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This Issue in the Journal

A nationwide survey of weight control practices among middle-aged New Zealand women
Sook Ling Leong, Clara Madden, Andrew R Gray, Caroline C Horwath

The majority of New Zealand middle-aged women reported using weight control practices that were consistent with public health messages. The practices most commonly used were cutting down on meal/snack size and cutting down on fats/sugars. However, the use of smoking and exercising in a driven or compulsive way are of particular concern.

Long-term outcomes in gastric bypass patients with and without type 2 diabetes—Waitemata District Health Board experience
Annika H L Lam, David D W Kim, Rick Cutfield, Cameron Walker, Michael Booth

Gastric bypass surgery is effective in achieving substantial weight loss over the medium to long term. Approximately 60% of patients with diabetes also become diabetes-free after surgery. However, some can have recurrence of diabetes despite initial resolution. Therefore, it is important to have regular testing for diabetes even after bariatric surgery.

The Canterbury Charity Hospital: an update (2010–2012) and effects of the earthquakes
Philip F Bagshaw, Miriam Maimbo-M’siska, M Gary Nicholls, Carl G Shaw, Randall A Allardyce, Susan N Bagshaw, Angela L McNabb, Stuart S Johnson, Christopher M Frampton, Brian W Stokes

The Canterbury Charity Hospital Trust provides free secondary healthcare to some of those patients who cannot access the care they need in the public hospital system and cannot afford private care. It is funded solely by public giving; there is no government funding. It functions as an expanding day hospital facility and is staffed almost exclusively by volunteers. Trust members are very concerned about the level of unmet need and argue strongly that an independent mechanism should exist for its regular measurement.

Patient-reported outcomes following breast reconstruction surgery in a public hospital: use of the Breast-Q questionnaire
Ryan Cha, Estelle Barnes, Michelle B Locke

Breast cancer is the most common cancer in women, and a proportion of women who have a mastectomy for breast cancer choose to undergo reconstruction. The success (or otherwise) of breast reconstruction is most appropriately assessed by the patients
themselves, rather than by the surgeons. The BreastQ is a quality of life questionnaire completed by breast reconstruction patients to provide meaningful outcome data from the patient’s perspective. We have administered this questionnaire to patients undergoing breast reconstruction in a busy public hospital plastic surgery department. Overall, our results show global patient satisfaction with outcomes, regardless of the type or timing of the reconstructive surgery.

**Lack of relationship between obesity and mortality or morbidity after coronary artery bypass grafting**
Tom Kai Ming Wang, Tharumenthiran Ramanathan, Ralph Stewart, Greg Gamble, Harvey White

We examined the outcomes of obese patients, i.e. those with a body mass index (BMI) >30 (kg/m²), compared to normal weight patients undergoing the coronary artery bypass grafting (CABG) operation. 38% of patients were obese. Mortality up to 1.4 years and complications were not increased in obese patients. Obesity should not prevent someone receiving the CABG operation.

**Therapeutic options in the management of obesity ((review article))**
Richard W Carroll, Rosemary M Hall, Amber Parry-Strong, John M Wilson, and Jeremy D Krebs

Over 1 in 4 New Zealand adults now classify as obese, while nearly 2 in 3 adults are overweight. In this article we look at the treatment options to achieve weight loss, with a focus on changes to diet and exercise that are fundamental to any weight loss program. We also review the available medications to aid weight loss, and discuss the role of weight loss (bariatric) surgery which is increasingly recognised as an effective method of achieving weight loss in appropriate people.

**Improving the New Zealand dairy industry’s contribution to local and global wellbeing: the case of infant formula exports ((viewpoint article))**
Judith A Galtry

This article looks at some of the high profile dairying incidents in recent years and questions whether NZ’s dairy industry is also undermining global best practice infant feeding practices through massive infant formula export marketing. I argue that while there is support for increased trade and exports, there are few voices promoting global infant health. Discussion is needed on this issue by the NZ public health community.
Obesity revisited, yet again

Jim I Mann, Kirsten J Coppell

Two papers in this issue of the *NZMJ* serve as reminders of the many complexities of managing the real and perceived problems of excess body fatness, and that an overarching strategy, including public health initiatives, is essential for the management of this global epidemic.

In October 2013, the *BMJ* published a systematic review and meta-analysis of the 11 randomised controlled trials of bariatric surgery with at least 6 months of follow-up, versus non-surgical treatment for obesity.¹ Those allocated to surgery lost more body weight (mean difference -25 [95% confidence interval -31, -21] kg) and had a higher remission rates of type 2 diabetes (relative risk 22.1 [3.2, 154.3]) and the metabolic syndrome (relative risk 2.4 [1.6, 3.6]) after a maximum of 2 years, compared with those receiving nonsurgical treatment.

Information regarding long-term outcomes is not available from randomised controlled trials and can only be derived from case series. Variable findings regarding remission and relapse rates for type 2 diabetes mellitus (T2DM) have emerged from such reports²-⁴ so the findings of Lam and colleagues, in this issue of the *Journal*,⁵ are of considerable interest. They report on their experience of 126 patients who had been followed for at least 4 years following gastric bypass surgery (GBP) at Waitemata District Health Board (WDHB), one of the few centres in New Zealand offering publically funded bariatric surgery.

After about 5 years average weight loss was around 45 kg having achieved a postoperative nadir around 55kg. Twenty-nine of the 33 subjects with preoperative T2DM fulfilled the criteria for complete remission at some stage postoperatively. At a mean follow-up of 63 months, 59% were regarded as full remitters. Short duration of diabetes and not being treated with insulin were the only predictors of full remission.

While the mechanism for the improvement in glucose metabolism is yet to be fully understood,⁶ these results provide some reassurance that in the context of routine publically funded care, bariatric surgery offers clinically meaningful outcomes for these patients who fulfil the currently agreed stringent criteria for surgery.

Given the absence of pharmacotherapy of proven benefit,⁷ lifestyle modification is the only other therapeutic option. While some individuals do manage to achieve and maintain weight loss and some dietary patterns and weight loss programmes appear to confer special benefit, the vast majority of patients tend to regain some or all of the weight lost after a few years.

Furthermore weight loss regimes or dietary patterns (e.g. the high fat, low carbohydrate diet) which have been shown in the short-term to promote more weight loss than other approaches, generally appear to have lost their advantage by 12 to 18 months after initiation.⁸
Against this background, the findings of Leong and colleagues\textsuperscript{9} in the second NZMJ paper are of relevance. Nearly 40\% of women participating in a cross-sectional mail survey reported that they were trying to control their weight—and among those who were not, almost 70\% were trying to prevent weight gain. Fewer than half reported use of appropriate measures such as reduction of portion sizes and cutting down of fats and sugars.

However rather alarmingly nearly a quarter said they were using exercise in what was described as a compulsive or driven way and 14\% were smoking as a method of assisting weight control. Smaller numbers were using intermittent fasting, laxatives, diuretics, self-induced vomiting and drugs.

Equally concerning findings were that nearly one-fifth of women who were underweight (BMI<18.5) and 9\% of those in the lower healthy age range (BMI 18.5–<22) were attempting weight loss whereas 10–14\% of those who were overweight or obese were not. Clearly these findings do not provide encouragement that ‘dieting’ as currently practised by women in New Zealand is an appropriate approach to weight management in the population at large.

Among adults aged 15 years and over, 27.7\% of women and 27.8\% of men are classified as obese\textsuperscript{10} and excess body fatness is a major driver of rates of T2DM, an important risk determinant for cardiovascular disease, and some of our commonest cancers, colorectal cancer and postmenopausal breast cancer. Yet we still have no overarching national strategy in New Zealand for dealing with the epidemic proportions of obesity and its comorbidities.

Appropriate services for advising and supporting those appreciably overweight, especially those who have already developed comorbidities such as prediabetes and T2DM, are woefully inadequate or absent in some parts of the country. Indeed, national criteria for bariatric surgery need to be adopted and implemented by all District Health Boards.

Most important of all, we need a raft of public health measures to alter an environment which promotes unhealthy weight gain. Re-establishing a programme supporting healthy eating in schools may be a good place to start.

Competing interests: Nil.

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References:


The Canterbury Charity Hospital: facing the challenge of unmet need in healthcare

Murray Pfeifer

In 2004 the Canterbury Charitable Hospital Trust (CCHT) was founded by Mr Philip Bagshaw, a Christchurch general surgeon, and a small group of like-minded supporters who were cognisant of the high level of unmet healthcare need in the Canterbury community. The goal of this group was to establish a charity hospital which would provide healthcare services for those who did not qualify for public hospital care and who were unable to afford private care. The condition had to be affecting quality of life and/or employment prospects.

In 2004 CCHT was founded. By 2007 sufficient money had been raised by grants and donations to enable the Trust to purchase a suitable property in Harewood Road and undertake an extensive conversion to create a ‘state of the art’ day surgery hospital. Staff were employed, volunteers recruited, and the Canterbury Charity Hospital (CCH) opened its doors to the public.

A report on the first 2½ years of operation of the new hospital is found in a previous edition of the Journal. This edition contains a report on activity over the next 3 years 2010–2012. This report documents the incredible progress which CCH has made since the first report. It outlines how the Hospital has changed and adapted to meet needs of the public of Christchurch, particularly in the wake of the earthquakes. It also undertakes an examination of the issue of unmet need in healthcare in the community which, after all, is the raison d’etre of the Charity Hospital.

The provision of healthcare in New Zealand is improving, or so we are lead to believe. There are indicators to suggest that this indeed is true. The rate of growth of spending on healthcare in this country is, year upon year, far outstripping the growth in GDP. Elective surgeries have increased from 117,863 in 2007/2008 to 158,482 in 2012/2013. Waiting times for both specialist assessment and surgery have been reducing as a result of Ministry initiatives. Those who have little or no chance of receiving care in our resource constrained public system now have greater transparency regarding their situation and no longer sit indefinitely on waiting lists. There has also been work put in to ensure better equity of access across specialties and across the country. The improvements which we have seen occur in access, timeliness, and quality of care have been measured, quantified and are palpable. What has not been measured and is therefore unknown is the level of unmet need in our community.

It is important to measure our services, know what we are doing well, and where we are making improvements. It is important to celebrate the progress which we have made. It is even more important to measure the aspects of our service were we have fallen short, failed to achieve. It is only then that we will improve. It is only then that we will start to close the gap between what is provided and what is needed. In this
report a call is made for the collection of information on unmet need. I believe that we all strongly support this call.

The data contained within this report relating to workload at CCH is impressive. Over the space of 3 years there were 4434 episodes made up of consultations, surgeries and counselling. By necessity the range of services provided was relatively narrow and capacity was sometimes limited by availability of volunteers. However the reported workload is impressive but must surely represent only the tip of the iceberg of unmet need.

In the report there are two areas of unmet need discussed which are concerning. The first is groin hernia surgery where demand at CCH has escalated to the point where there is now a waiting time of 12 months for surgery. It is reasonable to assume that the numbers presenting to CCH for this condition represents only a small proportion of the total unmet need in this area.

Groin hernia is not the cause celebre that some other conditions have become and the volume of unmet need for this condition has, by and large, been unrecognised. It is however the cause of significant morbidity in the community resulting in pain and suffering, depriving individuals and families of income, and depriving the community of productivity.

The second is colonoscopy. This is a newly established service at CCH and numbers are small. However in the 17 patients scoped, polyps were detected in six and one cancer was found. In this country, guidelines for open access colonoscopy are tight and the resource is highly constrained. Patients who have symptoms due to significant underlying disease will not always have access to the diagnostic service, cancers are missed, and premalignant lesions go undiagnosed and thus not treated in a timely way. The volume of pathology found in this small cohort of patients scoped at CCH (and therefore denied access elsewhere) is very concerning.

So is there a significant, indeed an unacceptable level of unmet need in this country? Unfortunately there is no answer for this question as there has never been an assessment of unmet need in the secondary healthcare sector. However the very existence of this hospital within the Canterbury community is confirmation of that need.

The donation of large sums of money from the community to this hospital and the legion of volunteers who enthusiastically donate their time suggests that there is need. Finally there are the patients who, unable to gain access to the elective services in the public sector, are so heavily utilising the services on offer at the Charity Hospital.

In 2004 a group of concerned people came together to form the CCHT. They perceived that a number of people in their community were in need of basic elective services to which there was no access. There was a vision to establish a charity hospital to provide the services which would help to satisfy that need. They are to be congratulated that through much hard work and having the courage of their convictions they succeeded. This report is testament to their success.
The issue of unmet need in healthcare is of course not peculiar to Canterbury. It is an issue in every community up and down the country. The CCH provides a splendid example of the way in which a community has come together to make a positive change. I wonder how the rest of us may face the challenge of unmet need in healthcare.

