate cancer diagnosis. The side effects of prostate cancer treatment are well recognised. We were interested in the supportive care needs of men who had been diagnosed with prostate cancer two years after diagnosis. One hundred and ninety-six men who were diagnosed in 2014/2015 were sent a postal survey designed to capture post-treatment information such as level of continuing GP involvement and quality of life using the Extended Prostate Cancer Index (EPIC26) and EQ-ED-5L Quality of Life tools. One hundred and thirty-two men responded to the follow-up survey.

The EPIC26 showed that for most men, quality of life following prostate cancer appeared to be good, with only 8 (6.0%) and 7 men (5.0%) reporting moderate or big problems with overall urinary and bowel function respectively. Erectile function was the most reported ongoing symptom, with 46 men (35.0%) indicating that sexual function was a moderate to big problem. The EQ-5D-5L recorded that 28 men (21.2%) had some problems with anxiety or depression, although when asked if they wanted to see a counsellor or psychologist, 120 men (90.9%)

responded that they did not want to seek psychological support. Ninety-six (72.7%) men had seen their GP in the previous three months, but 59 (44.7%) considered that their GP was not involved in their ongoing prostate cancer management.

These data suggest that while many men reported relatively few problems and a return to life as normal, there is still some ongoing need for support. We believe GPs could be more involved in the ongoing management of men with prostate cancer.

### The role of the FitAB toxin-antitoxin system in the maintenance of the carrier population of *Neisseria gonorrhoeae*

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Gonorrhoea is a sexually transmitted infection caused by the bacteria *Neisseria gonorrhoeae*. The bacterium adheres to and invades epithelial cells lining the urogenital tract, then traffics across the epithelium and exits into the sub-epithelial layer where it initiates infection. The success of gonorrhoea is in part due to a population of carriers who harbour the bacteria but show no symptoms of disease, yet can still transmit the bacteria to other humans via sexual contact. The carrier population of bacteria are hypothesised to persist in epithelial cells, remaining invisible to surveillance by the immune system. The mechanism by which it is able to persist within epithelial cells is unknown. Toxin-antitoxin systems have been hypothesised to play a role in the persistence of tuberculosis and other bacteria.<sup>1</sup> A toxin-antitoxin system termed FitAB (belonging to the VapBC toxin-antitoxin family<sup>2</sup>) from *N. gonorrhoeae* is involved in trafficking of the bacteria and replication within epithelial cells.

We have previously shown that VapC, the toxic component

of the VapBC system in *Mycobacterium smegmatis* regulates metabolism by cleaving at specific sites in mRNA transcripts involved in glycerol uptake and metabolism, to regulate and 'fine tune' growth of the organism.<sup>3</sup> Characterisation of the cellular target of FitB (the toxic component of the FitAB system) would provide a better understanding as to the mechanisms of persistence of this bacterial pathogen. Using the structure of FitAB4 and methods previously established in our lab for the characterisation of VapBC systems from mycobacteria, we are determining the cellular target(s) of FitB, using a combination of pentaprobates and mass spectrometry.<sup>5</sup> We can then compare this with RNA-seq data to determine RNA transcripts targeted by FitB.

With emerging multi-drug resistant strains of *N. gonorrhoeae* treatment options are becoming limited with no alternative treatments in the pipeline. Understanding the molecular mechanism by which the bacterium can slow replication within epithelial cells is crucial for future treatment of the disease.

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### Pre-operative full blood count markers as a predictor of mortality and morbidity risk after cardiac surgery

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#### Purpose

The use of inflammatory markers for risk stratification of post-operative morbidity and mortality in patients with cardiovascular disease may provide benefit in patient selection.<sup>1</sup> White cell subtypes such as neutrophils and lymphocytes may be predictive of peri-operative outcomes following cardiac surgery.<sup>2</sup> The aim of this study was to investigate the association between preoperative neutrophil to leucocyte ratio (NLR) and lymphocyte to monocyte ratio (LMR) after cardiac surgery. This study planned to add new data from a New Zealand-specific patient cohort to the literature on the effect of LMR and NLR on cardiac surgery patient outcomes.

#### Method

We present a retrospective study from September 2014 till November 2017 with 1,694 patients undergoing cardiac surgery. Pre-operative haematological profiles were obtained as well as data on pre-operative patient factors and primary end points. The primary end point was 30-day composite of new post-operative atrial fibrillation requiring treatment, new neurological insult, readmission within 30 days and 30-day mortality. The secondary endpoint was long-term all-cause mortality. Pearson's coefficient was utilised to examine the correlation between NLR and LMR and common markers of inflammation (WCC and CRP).

**Results**

We recorded 356 incidents of new AF requiring treatment, 31 neurological insults, 179 readmissions within 30 days and 46 deaths within 30 days. The aforementioned composite end points are reported versus NLR and LMR (three categories of ratios <2.1, 2.1–3.2 and >3.2). KM curve was analysed against composite end point and the grading of the LM ratio. A high LM ratio trended towards lower composite end points. A ROC curve utilised for the sensitivity

and specificity of LM ratio in prediction of composite end point at a cut off of 2.5. An elevated LMR correlated with raised inflammatory markers (WCC and CRP  $p < 0.05$ ) whereas NLR did not.

**Conclusion**

The interpretation and utilisation of ready available haematological markers can provide insight into the inflammatory status of a patient and highlight those more at risk of peri-operative morbidity and mortality.

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