Competing interests: Nil

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A nationwide survey of weight control practices among middle-aged New Zealand women

Sook Ling Leong, Clara Madden, Andrew R Gray, Caroline C Horwath

Abstract

Aim To examine the prevalence of weight control practices in a nationwide representative sample of 40–50 year old New Zealand women.

Methods In May 2009, a cross-sectional mail survey was conducted among 2500 women randomly selected from nationwide electoral rolls who were each mailed a self-administered questionnaire about their weight control practices, demographics and anthropometry.

Results After excluding ineligible recipients, a 66% participation rate was achieved (n=1601). Thirty-nine percent of the sample (n=630) reported trying to control their weight, and among those who were not, 69% (n=674) were attempting to prevent weight gain.

The weight control practices most commonly used were cutting down on meal/snack size (42%) and cutting down on fats/sugars (45%). Smoking, exercising in a driven or compulsive way, and fasting were used at least once a week as weight control strategies by 14%, 22% and 5% of women, respectively. Other potentially health-damaging practices (i.e. laxatives, diuretics, diet pills, vomiting) were employed by 1–4% of women.

Conclusions Most women reported weight control practices that were consistent with public health messages, however the use of smoking and exercising in a driven or compulsive way are of particular concern.

The latest Health of New Zealand Adults Survey showed that the prevalence of obesity is particularly high among women in the 45–54 and 55–64 year age groups, reaching 30.8% and 32.1% respectively.\(^1\)

Prospective studies overseas have also shown a high risk of weight gain in mid-life, with women aged 42–52 years gaining on average 0.6 kg per year.\(^2,3\)

Population surveys in Australia, North America and Europe show that at any time, 62-74% of adult women are trying to control their weight.\(^2,4\) In New Zealand, although 59.6% of females aged 10–24 years are trying to control their weight,\(^5\) to our knowledge there is no data regarding the weight control practices of adult women.

Overseas studies have shown that both potentially health promoting (e.g. reducing fat intake, increasing physical activity) and potentially health damaging weight control practices (e.g. use of laxatives, smoking, diet pills, diuretic pills) are widely used by women in attempts to achieve an ‘ideal body weight’.\(^2,6\)
With the rising prevalence of obesity and an increased emphasis on weight gain prevention, it is important to understand the practices used by adult New Zealand women in an attempt to control their weight.

This study aims to determine the prevalence of various weight control practices used for intentional weight loss or the prevention of weight gain among a representative sample of middle-aged women.

**Method**

**Sample**—In May 2009, the New Zealand electoral rolls including the Māori electoral rolls were used to randomly select 2500 women aged 40–50 years. Female electors were identified from the roll based on their title and/or name.

A self-administered 21-page questionnaire was mailed to all potential participants with a cover letter and a postage-paid return envelope. During its development, the questionnaire was pre-tested among 36 Dunedin women in the target age range for clarity, ease of completion and interpretation of questions. As a result of the pre-testing, minor improvements were made to the layout of the questionnaire and clarity of instructions.

Prior to the main mail survey, a pilot survey of 100 women selected randomly from the electoral rolls was undertaken with the purpose of refining survey procedures. Both the pilot and main survey procedures have been previously described. Those eligible for inclusion in the study were women aged 40-50 who were not pregnant, postpartum or currently lactating.

This study was approved by the University of Otago Ethics Committee and the Ngāi Tahu Research Consultation Committee. All participants were informed in the cover letter that by completing and returning the questionnaire, this would be taken as their consent to take part in the study.

**Questionnaire**—As part of a larger study examining the associations between eating behaviour regulation, psychological and lifestyle factors and body mass index (BMI), the questionnaire booklet included questions on weight control practices, weight control status, health conditions and self-reported weight and height.

The 12-item weight control practices questionnaire was based on the 9-item instrument used in the Australian Longitudinal Study of Women’s Health (ALSWH), 1998 (Survey 2, 47–52 years old). The original item ‘laxatives, diuretics and diet pills’ was separated into two items, ‘laxatives and diuretics’ and ‘diet pills’. The item ‘exercise’ was modified to ‘exercise in a driven or compulsive way’ since respondents were also asked to either select ‘yes’ or ‘no’ in response to the question ‘I do physical activity predominantly to lose weight or control my shape or weight’ in a separate section of the questionnaire.

Two items ‘making yourself sick (vomiting)’ and ‘low glycaemic index (GI) diet’ were added to the list and the item ‘vegetarian diet’ was removed. The other original items included were: ‘commercial weight loss programs’, ‘meal replacements or slimming products’, ‘cut down on size of meals or between meal snacks’, ‘cut down on fats and/or sugars’, ‘fasting’ and ‘smoking’.

The questionnaire was also modified from an assessment of when the practices were last used (three response options: ‘in the last 12 months’, ‘more than a year ago’, ‘never’) to assessment of the frequency with which women engaged in each individual weight control strategy during the past 12 months. Participants were asked to nominate one response from four options: ‘not at all’, ‘less than weekly,’ ‘once a week,’ or ‘two or more times a week.’

Respondents were asked to describe their weight control status by answering ‘yes’ or ‘no’ to the questions: ‘Are you currently trying to lose weight?’ and ‘If not, are you trying to maintain your current weight?’ Demographic questions (i.e. age, highest level of education, employment status, smoking status and ethnicity) were derived from questions included in the New Zealand Census 2006.

**Data analysis**—Self-reported current height and weight were used to calculate BMI (kg/m²). This has been shown to be a valid approach by Sharples et al (2012). Multiple ethnicities could be provided and ethnicity was prioritised in the following order: Māori, Pacific People, Asian, other and European. Using the New Zealand Socioeconomic Index (NZSEI) 1996—a continuous socioeconomic status score was determined for each participant’s usual occupation. If a participant responded to a question on spouse/partner occupation, the highest of the two scores was used as an estimate of household
socioeconomic status. Excluded from analyses were women who indicated a poor understanding of English, made geometric patterns when circling answers, simultaneously indicated answers at opposite ends of a scale or answered the questionnaire on behalf of someone else. All data were double entered to minimise errors.

**Statistical analysis**—Stata v12.1 software (2011, Stata Corp, College Station, TX) was used for all statistical analyses. Where two-sided p<0.05, the relationship was considered statistically significant. Chi-square tests and one-way ANOVAs were used to compare demographic and behavioural characteristics across the three weight control statuses (trying to lose weight, trying to maintain weight, and not attempting weight control). Descriptive statistics were used to describe the frequency of use for each weight control method. A test for difference in proportions was used to compare weight reduction goals between BMI categories.

**Results**

Twenty respondents did not meet inclusion criteria and six questionnaires were excluded from analysis. After taking into account 47 non-deliveries, the final response rate was 65.8% (n=1601).

Participants in this study had a lower mean BMI (25.8) than that reported for adult women in the 2008/09 New Zealand Adult Nutrition Survey (mean BMI, 30-50 age group: 27.9, 95%CI 27.3 to 28.6). The socioeconomic distribution of the sample was similar to that of the total New Zealand population in the 1991 Census; however, more respondents had a university qualification (32.1%) than New Zealand women in the 2006 Census (17.7%). The study sample included a representative percentage of Māori women (11.4% vs 12.1% in the 2006 Census) and a slight under-representation of Pacific People (3% compared with 4.6% in 2006 Census).

Overall, 39.4% (n=630) of women in the sample reported trying to lose weight and another 42.1% (n=674) were trying to prevent weight gain, leaving 18.6% (n=297) not indicating either. As expected, a higher proportion of women whose BMI was classified as underweight (BMI <18.5) and healthy weight (BMI >18.5 to <25) reported trying to maintain weight, while a higher percentage of women whose BMI was categorised as overweight (BMI >25 to <30) and obese (BMI >30) reported attempting weight loss (Table 1).

Twenty-three percent of women in the healthy weight range were trying to reduce weight. When examined by BMI groupings of 18.5 to <22 and 22 to <25, 8.6% (n=27) of the former were trying to lose weight compared to 33.3% (n=139) of the latter (test for difference p<0.001).

Among low socioeconomic status women (NZSEI category 10–29) was the highest proportion not attempting weight control and the lowest proportion trying to lose weight. Current smokers showed the same pattern as low socioeconomic status women.
Table 1. Demographic and behavioural characteristics of study participants by self-reported weight control status

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>Trying to lose weight 630 (39.4)</th>
<th>Trying to maintain weight 674 (42.1)</th>
<th>Not attempting weight control 297 (18.6)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI classification</td>
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<td></td>
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<td></td>
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<tr>
<td>&lt;18.5 (underweight)</td>
<td>27</td>
<td>5 (18.5)</td>
<td>11 (40.7)</td>
<td>11 (40.7)</td>
<td>&lt;0.001 *</td>
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<tr>
<td>18.5 to &lt;25 (healthy range)</td>
<td>732</td>
<td>166 (22.7)</td>
<td>385 (52.6)</td>
<td>181 (24.7)</td>
<td></td>
</tr>
<tr>
<td>25 to &lt;30 (overweight)</td>
<td>448</td>
<td>239 (53.4)</td>
<td>163 (36.4)</td>
<td>46 (10.3)</td>
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<tr>
<td>≥30 (obese)</td>
<td>315</td>
<td>185 (58.7)</td>
<td>87 (27.6)</td>
<td>43 (13.7)</td>
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<td></td>
<td></td>
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<td>Prioritised ethnicity</td>
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<td></td>
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<tr>
<td>European and others</td>
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<td>513 (40.1)</td>
<td>547 (42.7)</td>
<td>220 (17.2)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>181</td>
<td>68 (37.6)</td>
<td>70 (38.7)</td>
<td>43 (23.8)</td>
<td></td>
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<tr>
<td>Pacific People</td>
<td>48</td>
<td>23 (47.9)</td>
<td>14 (29.2)</td>
<td>11 (22.9)</td>
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<td>Asian</td>
<td>85</td>
<td>24 (28.2)</td>
<td>41 (48.2)</td>
<td>20 (23.5)</td>
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<td></td>
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<tr>
<td>Socioeconomic status (NZSEI)</td>
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<td></td>
<td></td>
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<td>10–29</td>
<td>234</td>
<td>78 (33.3)</td>
<td>99 (42.3)</td>
<td>57 (24.4)</td>
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<td>30–59</td>
<td>1065</td>
<td>430 (40.4)</td>
<td>439 (41.2)</td>
<td>196 (18.4)</td>
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<tr>
<td>60–90</td>
<td>298</td>
<td>119 (39.9)</td>
<td>136 (45.6)</td>
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<tr>
<td>Highest education level attained</td>
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<td></td>
<td></td>
<td>0.208</td>
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<tr>
<td>Primary and some secondary school</td>
<td>489</td>
<td>202 (41.3)</td>
<td>195 (39.9)</td>
<td>92 (18.8)</td>
<td></td>
</tr>
<tr>
<td>Completed secondary school</td>
<td>153</td>
<td>71 (46.4)</td>
<td>52 (34.0)</td>
<td>30 (19.6)</td>
<td></td>
</tr>
<tr>
<td>Technical/trade school or polytechnic</td>
<td>438</td>
<td>160 (36.5)</td>
<td>195 (44.5)</td>
<td>83 (19.0)</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>510</td>
<td>192 (37.7)</td>
<td>232 (45.5)</td>
<td>86 (16.9)</td>
<td></td>
</tr>
<tr>
<td>Missing data*</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001 *</td>
</tr>
<tr>
<td>Current smoker</td>
<td>295</td>
<td>83 (28.1)</td>
<td>124 (42.0)</td>
<td>88 (29.8)</td>
<td></td>
</tr>
<tr>
<td>Former smoker</td>
<td>419</td>
<td>186 (44.4)</td>
<td>168 (40.1)</td>
<td>65 (15.5)</td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>864</td>
<td>352 (40.8)</td>
<td>375 (43.4)</td>
<td>137 (15.9)</td>
<td></td>
</tr>
<tr>
<td>Missing data*</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>P value</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1589</td>
<td>45.4 (3.2)</td>
<td>45.6 (3.2)</td>
<td>45.4 (3.1)</td>
<td>0.489</td>
</tr>
<tr>
<td>Weight*</td>
<td>1555</td>
<td>76.2 (1.2)</td>
<td>67.1 (1.2)</td>
<td>64.8 (1.2)</td>
<td>&lt;0.001 †</td>
</tr>
<tr>
<td>BMI (kg/m²)*</td>
<td>1522</td>
<td>28.1 (1.2)</td>
<td>24.7 (1.2)</td>
<td>23.8 (1.2)</td>
<td>&lt;0.001 †</td>
</tr>
</tbody>
</table>

* Statistically significant difference, Chi-square by self-reported weight control status.
† Statistically significant difference, one-way ANOVA by self-reported weight control status.
* Total n varies from one variable to another due to missing data.
† Geometric mean and geometric standard deviation.

Note: Values expressed as n. Percentages in parentheses. Percentages may not add to 100% due to rounding.

Cutting down on the size of meals or between meals snack and decreasing the consumption of fats and/or sugar were the most commonly used weight control practices (Table 2). Among the potentially harmful strategies (laxatives, diuretics, diet pills, fasting, vomiting and smoking), smoking was the most common, with 12.8% women employing this strategy two or more times a week.
Use of other weight control tactics (commercial weight loss programmes, meal replacements, slimming products and diet books) was relatively uncommon. However, a relatively high proportion of women reported following a low glycaemic index diet, with 11.2% engaging in this practice two or more times a week.

About one-fifth of the respondents reported exercising in a driven or compulsive way at least once a week or more often in order to maintain or lose weight. When asked whether physical activity was utilised ‘predominantly to lose weight or control my shape’ or weight, 47.9% (n=762) of women reported ‘yes’.

Table 2. Frequency distribution for use of weight control practices by New Zealand women aged 40–50 years over the previous 12 months

<table>
<thead>
<tr>
<th>Method</th>
<th>Not at all</th>
<th>Less than weekly</th>
<th>Once a week</th>
<th>Two or more times a week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut down on fats and/or sugars (n=1597)</td>
<td>463 (29.0)</td>
<td>233 (14.6)</td>
<td>188 (11.8)</td>
<td>713 (44.7)</td>
</tr>
<tr>
<td>Cut down on size of meals/between meals snack (n=1596)</td>
<td>516 (32.3)</td>
<td>233 (14.0)</td>
<td>183 (11.5)</td>
<td>674 (42.2)</td>
</tr>
<tr>
<td>Exercise in a driven or compulsive way (n=1595)</td>
<td>1140 (71.5)</td>
<td>111 (7.0)</td>
<td>99 (6.2)</td>
<td>245 (15.4)</td>
</tr>
<tr>
<td>Smoking (n=1590)</td>
<td>1368 (85.6)</td>
<td>14 (0.9)</td>
<td>11 (0.7)</td>
<td>205 (12.8)</td>
</tr>
<tr>
<td>Low glycaemic index (GI) diet (n=1588)</td>
<td>1253 (78.9)</td>
<td>88 (5.5)</td>
<td>70 (4.4)</td>
<td>177 (11.2)</td>
</tr>
<tr>
<td>Commercial weight loss programs (e.g. Weight Watchers, Lite n’ Easy, Sureslim, Jenny Craig) (n=1597)</td>
<td>1422 (89.0)</td>
<td>44 (2.8)</td>
<td>55 (3.4)</td>
<td>76 (4.8)</td>
</tr>
<tr>
<td>Meal replacements or slimming products (e.g. OPTIFAST, Herbalife) (n=1597)</td>
<td>1474 (92.3)</td>
<td>47 (2.9)</td>
<td>16 (1.0)</td>
<td>60 (3.8)</td>
</tr>
<tr>
<td>Diet book diets (e.g. Atkins, Zone, CSIRO, Total Wellbeing Diet, Liver Cleansing diet) (n=1595)</td>
<td>1490 (93.4)</td>
<td>46 (2.9)</td>
<td>24 (1.5)</td>
<td>35 (2.2)</td>
</tr>
<tr>
<td>Fasting (i.e. eating hardly anything at all for a time) (n=1596)</td>
<td>1414 (88.6)</td>
<td>99 (6.2)</td>
<td>48 (3.0)</td>
<td>35 (2.2)</td>
</tr>
<tr>
<td>Laxatives or diuretics (e.g. water tablets)</td>
<td>1533 (96.1)</td>
<td>24 (1.5)</td>
<td>10 (0.6)</td>
<td>29 (1.8)</td>
</tr>
<tr>
<td>Diet pills (e.g. Xenical, Reductil) (n=1598)</td>
<td>1570 (98.3)</td>
<td>8 (0.5)</td>
<td>3 (0.2)</td>
<td>17 (1.1)</td>
</tr>
<tr>
<td>Making yourself sick (i.e. vomited) (n=1597)</td>
<td>1578 (98.8)</td>
<td>11 (0.7)</td>
<td>3 (0.2)</td>
<td>5 (0.3)</td>
</tr>
</tbody>
</table>

Note: Values expressed as n. Percentages are in parentheses. Percentages may not add to 100% due to rounding.

Discussion

Our study is the first to describe weight control practices among a nationwide sample of adult New Zealand women. Compared to overseas studies, a lower proportion (39%) of women reported ‘currently trying to lose weight’. For example, Serdula et al (1999) in their United States population study reported that 50% of middle-aged women were ‘currently attempting weight loss’.

In the mid-age cohort of a major Australian prospective study, 48% of participants reported ‘currently trying to lose weight’ in 1996. In the present study, among those
who were not attempting weight loss, 69% reported ‘currently trying to maintain their weight’. This is substantially higher than the prevalence observed by Serdula and colleagues, where 32% of the middle-aged women who were not ‘currently attempting weight loss’ were trying to maintain weight.

It is of concern that 18.5% of underweight women were trying to reduce weight, with another 8.6% of women in the lower healthy weight range (BMI 18.5 to <22) also attempting weight loss. Amongst adult women, a BMI below 18.5 has been associated with an elevated risk of all-cause mortality. The United States National Health and Nutrition Examination Survey (NHANES) reported that 23% of healthy weight adult women inaccurately perceived themselves as overweight, this self-perception being a strong predictor of attempted weight loss.

Further research is needed to determine whether weight loss attempts among underweight New Zealand women are the result of weight misperception or reflect negative body image and attempts to achieve an idealised thin figure. Exposure to media depicting an idealized thin figure has been associated with negative body image and disordered eating among women.

Results of our study also revealed that 10-14% of overweight and obese women were making no attempt at weight control. There is mounting evidence that the long-term success of weight loss efforts is modest and that the experience of repeated failures leads to discouragement and a sense of hopelessness. Thus a stronger focus on the promotion of weight gain prevention and weight maintenance may be useful.

Given that more than half of the healthy weight women in this sample were attempting weight maintenance, further investigation regarding motivations underlying weight maintenance efforts may be valuable to health authorities and practitioners.

It was encouraging that the most prevalent strategies utilised for weight control were those recommended by health authorities. Decreasing the consumption of fats and/or sugar, cutting down on the size of meals/between meals snacks and exercising regularly have been recommended by the New Zealand Ministry of Health as part of the obesity prevention and management initiative. In the 1997 New Zealand National Nutrition survey, 39% of adult females reported trying to make dietary changes. This National Nutrition survey also showed that 22% of both males and females were attempting to make changes to their intake of high fat foods. Among this 22%, 94% were attempting to decrease the amount consumed and 31% were changing the type of fat eaten.

Although most women reported weight control practices that were consistent with public health messages, some of the reported practices may be health damaging. For example the proportion of women reporting smoking in an attempt to control weight (13%) was twice that reported by studies in Australia and the United States.

The fear of gaining weight upon cessation is one of the major obstacles to quitting smoking reported by women of all ages. A recent prospective study of 300 000 middle-aged men and women supports the contention that, compared to never smokers, quitting smoking is associated with additional weight gain during the first 5 years after quitting, but not subsequent to that.
The practice of exercising in a compulsive way as a means of weight control (reported by 15.4% of women two or more times a week) is a cause for concern. An unhealthy preoccupation with exercising is recognised as a factor in the development of eating disorders.24,25 Exercising in a compulsive way has been associated with food restriction and weight preoccupation among both eating-disordered and non eating-disordered populations.24,25

Consistent with overseas studies, the prevalence of other potentially health damaging weight control practices such as fasting, using laxatives or diuretics, diet pills and vomiting was low. For example, an Australian study of women in the same age group also reported the percentage of women using these weight control strategies to be: slimming pills (1.5%), diuretics (2.3%) and laxatives (2.3%).26 The use of these potentially health damaging weight control methods has been associated with overeating,27 loss of control over food28 and subsequent weight gain.28

Our findings regarding socioeconomic status differences in women’s weight control practices are consistent with findings from a United Kingdom study which showed that adult women from higher socioeconomic groups were more likely to be attempting weight loss, monitored their weight more closely and were more likely to perceive themselves as being overweight.29 In a recent Australian survey of 1013 middle-aged men and women, lower socioeconomic groups considered losing weight to be ‘expensive’, ‘not of high priority compared to other things they had to do’, ‘required a lot of cooking skills’ and ‘involved eating differently from people in the household’.30

The main limitation of the study is the use of self-reported data on weight control practices and height and weight. Social desirability bias may have increased the reporting of healthy practices and reduced reporting of unhealthy practices. Although self-reported height and weight is subject to measurement error, this has been found to be valid in New Zealand.11

Another limitation is that the questionnaire did not explore the extent to which women pursued various practices (for example, the specific approaches used and the extent to which fat or sugar intake was reduced).

In spite of the prominent use of potentially health promoting weight control practices, the prevalence of obesity among New Zealand women is high and rising.1 The New Zealand Ministry of Health reported that among adult women, the prevalence of obesity increased from 23% in 2002/03 to 27% in 2006/07, reaching 29% in 2011/12.1 It is possible that weight gain may have been even greater in the absence of the reported healthy weight control practices, or alternatively that social desirability bias led to over-reporting of healthy practices.

National nutrition surveys indicated no change in mean energy intake and percentage energy from fat among adult New Zealand women from 1997 to 2008/09.14,21 Survey participants reporting cutting down on fats or sugars may have had misconceptions regarding sources or limited skills for reducing these dietary components, or have made appropriate dietary changes but not to a sufficient degree to have a significant impact on body weight.
Conclusions

More than 80% of mid-age women are trying to either lose weight or maintain weight. The majority of women trying to control their weight report utilising weight control strategies consistent with those recommended by health authorities. However, the use of smoking and exercising in a compulsive way are of concern.

Competing interests: Nil.

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References:


Long-term outcomes in gastric bypass patients with and without type 2 diabetes—Waitemata District Health Board experience

Annika H L Lam, David D W Kim, Rick Cutfield, Cameron Walker, Michael Booth

Abstract

Background/Objectives Dramatic early postoperative improvement or resolution of type 2 diabetes mellitus (T2DM) has been widely reported after bariatric surgery but there is limited long-term data on T2DM outcome. Moreover, data on long-term weight outcomes of government funded bariatric surgery in New Zealand is lacking. We report weight and glycaemic outcomes in subjects with and without T2DM who underwent gastric bypass surgery (GBP) at Waitemata District Health Board (WDHB).

Methods Clinical records of those who underwent a GBP (Roux-en-Y gastric bypass or loop gastric bypass) at WDHB between 2001 and 2007 were reviewed. Relevant pre- and postoperative data, including weight and diabetes related parameters, were collected from hospital records and analysed. Missing clinical data was attained by contacting patients, their primary practitioners and local laboratories, and also by performing HbA1c in T2DM subjects in whom latest diabetes status was unclear.

Results Data of 126 subjects was analysed. Their mean age was 43.7 years, 73% were female and 83% were Pākeha/European. Mean preoperative weight was 136.2 kg (SD±29.1, range 81.3-241) with a mean BMI of 48.3kg/m². Postoperative nadir weight was 80.6 kg (SD±18.1, range 48.0–132.8) at 20.8 months (SD±14.6, range 4–98) (BMI 28.6) with percentage of excess body weight loss (%EBWL) of 84.7%. Latest mean weight was 90.5kg (SD±18.8, range 57–140) (BMI 32.2, %EBWL 70.7%) at a mean of 63.4 months (SD±19.7, range 12–109) post-op. Thirty four subjects (27.0%) had preoperative diagnosis of T2DM, of whom 29 (85.3%) had complete remission at some stage postoperatively. At the latest follow-up, 19 of 33 (57.6%) remained in complete remission, and the rest had either never remitted or had evidence of T2DM relapse after an initial remission. Weight loss outcomes were comparable between T2DM and non-T2DM subjects, and also between European and Maori & Pacific Islanders.

Conclusion GBP resulted in substantial weight loss in essentially all subjects, and weight loss was well maintained over time. GBP also had dramatic and favourable effect on T2DM but did not uniformly result in prolonged diabetes remission. Long-term glycaemic surveillance is desirable.

Background

Bariatric surgery is being performed at an increasing frequency both nationally\(^1\) and internationally.\(^2\) Type 2 diabetes (T2DM) is a frequent comorbidity in obese bariatric surgical candidates, and is a strong indication for performing the surgery.
Gastric bypass (GBP) surgeries, such as Roux-en-Y gastric bypass (RYGB), have been considered the gold-standard procedure for weight management, and have been suggested to be a superior procedure for T2DM outcomes when compared to other restrictive procedures such as gastric banding or sleeve gastrectomy. Though impressive short term (<3 years) outcomes of GBP in subjects with T2DM are well described by numerous studies including recent prospective trials, data on long-term T2DM outcomes are scant.

Recent studies have indicated significant T2DM relapse rate of 24-43% in those who initially remitted post bariatric surgery. Moreover, another recent study, which used more stringent T2DM remission criteria as proposed by American Diabetes Association (ADA), suggested a much lower rate of T2DM remission (40.6% with new criteria compared to 57.5%) after bariatric surgery compared to remission rates reported previously.

Long-term results of RYGB subjects reported from Wellington have been more encouraging, however this was in a predominantly privately funded population. Reports of long-term outcomes of government funded bariatric surgery in New Zealand are lacking. Waitemata District Health Board (WDHB) is one of a few centres in New Zealand offering publicly funded bariatric surgery since 2001.

We report long-term weight and glycaemic outcomes in subjects with and without T2DM who underwent GBP by a single surgeon at WDHB.

**Methods**

**Population**—Patients who had undergone GBP (open or laparoscopic RYGB or loop GBP, with a silastic ring placed above the gastro-jejunostomy) at WDHB, from 2001 to December 2007 (therefore at least 4 years since surgery at the time of analysis) were included.

Subjects who had undergone other bariatric procedures such as gastric banding, sleeve gastrectomy or biliopancreatic bypass with duodenal switch, were excluded. Patients who died within the first 12 months of their surgery, therefore with no meaningful long-term data, were also excluded.

Pre-defined relevant demographics, pre- and postoperative data, including weight and T2DM related indices were collected retrospectively. Each subject’s nadir and most recently recorded weights were sought. For those with T2DM, preoperative disease duration and treatment regimen was sought as well as all available postoperative T2DM-related indices.

Both the hospital electronic database and clinical records were screened for the initial data collection. If a given subject’s required clinical information for the study was missing, up-to-date weight and diabetes related information were sought by contacting the patient’s general practice and their local laboratory.

If relevant details were still missing, multiple attempts were made to contact the patient directly by a phone call to further attain the required information. Subjects with preoperative T2DM whose current diabetes status was unclear (i.e. no relevant laboratory testing in past 12 months) were asked to have a blood test for a haemoglobin A1c (HbA1c).

**Definitions**—Patients were identified as having preoperative T2DM if they were stated to have T2DM in clinical records and were on oral hypoglycaemic agent(s) and/or insulin. For those subjects stated to have T2DM but not on relevant therapy, prior laboratory test results were sought to determine if they fulfilled the current ADA diagnostic criteria for diabetes, namely HbA1c over 6.5% (48 mmol/mol), fasting plasma glucose ≥7.0 mmol/L on two occasions, or 2-hour post oral glucose tolerance test result of ≥11.1 mmol/L.

Postoperative T2DM outcomes were categorised using definitions from the ADA consensus statement published in 2009. This document defines complete remission as either HbA1c less than 6% or fasting glucose below 5.6 mmol/L at least 1 year after the surgery without hypoglycaemic pharmacological
therapy. Prolonged remission was defined as remaining in complete remission for at least 5 years’ duration.

Partial remission (or partial relapse) was defined as hyperglycaemia (HbA1c between 6.0–6.5% and fasting glucose 5.6–6.9 mmol/L) at least 1 year after surgery in the absence of active hypoglycaemic pharmacological therapy, and non-remission or relapse was defined as either ongoing requirement for hypoglycaemic pharmacological therapy and/or laboratory test result fulfilling the T2DM diagnostic criteria postoperatively.

**Statistical analysis**—Statistical analyses were performed using Student’s t-test and two proportion z-test for unadjusted comparisons between subgroups. Adjusted comparison was attained using the R Statistical Package.\(^1\)\(^2\)

Comparison of categorical responses between the groups of interest were conducted using odds ratios. Two sample t-tests were used to compare quantitative responses between the groups of interest, with model assumptions being tested using the Levene test (equal variance) and the Shapiro-Wilk test (normality). In cases where there was evidence that the variance was not equal we used the Welch version of the two sample t-test.

In cases where there was evidence against the assumption of normality we had sufficient data to invoke the Central Limit Theorem. Logistic Regression models were fit to identify which covariates exhibited high correlation to the response. For all statistical tests a p-value of less than 0.05 was deemed significant.

Percentage of excess body weight lost (%EBWL), as described by others,\(^3\)\(^4\) was derived by assuming the ideal body weight as the weight at body mass index (BMI) of 25 kg/m\(^2\) for the subject’s height. Body weight lost was then divided by the calculated excess weight, then multiplied by 100 to be expressed in percent.

**Ethical approval**—This study protocol was approved by Northern X Regional Ethics Committee of New Zealand (NTX/11/EXP/081).

**Results**

**Patient characteristics**—147 patients were identified as having had a bariatric surgical procedure at WDHB between October 2001 and December 2007. Thirteen patients who had gastric banding and 5 who had sleeve gastrectomy were excluded. Three of the remaining 129 patients who had GBP died within the first 12 months of their surgery, and were further excluded.

Baseline characteristics of the 126 patients analysed in this study are summarised in Table 1. Patients were predominantly female, and had a mean age of 43.1 years (range 23 to 69 years). Majority were Caucasian and the rest were of Māori or Pacific Island origin.

Thirty-six underwent silastic ring loop gastric bypass and 90 had silastic ring Roux-en-Y gastric bypass. About a third were open surgery and the rest were done laparoscopically. Mean roux limb and biliopancreatic (BP) limb lengths in RYGB were approximately 100 cm and 50 cm respectively, and the mean loop length was 170 cm in loop GBP. A 6.5–7.0 cm silastic ring was placed 1–2 cm above the gastrojejunostomy.

**Preoperative type 2 diabetes mellitus characteristics**—34 patients (27.0%) were identified as having T2DM preoperatively and their preoperative characteristics are summarised in Table 2. Mean duration of T2DM at the time of operation was 6.0 years (range 0.5–23 years). Mean preoperative HbA1c (taken nearest to the time of operation) was 7.4% (57 mmol/mol). Most subjects were treated with oral hypoglycaemic agents. Seven subjects were on insulin and had a mean daily dose was 103 units (range 40–260 units).
## Table 1. Patient demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of subjects</td>
<td>126</td>
</tr>
<tr>
<td><strong>Gender (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>34 (27%)</td>
</tr>
<tr>
<td>Female</td>
<td>92 (73%)</td>
</tr>
<tr>
<td><strong>Ethnicity (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Pākeha/European</td>
<td>104 (82.5%)</td>
</tr>
<tr>
<td>Māori/Pacific Islander</td>
<td>22 (17.5%)</td>
</tr>
<tr>
<td><strong>Type of surgery (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Roux-en-Y bypass</td>
<td>90 (71.4%)</td>
</tr>
<tr>
<td>Loop bypass</td>
<td>36 (28.6%)</td>
</tr>
<tr>
<td><strong>Open vs laparoscopic surgery (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>42 (33.3%)</td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>84 (66.7%)</td>
</tr>
<tr>
<td><strong>Diabetes status (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>34 (27%)</td>
</tr>
<tr>
<td>Non-diabetic</td>
<td>92 (73%)</td>
</tr>
<tr>
<td><strong>Pre-op weight and BMI</strong></td>
<td></td>
</tr>
<tr>
<td>Mean weight (kg)</td>
<td>136.2</td>
</tr>
<tr>
<td>(95% CI 131.1–141.3)</td>
<td>(range 81.3–241)</td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>48.3</td>
</tr>
<tr>
<td>(95% CI 46.8–49.7)</td>
<td>(range 31.5–89.2)</td>
</tr>
</tbody>
</table>

## Table 2. Diabetic patient characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>34</td>
</tr>
<tr>
<td><strong>Pre-op mean</strong></td>
<td></td>
</tr>
<tr>
<td>Duration of disease (years)</td>
<td>6.0</td>
</tr>
<tr>
<td>(95% CI 4.2–7.7)</td>
<td>(range 0.5–23)</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>7.4</td>
</tr>
<tr>
<td>(95% CI 6.8–8.1)</td>
<td>(range 5.1–12.4)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>138.2</td>
</tr>
<tr>
<td>(95% CI 127.4–129.0)</td>
<td>(range 91–241)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>50.9</td>
</tr>
<tr>
<td>(95% CI 47.3–54.6)</td>
<td>(range 34.9–89.2)</td>
</tr>
<tr>
<td><strong>Pre-op treatment (n)</strong></td>
<td></td>
</tr>
<tr>
<td>Diet control only</td>
<td>4 (11.8%)</td>
</tr>
<tr>
<td>Oral hypoglycaemic agent(s)</td>
<td>23 (67.6%)</td>
</tr>
<tr>
<td>only</td>
<td></td>
</tr>
<tr>
<td>Insulin (with or without oral hypoglycaemic agents)</td>
<td>7 (20.6%)</td>
</tr>
</tbody>
</table>
**Length of follow-up**—The mean follow-up for the entire cohort was 63 months (range 12-109 months), as determined by the period between the time of operation and the time of last recorded weight. Fifty-nine percent of patients had a length of follow-up of at least 60 months. Six of the 126 patients had died at the time of analysis. Mean time to death after surgery was 36 months.

Cause of deaths included metastatic sigmoid colon cancer, pancreatic cancer, intra-abdominal sepsis, and sudden deaths of unknown cause.

**Weight outcome** - Mean preoperative weight, taken nearest to the time of surgery, was 136.2 kg (SD±29.1, range 81.3–241) with a mean height of 167.7 cm. This corresponded to a mean pre-op BMI of 48.3 kg/m$^2$ and a mean excess weight of 65.7 kg.

Mean postoperative nadir weight was 80.6 kg (SD±18.1, range 48.0–132.8), which correlates with a mean BMI of 28.6 kg/m$^2$ and %EBWL of 84.7%. This is achieved on average at 20.8 months (SD±14.6, range 4–98) post-operatively. Most recently recorded mean weight was 90.5 kg (SD±18.8, range 57–140) at a mean of 63.4 months (SD±19.7, range 12–109) post-op, with a mean BMI of 32.2 kg/m$^2$ and %EBWL of 71.0% (range 20–147). See Figure 1.

**Figure 1. Weight outcomes in all subjects represented by LOWESS smoother (data fraction=0.5, dotted line represent±1SD)**

![Weight outcomes](image-url)
**Diabetes outcome**—Amongst the 34 subjects with pre-op T2DM, one had pancreatectomy for pancreatic cancer diagnosed 1 year after GBP and died 6 months later, and was therefore excluded from diabetes outcome analysis.

Of the remaining 33 subjects, 29 fulfilled ADA criteria for complete remission of diabetes at some stage postoperatively. Two subjects did not remit at any stage postoperatively, and another two partially remitted initially then relapsed.

Of the 29 with complete remission at any one stage, 5 subsequently had T2DM relapse, another 4 had partial relapse, and 1 did not have relevant laboratory data to elucidate current T2DM status.

Therefore 19 of the 32 (59.4%) subjects with relevant laboratory data remained in complete remission at the time of study analysis, at a mean of 63 months (these 19 subjects will be referred to as full remitters in comparative analysis below) and the other 13 had either not remitted postoperatively or had initial remission followed by relapse (will be referred to as others in comparative analysis below). See Figure 2.

**Figure 2. Diabetic outcomes at mean follow-up of 63 months**

Of 21 subjects who were eligible to be assessed for the ADA criteria for prolonged remission (i.e. laboratory data beyond 5 years after GBP), 9 (42%) fulfilled the criteria.

In those who were not in complete remission for T2DM at the time of analysis (i.e. never remitted, partially or fully relapsed after initial remission, n=13), glycaemic
control remained favourable in the majority with their latest mean HbA1c of 7.1% (SD±0.5, range 6.2–10.9). This compares to 5.6% in full remitters.

There was no clinical or laboratory evidence to suggest new T2DM diagnosis in any of the preoperatively non-diabetic subjects (n=92).

**Comparative analyses**—DM subjects identified as full remitters had significantly shorter duration of T2DM preoperatively compared to others (3.8 vs. 9.4 years, p=0.0078). Fewer full remitters were on insulin preoperatively than others (10.5% vs. 30.8%, p=0.17). 4 of 19 full remitters were on diet control only whereas none of the 13 others were (p=0.024). These differences observed were not significant on logistic regression analysis, however. There was also no statistically significant difference in mean age, ethnicity, pre and post-op (both nadir and latest) weight and %EBWL between the two groups.

Amount of weight regained from nadir weight was greater in full remitters than others (14.0kg vs 11.1kg), however the difference was not statistically significant (p=0.33 from logistic regression).

Although Maori/Pacific Island subjects had more excess weight and a higher pre-op BMI pre-op, they experienced similar degree of weight loss benefit postoperatively with comparable %EBWL (70% vs 74% in Europeans, p=0.34) and latest BMI (32.1kg/m\(^2\) vs 32.8 kg/m\(^2\) in Europeans, p=0.84). There was also no difference between diabetes remission rates between the two ethnic groups.

Similarly T2DM and non-T2DM subjects had comparable outcomes overall. Both groups weight loss postoperatively were similar with %EBWL at nadir of 80.5% vs 86.4%, respectively (p=0.086), though %EBWL at latest weight was statistically less in T2DM group (62.6% vs. 73.7%, p=0.01).

**Discussion**

We describe a long-term follow up data on over a hundred, single surgeon operated GBP subjects in a New Zealand public hospital setting. Our study shows that GBP uniformly result in substantial weight loss that was well maintained over medium to long term, as previously demonstrated in other national and international studies.\(^{10,14,15}\) This favourable long-term weight loss outcome was regardless of age, ethnicity or diabetes status in our study.

Our study also demonstrated that overwhelming majority of T2DM subjects achieved marked improvements in T2DM early after GBP, where complete remission was almost the expected norm. This finding is consistent with findings of previous studies.\(^ {14,16}\)

In longer term, however, a significant proportion of T2DM subjects had T2DM relapse. Of 29 subjects who initially went into complete remission, 5 had subsequently relapsed and another 4 had partial relapse at a mean follow up of 63 months. This, in addition to 4 others who never completely remitted post GBP, gives an approximate 40% chance of what might be considered an imperfect T2DM long-term outcome.
Our data concurs with other recent studies that raised this same issue of T2DM recurrence in the longer term, and highlights the importance of regular and indefinite surveillance for T2DM recurrence in GBP subjects.

Nonetheless, our study reassuringly demonstrated that, even using a stringent ADA diabetes remission criteria, long-term T2DM glycaemic control is favourable in the majority, with durable complete remission in 59.4% at mean follow up of over 5 years, allaying concerns raised by another recent study that showed disappointing T2DM outcome post bariatric surgery using the same ADA criteria.

Exact mechanism responsible for this marked improvement in glucose metabolism is unclear. It has been known that glycaemic improvement occurs within days of GBP well before any significant weight loss, suggesting that improved glycaemia may not be merely due to improved peripheral insulin resistance associated with weight loss per se.

Amelioration of hepatic insulin sensitivity due to caloric restriction seems, at least partly, responsible for the early improvement in glucose metabolism. Improved beta-cell function due to exaggerated post prandial glucagon like peptide-1 (GLP-1) secretion owing to early nutrient passage into the distal small intestine is thought to be another very important contributor.

In our study duration of T2DM and pharmacologic treatment for T2DM, particularly insulin, preoperatively were possible predictors of T2DM remission, while pre and postoperative weight or BMI, age and gender were not. However, given the small number of T2DM subjects it is difficult to draw any firm conclusions.

Significant inconsistencies exist among a number of studies on this matter of predictors of T2DM remission post bariatric surgery. One such study was a recent New Zealand based study of 130 obese T2DM subjects who underwent RYGB. Authors suggest key predictive variables to be preoperative BMI, HbA1c, fasting plasma glucose, hypertension and insulin requirement.

Māori and Pacific island subjects in our study derived similar weight and T2DM benefit when compared to Pākeha and other European counterparts. It was interesting to note that there is modest, but statistically significant less, weight loss observed in T2DM subjects compared to those without diabetes. This finding is in line with previous trials describing less weight loss achieved and/or maintained in T2DM subjects with lifestyle interventions, compared to those without diabetes.

Our study has several drawbacks. First, it was a retrospective study with all the short-comings that it entails. Subjects did not have standardised schedule of weight measurement and laboratory testing regimen pre and postoperatively. Subjects did not have routine preoperative islet cell antibodies, such as GAD and IA-2 antibodies, hence possibility of type 1 or autoimmune diabetes in a few of our subjects cannot be fully ruled out.

Second, we had a relatively small number of subjects with T2DM. This limited our statistical power, restricting our ability to detect determinants of postoperative T2DM remission.

In conclusion, GBP in carefully selected obese subjects uniformly results in substantial weight loss that is maintained in longer term. Overwhelming majority of
those with T2DM have markedly favourable outcome after GBP, but a durable remission is not observed in a significant proportion of subjects, highlighting the importance of ongoing T2DM surveillance.

Competing interests: Nil.

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References:


The Canterbury Charity Hospital: an update (2010–2012) and effects of the earthquakes

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Abstract

**Aim** To update activities of the Canterbury Charity Hospital (CCH) and its Trust over the 3 years 2010–2012, during which the devastating Christchurch earthquakes occurred.

**Methods** Patients’ treatments, establishment of new services, expansion of the CCH, staffing and finances were reviewed.

**Results** Previously established services including general surgery continued as before, some services such as ophthalmology declined, and new services were established including colonoscopy, dentistry and some gynaecological procedures; counselling was provided following the earthquakes. Teaching and research endeavours increased. An adjacent property was purchased and renovated to accommodate the expansion. The Trust became financially self-sustaining in 2010; annual running costs of $340,000/year were maintained but were anticipated to increase soon. Of the money generously donated by the community to the Trust, 82% went directly to patient care. Although not formally recorded, hundreds of appointment request were rejected because of service unavailability or unmet referral criteria.

**Conclusions** This 3-year review highlights substantial, undocumented unmet healthcare needs in the region, which were exacerbated by the 2010/2011 earthquakes. We contend that the level of unmet healthcare in Canterbury and throughout the country should be regularly documented to inform planning of public healthcare services.

Charity hospitals have developed in many countries to address unmet healthcare needs. The Canterbury Charity Hospital Trust (CCHT) was established in Christchurch in 2004 to facilitate the provision of free elective health care to patients with selected disorders in the Canterbury District Health Board (CDHB) region who were otherwise unable to access treatment.

The initial report described the establishment of the CCHT, the development, staffing, financing and running of the Canterbury Charity Hospital (CCH), and provided details of patients seen during its first 2½ years up to the end of 2009.1 As noted in that report, the health reforms of the early 1990s, described at the time as “jumping on the spot”, had wide-ranging effects on the provision of healthcare services, especially in the provision of elective hospital services.2

The purpose of this document is to update activities of the CCHT and its CCH over the three year period from the beginning of 2010 to the end of 2012. It details patients
seen and treated, the effects of the Christchurch earthquakes, new specialist services and hospital facilities.

A call is made for the systematic, objective documentation of unmet healthcare needs throughout New Zealand as a logical basis for the provision of healthcare by the state.

Methods
The early history of the CCHT and the CCH, together with its initial clinical activities, is described in detail elsewhere. Referrals from general practitioners (GPs) continued to meet the following criteria: inability to access care through the public hospital system; having no medical insurance and unable to afford private care; not entitled to Accident Compensation Corporation (ACC)-funded treatment; and having a condition affecting quality of life and/or employment prospects.

A letter was required confirming that these criteria applied, and signed by both the patient and the GP. They were able to obtain an updated list of services available at the CCH on the CCHT website (www.charityhospital.org.nz). The available services changed over time to respond to alterations in the services provided by the public hospital system, and what volunteer staff and resources were available at the CCH.

The CCH had only two full-time (or equivalent) paid staff members; all other work was carried out by an “army” of over 200 volunteers who provided medical, surgical, anaesthetic, nursing, technical, legal, financial, administrative and manual skills (see Results). Funding was exclusively by public donations, bequests, fundraising activities and interest on investments. There was no Government funding or payment for services by any third party.

The usual functioning of the CCH was disrupted by earthquakes in 2010 and 2011—as summarised in Table 1.

Table 1. Timeline of changes to services and major events during years 2010, 2011, and 2012

<table>
<thead>
<tr>
<th>September 2010</th>
<th>First earthquake: all clinical services in the CCH suspended for 1 week.</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2011</td>
<td>Second earthquake: all surgical and medical services in the CCH suspended. Counselling services started 6 days later in CCH; additional counselling space provided by placing Portacabins in CCH car park.</td>
</tr>
<tr>
<td>February 2011</td>
<td>Offer by CCHT to all local public and private hospitals damaged by earthquakes of short-term use of any resources not immediately required by CCH as a help in dire circumstances. Offer temporarily taken up by only one private local hospital at no pecuniary benefit to CCHT.</td>
</tr>
<tr>
<td>April 2011</td>
<td>New Brighton counselling service started; closed in June.</td>
</tr>
<tr>
<td>May 2011</td>
<td>Adjacent property (351 Harewood Road) purchased; some rooms there used immediately for counselling. Previous surgical and medical services re-started in CCH (in 349 Harewood Road, subsequently designated as East Wing).</td>
</tr>
<tr>
<td>September 2011</td>
<td>Use of Portacabins and adjacent property ceased. Counselling continued in East Wing and/or adjacent property.</td>
</tr>
<tr>
<td>October 2011</td>
<td>Work to convert adjacent property into new CCH West Wing started.</td>
</tr>
<tr>
<td>May 2012</td>
<td>Construction of West Wing completed; all counselling service transferred there.</td>
</tr>
<tr>
<td>June 2012</td>
<td>Dental service started in West Wing.</td>
</tr>
<tr>
<td>August 2012</td>
<td>Endoscopy service started in West Wing.</td>
</tr>
<tr>
<td>November 2012</td>
<td>Official opening of West Wing by His Excellency the Governor–General.</td>
</tr>
</tbody>
</table>
Clinical services were interrupted for 1 week only after the first earthquake, which occurred on 4 September 2010. This earthquake produced only minor damage to the CCH. The second earthquake on 22 February 2011, whilst likewise causing only minor damage to the CCH, resulted in 182 deaths and 6659 injuries in the initial 24 hours\(^3\) and produced severe infrastructural damage throughout the city, necessitating the suspension of elective surgery in all surgical facilities.

The trustees perceived a sudden and massive unmet need for counselling that overwhelmed local health services, and so they decided to suspend all other clinical activities at the CCH. A counselling service was established and additional temporary space provided (Figure 1). Volunteer counsellors and clinical psychologists started the service 6 days after the second earthquake.

Another clinic was opened temporarily in the seaside suburb of New Brighton (which suffered severe damage from the second earthquake) to provide counselling for patients who were unable to travel to the CCH.

**Figure 1. A Portacabin for counselling services being positioned at the CCH following the February 2011 earthquake**

![Portacabin for counselling services](image)

Expert opinion advised that a substantial need for counselling was likely to persist for years after the second earthquake and would not be met by existing services. The adjacent property was therefore immediately purchased by the CCHT and labelled the “West Wing”. All previous day-surgery and medical services were restored in May 2011 in the original CCH building, now designated the “East Wing”.

The new West Wing was extensively renovated (Figure 2) to allow not only the continuation of counselling services but also to add a dental service (Figure 3), endoscopy and minor surgery in a new operating theatre, and a teaching facility with fibreoptic technology for the purpose of virtual learning.

In November 2012 the West Wing was officially opened by His Excellency the Governor-General in the presence of the Anglican Bishop of Christchurch, The Mayor and Mayoress of Christchurch, the President of the New Zealand Nurses Organization, and a senior representative of the volunteer medical workforce.
Figure 2. October 2011–May 2012: conversion of the house purchased at 351 Harewood Road into the “West Wing” of the CCH

![Image](image1.png)

Figure 3. From June 2012: volunteers working in the dental clinic within the “West Wing” of the CCH

![Image](image2.png)
Results

In the 3 years from the beginning of 2010 to the end of 2012, for surgical patients there were: 955 initial outpatient appointments, 645 follow-up appointments, and 1050 surgical procedures; for counselling patients there were 1784 counselling sessions.

The mean ages of all patients was 48.0 years (SD=18.7; range 2 to 94 years; 77.9% <65 years). Demographic data including ethnicity, employment and marital status were requested from all patients but were rarely provided. For example, only 14% of patients provided ethnicity data.

During this 3-year period, although not formally recorded, many hundreds of initial patient appointment requests from GPs, other health professionals and directly from patients were refused by the CCH because the services they required were unavailable.

Smaller numbers were rejected because they did not meet referral criteria. Moderate numbers were turned down after outpatient assessments for treatment because they had medical comorbidities that proscribed day case surgery. Because of domestic circumstances or requirement for postoperative observation beyond the day of surgery, some patients initially deemed as unsuitable for surgery at the CCH were, in fact, accommodated because of the provision of free 2-day post-operative respite care at one of two local domiciliary establishments.

Waiting times for surgery at the CCH for the various specialities varied over the three year period but the average wait for gynaecological and most general surgical procedures was 6 to 12 weeks. The exception was groin hernia surgery, for which demand escalated and, by the end of 2012, the waiting time was approximately 1 year.

The specialist elective medical and day surgery services provided before and after the original East Wing of the CCH was opened in 2007 are shown in Table 2. Notwithstanding the disruptive impact of the earthquakes, the number of patients treated by some services, such as general surgery, remained relatively stable. Use of other services such as some medical clinics declined as their provision in the public sector revived.

New services, including counselling, colonoscopy, dentistry and some gynaecological procedures were added to those originally provided by the CCH as access to public hospital services decreased or in response to new needs arising from the earthquakes. Availability of volunteer staff also influenced both the types of services and the numbers of patients treated within services. For example, ophthalmological procedures were carried out in the CCH until 2010 after which, in the absence of volunteer ophthalmologists, this service ceased (Table 2).
Table 2. Numbers of surgical procedures, counselling sessions and medical clinic appointments

<table>
<thead>
<tr>
<th>Calendar year</th>
<th>2005–2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>–</td>
<td>8</td>
<td>22</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Dermatology</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>General Surgery</td>
<td>18</td>
<td>206</td>
<td>221</td>
<td>138</td>
<td>134</td>
<td>151</td>
<td>868</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>4</td>
<td>4</td>
<td>42</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>54</td>
</tr>
<tr>
<td>Gynaecology</td>
<td>–</td>
<td>5</td>
<td>36</td>
<td>36</td>
<td>52</td>
<td>76</td>
<td>205</td>
</tr>
<tr>
<td>Orthopaedic</td>
<td>–</td>
<td>–</td>
<td>22</td>
<td>11</td>
<td>4</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Podiatric</td>
<td>–</td>
<td>–</td>
<td>13</td>
<td>30</td>
<td>39</td>
<td>24</td>
<td>106</td>
</tr>
<tr>
<td>Plastic &amp; Hand</td>
<td>–</td>
<td>2</td>
<td>8</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Vasectomy</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3</td>
<td>12</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Counselling/Psychological</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1335</td>
<td>449</td>
<td>1784</td>
</tr>
<tr>
<td>Dental</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>285</td>
<td>285</td>
</tr>
<tr>
<td>Colonoscopy</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>228</td>
<td>368</td>
<td>242</td>
<td>1578</td>
<td>1023</td>
<td>3461</td>
</tr>
</tbody>
</table>

Over the 3-year period, there were four postoperative complications as follows: one patient had a myocardial infarction on the second day after an open inguinal herniorrhaphy, but made a full recovery; two infected haematomas after Bascom Cleft Lift operations for pilonidal sinus required further surgical treatment; and, one failed laparoscopic sterilisation required a bilateral salpingectomy.

Volunteer specialists and employee details are shown in Table 3. Some volunteers worked at the CCH on a regular basis, often weekly, whilst others provided expertise on a less regular or less frequent basis as dictated by personal circumstances. More volunteers were available than could be accommodated.

Table 3. Numbers of volunteers and employees by the end of 2012

<table>
<thead>
<tr>
<th>Staff</th>
<th>Ever worked since 2005</th>
<th>Worked (volunteered) in 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurses</td>
<td>73</td>
<td>38 (56)</td>
</tr>
<tr>
<td>Anaesthetists</td>
<td>24</td>
<td>12 (18)</td>
</tr>
<tr>
<td>Physicians</td>
<td>11</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Surgeons</td>
<td>34</td>
<td>13 (32)</td>
</tr>
<tr>
<td>Dentist/Dental Nurses</td>
<td>34/26</td>
<td>34/26</td>
</tr>
<tr>
<td>Counsellors/Psychologists</td>
<td>58</td>
<td>10 (10)</td>
</tr>
<tr>
<td>Technicians</td>
<td>12</td>
<td>5 (6)</td>
</tr>
<tr>
<td>Non-Medical</td>
<td>86</td>
<td>23 (23)</td>
</tr>
<tr>
<td>Full Time Employees</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Part Time Employees</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Immediately after the February 2011 earthquake, the CCHT offered its surgical facilities to Christchurch Hospital to deal with acute injuries. This offer was not taken up. CCHT then offered the use of any of its spare facilities to any of the other local hospitals damaged by the earthquakes. This offer was taken up by one of the private hospitals as a temporary expedient. No charge was made for the use of CCHT facilities; the number of patients treated by this private group is not reported here.
Counselling Service—In 2011 and 2012, 858 patients (23.2% male, 76.8% female; mean age was 48 years; SD=19.2; range 4 to 93 years) were seen at 1784 1-hour sessions.

Immediately after the February 2011 earthquake, patients were seen by volunteer counsellors and clinical psychologists who came from Canterbury, elsewhere in New Zealand as well as Australia and USA—as described elsewhere. They provided an acute counselling service, of up to three sessions each, for stressed patients who were either GP or self-referred.

Between 28 February and 2 August 2011, 56 volunteer counsellors offered their time, providing support to the CCHT. After 16 weeks, as the demand for acute stress counselling began to reduce, the out-of-town volunteer counsellors were able to leave and the service was continued by a group of locally-based practitioners. Although the number of new patients requiring counselling decreased in this later phase, the cases became more complex, hence it was necessary to increase the number of counselling sessions to more than three for some patients (Table 4).

Table 4. Numbers of counselling sessions per patient

<table>
<thead>
<tr>
<th>Number of counselling sessions per patient</th>
<th>2011 Number of patients (%)</th>
<th>2012 Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>621 (82.7)</td>
<td>55 (51.4)</td>
</tr>
<tr>
<td>3–9</td>
<td>127 (16.9)</td>
<td>39 (36.4)</td>
</tr>
<tr>
<td>10–20</td>
<td>3 (0.4)</td>
<td>8 (7.5)</td>
</tr>
<tr>
<td>&gt;20</td>
<td>0</td>
<td>5 (4.7)</td>
</tr>
<tr>
<td>Total</td>
<td>751</td>
<td>107</td>
</tr>
</tbody>
</table>

At that stage, self-referral became unnecessary but referrals were accepted from all qualified health professionals, including social workers, school nurses, etc. The local counsellors and clinical psychologists continued to provide counselling for acutely stressed patients but the breadth of the service at CCH was increased to include the following: anxiety/depression, grief, attention deficit hyperactivity disorder, family therapy, group support, child behavioural issues, and anger management. Many of the patients who presented in these new categories had earthquake related problems.

Dental Service—The cost of routine dental care in the community was often prohibitive for those on a low income. Adults in receipt of a Work and Income New Zealand (WINZ) benefit were able to receive subsided treatment, or a grant, for the relief of dental pain or infection. However, no assistance was available for routine dental treatment for this group of patients. Previously these patients could be treated at the Dental Department in Christchurch Hospital but the level of service was reduced by earthquake damage and policy changes.

From July 2012, CCH offered treatment for those WINZ beneficiaries who might not otherwise access necessary dental care. In the second half of 2012, 285 treatments were provided and the aim for 2013 is to achieve 1000 treatments.

The dental service at the CCH offered a single course of treatment for adult WINZ beneficiaries in order to get them “dentally fit”. It was not designed to provide acute
relief of pain and therefore was not “competing” for those patients who were already able to receive government assistance for this type of service. Treatment offered by the CCH included a check-up, clean, non-urgent extractions, root canal treatment on front teeth, and fillings.

Thirty dentists and a similar number of dental nurses voluntarily offered their time and expertise. The CCH ran 3 to 4 half day dental sessions per week on average but the hope is to increase these in 2013 as demand increases.

**Colonoscopy Service**—Many patients were referred to the CCH for management of undiagnosed rectal bleeding. For this reason a colonoscopy was thought to be an essential service. Therefore a small theatre complex, with state of the art equipment, was constructed in the new West Wing. This was purpose-built as a colonoscopy suite and small procedure operating facility.

The first colonoscopy list was completed on 10 August 2012. By the end of that year, during which the service was slowly introduced, the procedure had been performed on 17 patients (23.5% male, 76.5% female; mean age was 47.7 years; SD=17.4; range 21 to 80 years) by 6 endoscopists from a pool of 17 volunteers (Table 2). Colorectal pathology was detected in 12 patients, with polyps in 6, one of whom had an adenocarcinoma of the descending colon.

The future intention was to provide a diagnostic service for patients over 50 years of age with symptomatic rectal bleeding and screening for colon cancer for medium-risk category patients.

**Teaching and research**—The CCHT had an extensive programme of teaching and research, which was supported by an education grant from the Tait Foundation. There were many educational activities for qualified and student nurses in association with the Christchurch Polytechnic Institute of Technology. Christchurch surgical registrars obtained supervised operative experience at the CCH of surgery for common elective conditions, which were infrequently performed in the public hospitals. The new virtual teaching facilities were also used for GP educational sessions. All clinical activities were both internally and externally audited. For example, the post-earthquake counselling service was subjected to an independent research study.4

**Finances**—In the CCHT’s third year of operation (2010), it became financially self-sustaining, generating a steady income flow from appeals, grants and public donation. A considerable donation in 2010 brought the cash and investments to a total of $4.3m. Subsequent to the February 2011 earthquake, however, the expansion of the CCH site, combined with capital investments and establishment of new services, reduced the financial reserves to $2.3m.

Major costs included purchase of the adjacent property ($440K), a rebuilding contract ($1.2M) and major medical equipment ($440K). Outside of the expansion project, running costs for the expanded facility remained within the original operating budget of $340k in 2012 although forecasts were that this will double over the next few years.

In late 2012, the CCHT appointed a contracted part-time fundraiser and re-evaluated its long term investment portfolio. Since the original report,1 the CCHT increased the
percentage of each donated dollar going directly to patient care from 75% to 82% (Figure 4).

**Figure 4. Breakdown of spending by the CCH 2010–2012**

The 3 years since our first report in 2010 saw a substantial increase in activity at the CCH, driven by the large number of patients with unmet healthcare needs and exacerbated by the earthquakes of 2010/2011. Since its establishment, the CCHT endeavoured to be flexible in its provision of services.

When services became unavailable or were severely restricted in the public hospital system, the CCHT attempted to fill the gap. In 2008, for example, the CCHT began to provide laparoscopic sterilization in response to an increased need resulting from a progressive reduction in the service provided by the CDHB.

The severe earthquakes of September 2010 and February 2011, along with numerous after-shocks, had a major impact on the population in the Christchurch region and precipitated changes in the functioning of the CCH. Many services there were put on hold in order to allow inspection of the buildings and to establish counselling services. Because of these imperatives, and with unavailability of volunteer health professionals in some specialties, the number of patients treated per year in some categories was less than in 2009.

**Note:** Patient treatments included costs of operative procedures, medications and consultations. Fixed costs included rates, power and insurance. Running costs included administration, ACC, legal and security fees. Fundraising costs included advertisements, events and publicity.
By contrast, patient flow in other services such as general surgery, gynaecology and podiatric surgery remained steady, whilst new services were introduced. In particular, and with opening of a new West Wing of the CCH, a large number of patients requiring counselling were seen in 2011, and dental and colonoscopy services were established.

It is evident that before the earthquakes of 2010/2011 there was a substantial burden of unmet healthcare need in Canterbury. It should be noted that surgical services provided by the CCH were not comprehensive. Rather, they were available, with few exceptions, only to those who could be treated as day patients and were selective according to availability of specialist volunteer clinicians and necessary physical resources. Clearly, therefore, the number of patients treated in the CCH represented only a fraction of unmet healthcare need in the CDHB region.

Why is there such a high, though undocumented, level of unmet healthcare need? The New Zealand Medical Association in 2011 made note that New Zealand performs poorly when compared with other high income countries in regard to health equity and “this poor performance has direct links to our own particular set of social determinants”. These determinants have been analysed and discussed by various authorities and professional bodies and, notwithstanding some criticism and contrary views, are not only intuitively logical but based on robust research information.

Adverse changes since the late 1980s - early 1990s in the social determinants of health, perhaps most easily reflected in the substantial increase over time in income inequality in New Zealand, as measured by the P80/P20 ratio or the Gini coefficient, appears likely to be the biggest single contributor to the current level of unmet healthcare needs.

We acknowledge that the level of unmet health care need in the CDHB region is unlikely to be typical of all other regions in the country. We contend, however, that without documenting the level of such unmet need, both regionally and nationally, it is not possible to plan for the provision of public health services in a logical, open and cost-effective fashion. It is, of course, important to continue monitoring and publishing details of what services are currently provided.

Some attempt was made by the Ministry of Health to gather such information in its four NZ Health Surveys. Their 2011/2012 Survey documented that “about 27% of adults had an unmet need for primary health care at some time in the past year”. One must add to this the conclusion from the publication by Derrett et al noting that “...rates of public funded surgery leave considerable unmet need in NZ, even in better served areas”. There is also unmet need in areas such as dentistry and mental health. One must therefore conclude that the overall level of unmet health care need in New Zealand, although documented only in part, is alarmingly high.

Whereas we are not in a position to provide even a broad estimate of the financial consequences of the present level of unmet healthcare needs, our strong impression is that the current situation results in greater costs to the country in the long term through, for example, the unnecessary payment of welfare/health benefits and lost employment/taxable income, than would a more comprehensive public health system.
In this regard, the opinion of Nobel Prize winning economist Joseph Stiglitz is: “Lack of access to health care contributes significantly to inequality, and this inequality in turn undermines the performance of our economy”.  

Competing interests: Nil.

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REFERENCES


Patient-reported outcomes following breast reconstruction surgery in a public hospital: use of the Breast-Q questionnaire

Ryan Cha, Estelle Barnes, Michelle B Locke

Abstract

**Aim** To assess patients’ quality of life and satisfaction with individual outcomes following breast reconstructive surgery, using the BREAST-Q© questionnaire.

**Methods** The BREAST-Q questionnaire was used to collect information on patients’ satisfaction in various domains following breast reconstructive surgery. The questionnaire answers were entered into the Qscore Excel template. Scores for each domain were obtained and different comparison groups were analysed for statistical significance.

**Results** Overall, patients showed above average satisfaction in majority of the domains. No statistically significant difference in satisfaction was seen with breast or overall outcome when compared by type or timing of reconstruction; presence or absence of significant complication; and completed or ongoing surgery. However, some difference in satisfaction with medical and office staff by ethnicity was evident, with Europeans being more satisfied than Māori or other ethnicities.

**Conclusion** The BREAST-Q questionnaire is a valuable tool to provide patient satisfaction information on breast reconstruction. Our retrospective audit shows that our patients are currently satisfied with their breast and outcomes overall. We will now use this tool prospectively to assess our patients’ progress and satisfaction, and improve our service delivery for our future patients.

In New Zealand, breast cancer is the most common cancer in women, accounting for 28.4% of cancer in 2009 (the latest year for which data are available).1–3 Breast reconstruction is aimed at improving the quality of life or wellbeing of patients.

There is no survival benefit between breast conservation therapy (BCT), mastectomy alone and mastectomy with reconstruction.4,5 In fact, as with any elective surgery, reconstruction brings with it the risk of complications. Despite this, many women choose the option of breast reconstruction for a wide variety of reasons, including enhancement of their body image, confidence, femininity and quality of life (QOL) following mastectomy.

It has been shown that breast reconstruction has a positive effect on the psychological wellbeing of women with breast cancer.6 Traditionally, surgical outcomes in plastic surgery were centred on the provider’s perspective, evaluating objective clinical measures such as complications and morbidity, and cosmetic outcomes by considering photographic analyses.7–9 However these measures are recognised as not sufficient to assess the quality and effectiveness of breast reconstruction.10
Recently, QOL outcomes from a patient’s perspective have become a more important issue to consider.\textsuperscript{8,9,11}

The BREAST-Q\textsuperscript{©} questionnaire is a newly developed, reliable, validated and clinically meaningful patient-reported outcome measuring tool, created by Memorial Sloan-Kettering Cancer Centre in 2006 to help surgeons and patients evaluate and appreciate patients’ satisfaction and QOL with different surgical techniques of breast reconstruction.\textsuperscript{8} In other words, it is used to provide essential information about the impact and effectiveness of breast reconstructive surgery from the patient’s perspective.\textsuperscript{12}

The breast reconstruction BREAST-Q questionnaire has both pre and postoperative versions. The questionnaire can be used to compare the outcomes of different surgical options; to assess changes in individual patients over time; to provide surgeons with valuable insights into the patient’s concerns; and to improve problems identified by patients in the clinical practice, among other things.\textsuperscript{8} To this end, the Department of Plastic, Reconstructive and Hand Surgery at Middlemore Hospital, Counties Manukau District Health Board (CMDHB) has purchased the reconstruction modules to administer to our breast reconstruction patients.

These questionnaires assesses 6 domains with 11 sections, being:

- Satisfaction with breast;
- Satisfaction with outcome;
- Psychosocial wellbeing;
- Sexual wellbeing;
- Physical wellbeing: chest;
- Physical wellbeing: abdomen;
- Satisfaction with nipples;
- Satisfaction with information;
- Satisfaction with surgeon;
- Satisfaction with medical staff; and
- Satisfaction with office staff.

It is scored by the associated QScore programme, which transforms the raw data into a scale of 0 to 100, where a higher score suggests a better QOL or satisfaction.\textsuperscript{13}

We wish to use the knowledge gained and feedback provided by the BREAST-Q to assess our results, improve our service delivery and increase our patient satisfaction.

**Methods**

The project was screened by the Health and Disability Ethics Committee online process and was deemed to not require ethical approval. The postoperative reconstruction BREAST-Q questionnaire was administered to patients who have received any breast reconstruction surgery in our department in 2011 and 2012. Potential participants were identified from departmental operative records.

Comparative data on the number of patients undergoing mastectomy per year was obtained from the Auckland Breast Cancer Register held by the Auckland District Health Board, which records every patient diagnosed with breast cancer in the Auckland region.\textsuperscript{14}
Of the 304 reconstruction patients identified from our database, there were 236 eligible participants by the following inclusion criteria:

- Female gender.
- Mastectomy secondary to breast cancer or for prophylactic purposes.
- Primary reconstructive surgery received more than 6 months ago but no longer than 5 years ago.

Exclusion criteria included:

- BCT or partial mastectomy.
- Significant reconstructive surgery performed outside of our department.
- Non-English speaking.
- Presence of breast cancer metastasis.
- Secondary or subsequent reconstructive surgery.

Of these, 98 participants were excluded because they were unable to be contacted after multiple attempts of calling their home and mobiles numbers provided in the database.

Out of 138 patients who could be contacted, 131 agreed to complete the questionnaire. At the completion of the study period, 76 questionnaires had been returned, giving a response rate of 58%, as seen in Figure 1.

Figure 1. Recruitment of patients to BREAST-Q study
Additional data on age, a reason for mastectomy, type(s) of reconstruction surgery and any recorded complications were collated. For the purposes of our data analysis, patients were classified into different sub-groups to analyse whether treatment differences contribute to their overall satisfaction levels.

These groups were based on type of reconstruction; completed treatment or ongoing treatment; ethnic groups as per Census definition (self-reported ethnicity); presence or absence of major complications related to the reconstructive surgery; and timing of reconstructive surgery (immediate [at the time of the mastectomy] or delayed). Patients were categorised into the completed treatment group if breast reconstruction was finished to satisfaction of surgeon and patient. This generally included creation of suitable breast mounds, as well as nipple reconstruction and subsequent nipple micropigmentation (tattooing) unless the patient had declined these additional surgeries.

If further breast surgery was planned, the patient was categorised into the ongoing treatment group. Major complications were defined as those requiring in-patient treatment or further surgery for management. Some patients who underwent bilateral reconstruction were excluded from the relevant sub-group analysis if the surgery performed or the timing of the surgery differed between breasts. This is due to the fact that the BREAST-Q questionnaire is designed to look at overall outcomes but not differences between individual breasts.

Responses from the 75 valid questionnaires were entered into the QScore Excel (Microsoft Corp., USA) template and analysed by the QScore programme, which automatically transforms the raw data into summary scores ranging from 0 (very dissatisfied) to 100 (very satisfied) for each of the 11 sections.

Statistical analysis was performed using GraphPad InStat v3.10 software (GraphPad Software, Inc., California, USA). The mean, standard deviation and number of participants in different groups were calculated and groups were compared by unpaired two-tailed t-testing or one way analysis of variance (ANOVA) testing as appropriate. A p value of ≤0.05 was considered statistically significant. Graphed results are shown as mean ± standard error of the mean (SEM).

Results

Over the previous 5-year period, 2760 women in the Auckland region underwent mastectomy surgery, an average of 552 per year. The average age of the patients undergoing mastectomy was 56 years (range: 22–95). By comparison, our breast reconstruction patients were younger, with an average age of 49 at the time of mastectomy and 50 at the time of reconstruction (range: 33–67) as per Table 1.

Table 1. Age of reconstructive surgery patients compared with all mastectomy patients in the Auckland region

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Age of all mastectomy patients in Auckland (2006–2011)*</th>
<th>Age of study participants (from study database 2011–2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At the time of mastectomy (%)</td>
<td>At the time of reconstruction (%)</td>
</tr>
<tr>
<td>20–29</td>
<td>12 (0.4%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>30–39</td>
<td>214 (7.8%)</td>
<td>11 (14.7%)</td>
</tr>
<tr>
<td>40–49</td>
<td>753 (27.3%)</td>
<td>27 (36.0%)</td>
</tr>
<tr>
<td>50–59</td>
<td>729 (26.4%)</td>
<td>27 (36.0%)</td>
</tr>
<tr>
<td>60–69</td>
<td>539 (19.5%)</td>
<td>10 (13.3%)</td>
</tr>
<tr>
<td>70+</td>
<td>515 (18.6%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Total</td>
<td><strong>2760 (100%)</strong></td>
<td><strong>75 (100%)</strong></td>
</tr>
<tr>
<td>Average</td>
<td>56</td>
<td>49</td>
</tr>
<tr>
<td>Range</td>
<td>22–95</td>
<td>33–67</td>
</tr>
</tbody>
</table>

* Data from Auckland Breast Cancer Registry, Auckland District Health Board.
The majority of our patients were of New Zealand European origin (70.7%), with 10.7% identifying as Māori (see Table 2).

Table 2. Ethnicity of study participants

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Number of participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand European</td>
<td>53 (70.7%)</td>
</tr>
<tr>
<td>Other European</td>
<td>8 (10.7%)</td>
</tr>
<tr>
<td>New Zealand Māori</td>
<td>8 (10.7%)</td>
</tr>
<tr>
<td>Others</td>
<td>6 (8.00%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75 (100%)</td>
</tr>
</tbody>
</table>

Surgery was performed in an immediate fashion in the majority of patients (70.7%, see Table 3) and reconstruction was performed by autologous methods in slightly over half of the patients (54.7%, see Table 4).

Table 3. Timing of reconstructive surgery

<table>
<thead>
<tr>
<th>Timing of reconstruction</th>
<th>Number of participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed</td>
<td>16 (21.3%)</td>
</tr>
<tr>
<td>Immediate</td>
<td>53 (70.7%)</td>
</tr>
<tr>
<td>Combination</td>
<td>6 (8.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75 (100%)</td>
</tr>
</tbody>
</table>

Table 4. Type of reconstructive surgery

<table>
<thead>
<tr>
<th>Type of reconstruction</th>
<th>Number of participants (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prosthetic</td>
<td>34 (45.3%)</td>
</tr>
<tr>
<td>Autologous</td>
<td></td>
</tr>
<tr>
<td>DIEP flap</td>
<td>10 (13.3%)</td>
</tr>
<tr>
<td>TRAM flap</td>
<td>22 (29.3%)</td>
</tr>
<tr>
<td>Latissimus dorsi flap</td>
<td>9 (12.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75 (100%)</td>
</tr>
</tbody>
</table>

DIEP=deep inferior epigastric artery perforator flap; TRAM=transverse rectus abdominus myocutaneous flap.

Only 24 patients (32%) had completed their reconstructions at the time of the study, with 51 (68%) still requiring further surgery for completion. 14 patients were identified as having a major complication associated with their surgery (18.7%).

Overall, the patients reported good levels of satisfaction with breasts and overall satisfaction with outcome of their surgery, which scored 62.6 and 70.3 respectively (Figure 2).

Most scores were between 60 and 75. In majority of the domains, almost all participants provided a satisfaction score (i.e. N=74 or 75). However decreased response was seen in three domains—sexual wellbeing, physical wellbeing (of abdomen) and satisfaction with nipples (N=67, 34 and 34, respectively).
The lowest satisfaction was 49.8 for sexual wellbeing, while high satisfaction scores of above 90 were evident in domains of satisfaction with surgeon, medical staff and office staff. Also, satisfaction did not seem to vary with age.

When grouped by decade (30–39, 40–49, 50–59, 60–69), mean values for satisfaction with breasts and satisfaction with outcome showed no significant difference with one way ANOVA testing (p=0.37 and p=0.81 respectively).

**Figure 2. Overall results from QScore analysis**

![Overall Results of QScore](image)

0=very dissatisfied; 100=very satisfied; ± SEM.

In sub-group analysis, patients who had completed their surgery seemed to report a higher level of satisfaction with breasts than those having ongoing surgery (67 vs 60.6 respectively, Figure 3) as well as higher satisfaction with outcome (73.6 vs 68.9 respectively), but these differences were not statistically significant (p=0.156 and p=0.38 respectively).
When the results were analysed on the basis of the type of reconstruction performed, there were no significant differences between groups with respect to satisfaction with breasts (Figure 4), satisfaction with outcome, psychosocial or sexual wellbeing. Also, the presence of a major complication did not significantly alter the patients’ satisfaction with outcome, or satisfaction with surgeon, medical or office staff, compared to patients without a complication.

Figure 4. Satisfaction with breasts by type of reconstruction

0=very dissatisfied; 100=very satisfied; ± SEM.
Analysing the timing of reconstruction was somewhat hampered by the small number of patients in the delayed reconstruction group. The immediate reconstruction cohort seemed to have higher average scores for sexual wellbeing and physical wellbeing of the chest, with mean values of 72.0 and 53.0 respectively, compared to 61.3 and 40.2 in the delayed group. However, p values were not significant (0.09 and 0.06, respectively).

Some significant differences were seen between the ethnic groups with regards to their satisfaction with medical and office staff. Overall, Europeans were more satisfied than other ethnicities. With regards to satisfaction with medical staff, Other Europeans were much more satisfied (mean of 98.9) compared to New Zealand Māori (mean of 81.0, p =0.05). See Figure 5.

**Figure 5. Satisfaction with medical staff by ethnicity**

![Satisfaction with Medical Staff by Ethnicity](image)

0=very dissatisfied; 100=very satisfied; ± SEM.

Similarly, New Zealand Europeans reported a much higher satisfaction with office staff than other ethnic participants (93.2 vs 76.0 respectively, p=0.03). See Figure 6.
Discussion

Breast cancer is commonly treated by either BCT or mastectomy, with or without adjuvant chemotherapy and radiotherapy. A proportion of women who undergo mastectomy will desire breast reconstruction to restore body image and improve quality of life following mastectomy.\(^1\)

Breast reconstruction QOL studies vary in their conclusions regarding the benefits of the operation. In a recent systematic review, most of the studies identified did not find any statistically significant differences in QOL between people who had mastectomy alone and mastectomy with reconstruction.\(^{15}\)

However, one key limitation to these studies is unavoidable selection bias. Therefore we are limited to assessing the outcomes of patients who self-select to electively undergo reconstructive surgery, without the benefit of a “control” cohort.

Interestingly, research has shown that patient satisfaction also seems unrelated to aesthetic outcome, with the majority of the patients who expressed dissatisfaction having aesthetic results that were rated good to excellent by surgeons.\(^7\)

This affirms the importance of assessing patient reported outcomes using a validated, quality of life tool such as BREAST-Q questionnaire, because “care cannot be of high quality unless the patient is satisfied”.\(^{16}\)

Saulis and colleagues found that poor satisfaction with reconstruction correlated with patients’ dissatisfaction with preoperative counselling about the reconstructive options.
and the process of care, rather than patients’ perception of their overall aesthetic result. This emphasises the importance of thorough pre-operative counselling, as well as assessing and exploring patients’ satisfaction from the preoperative period onwards.

According to the Auckland Breast Cancer Register, between 2006 and 2011 an average of 552 mastectomies were performed annually in the Auckland region. Unfortunately, the rate of reconstruction performed in Auckland for the same time period is difficult to quantify. There is no unifying database to capture all breast reconstruction patients.

Over the 2-year period of our study, our department performed 304 breast reconstruction surgeries, being an average of 152 per annum. Therefore the rate of breast reconstruction surgery performed by plastic surgeons in the public health system over this period was approximately 27.5% of all mastectomy patients. However, the actual rate of reconstruction in the region may be different, as our study did not include patients who had their reconstructions performed by surgeons other than plastic surgeons employed by CMDHB, or any reconstructions performed in the private healthcare sector and also because the Auckland Breast Cancer Register may not 100% complete.

According to the 2006 Census data, the most recent statistics available, 11.1% of the population in Auckland identified as Māori. While these data are somewhat historic, the fact that 10.7% of our reconstruction patients identify as Māori seems to imply an appropriate, proportional representation for our region.

Our results showed good to very good scores in almost all domains, with the lowest satisfaction in sexual wellbeing and the highest scores in satisfaction with surgeon, medical staff and office staff. No significant difference was found in satisfaction with breast or outcome overall when compared by type or timing of reconstruction; presence or absence of significant complication; age at time or reconstruction or completed compared with ongoing treatment.

These results are in keeping with the literature. Alderman and colleagues found similar level of satisfaction between patients who had autologous tissue reconstruction and prosthetic reconstruction, and two other studies have also showed no significant differences between different methods of reconstruction.

Analysing our results by timing of surgery was hampered by the small number of patients in the delayed group. However, a study from 2001 concluded that there is no strong evidence to indicate immediate reconstruction is superior to delayed reconstruction.

A recent Cochrane review on the topic found some evidence to support the view that immediate reconstruction had psychological benefits, an overall better aesthetic outcome and decreased complication rates, which may contribute to patient satisfaction in other areas. But the review itself admitted to having limited data to draw these conclusions.

Regarding the outcomes of patients with major complications, our results are in line with a 2008 review of breast reconstruction outcomes, which found that satisfaction did not correlate with development of a complication.
When looking at the effect of completion of the reconstructive process, our average values for Satisfaction with Breast and Satisfaction with Outcome were higher in our completed treatment group than the ongoing surgery group, but the difference was not statistically significant. This is likely due to the small number of participants in our completed treatment group.

The trend towards increased satisfaction with surgical completion is in keeping with the findings of Elders and colleagues, who concluded that the major determinant of aesthetic satisfaction came from completion of the procedure.\(^6\)

The only significant differences were in the categories of Satisfaction with Office and Medical Staff when analysed by ethnicity. Overall, Europeans were more satisfied.

These results must be interpreted in the context of the small number of patients in some of the subgroups. Indeed, one of the limitations of this study is the small numbers in some subgroups.

Other limitations include the possibility that majority of patients who consented and returned the questionnaire were the more satisfied patients. Given the limited number of returned questionnaires compared with the possible number of eligible women for this study, the results may not be generalizable across all breast reconstruction patients.

Additionally, as it was a retrospective survey study, recall bias could have existed, as patients tried to remember the details of their reconstruction. It has been shown that the reconstructive surgery becomes less important in patients’ lives as time passes.\(^22\)

Also, many patients expressed their desire to complete the questionnaire with word answers rather than numbers, providing anecdotes related to their reconstructive surgery, which BREAST-Q is not designed to capture.

The BREAST-Q questionnaire is very good at identifying areas that patients are satisfied or dissatisfied but it does not tell us exactly what the patients would like the health service providers to improve on. Thus it may be a worthwhile to consider carrying out a qualitative study to obtain a bigger picture of patients’ satisfaction level with possible improvement ideas from patients’ perspective.

Our long-term goal is to fully implement the BREAST-Q tool by administering both pre- and post-operative questionnaires to all our future breast reconstruction patients at set post-operative time points in a prospective fashion. We anticipate that this will allow us to more accurately assess the results of our surgery, from our patients’ point of view.

Better quality information regarding our patients’ opinion of their treatment and outcome will allow us to improve our service. We need reliable, reproducible data to allow comparisons of outcomes, not just within our department but also across all service providers, to ensure equitable access to high quality breast reconstructive surgery throughout New Zealand.

**Conclusions**

In the past 2 years, the rate of publicly funded reconstructions has equated to 27.5% of the patients undergoing mastectomy in the Auckland region. Our reconstructive cohort is younger on average than the mastectomy cohort.
Our patients are generally satisfied with the surgical outcomes regardless of the type or timing of their reconstruction, the presence or absence of a major complication and whether their treatment has been completed or is on-going.

This study has demonstrated that the assessment of patient satisfaction and quality of life with a PRO tool such as the BREAST-Q questionnaire is a valuable source of information for service providers following breast reconstruction surgery.

As the BREAST-Q was originally designed to compare preoperative and postoperative satisfaction levels, our ongoing plan is to use the BREAST-Q prospectively from the first preoperative appointment.

Our goal is to improve our service and therefore our patients’ satisfaction scores in all domains. We will analyse our results over the next several years to follow surgical outcomes from our patients’ perspectives and to track satisfaction or potential areas for improvement.

Competing interests: Nil.

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References:


Lack of relationship between obesity and mortality or morbidity after coronary artery bypass grafting

Tom Kai Ming Wang, Tharumenthiran Ramanathan, Ralph Stewart, Greg Gamble, Harvey White

Abstract

Aims Obesity has significant adverse effects on cardiovascular health. Conflicting results have been reported regarding relationships between body mass index (BMI) and outcomes after coronary artery bypass grafting (CABG). We compared outcomes of CABG patients by BMI categories.

Methods Isolated CABG performed between July 2010–June 2012 at Auckland City Hospital were categorised into four groups of BMI ≤25 (normal), >25–30 (overweight), >30–35 (obese) and >35 kg/m² (morbidly obese) retrospectively for analyses.

Results The four groups had 181(22.4%), 320(39.6%), 205 (25.3%) and 103 (12.7%) patients respectively. Increasing BMI was associated with younger age (p<0.001) and increasing creatinine clearance (p<0.001).

Obesity was associated with a higher proportion of patients of Māori or Pacific ethnicity and patients with more hypertension. Morbid obesity was associated with female sex, higher mean New Zealand Deprivation Index, diabetes, longer operation time and sternal wound infection. Thirty-day mortality (p=0.702), composite morbidity (p=0.904) and survival (p=0.112) during 1.4±0.6 years of follow-up were similar across BMI categories.

Conclusion Obesity was common and was present in over a third of patients undergoing CABG with 13% of the entire cohort being morbidly obese. Mortality and morbidity rates did not differ across BMI categories. Obesity should not be considered a risk factor for adverse outcomes after CABG and should not be a contraindication for surgery.

Obesity has become a global epidemic and is a risk factor for many diseases including coronary artery disease (CAD), the single most common cause of mortality in New Zealand (NZ).1–3 However, the association between obesity, or categories of body mass index (BMI), and all-cause mortality remain controversial.

Although most studies found obesity to be associated with increased all-cause and cardiovascular deaths,4,5 recent meta-analyses have found that compared to those with normal weight (BMI <25 kg/m²), all-cause and cardiovascular mortality was reduced in those who are overweight (BMI 25–30 kg/m²) and was similar in those who were obese (BMI 30–35 kg/m²). These findings have been called the obesity paradox.6,7 Furthermore several studies suggest that a BMI of approximately 25–35 kg/m² may be beneficial in patients with chronic disease.8,9
Coronary artery bypass grafting (CABG) surgery is the recommended treatment for patients with severe three-vessel CAD, left main stem CAD and multi-vessel CAD in diabetic patients.\textsuperscript{10–12}

The relationship between BMI and outcomes after cardiac surgery is unclear with conflicting results in the literature with some studies, showing no association, or a U-shaped association with higher mortality in those at lower BMI or high BMI.\textsuperscript{13–28} We therefore compared the characteristics and outcomes of patients undergoing CABG by BMI categories.

**Methods**

Ethics approval of this study was obtained from the Auckland District Health Board Research Office. All patients having isolated CABG without concomitant valve surgery from July 2010 to June 2012 at Auckland City Hospital were included in the study. Nine had missing height data. Patients were divided into 4 categories based on BMI: \( \leq 25 \) (normal or underweight, as only 14 patients were underweight BMI <20), >25–30 (overweight), >30–35 (obese) and >35 (morbidly obese) kg/m\(^2\).

Decisions for cardiac surgery are made at our weekly combined Cardiosurgical Conference with cardiac surgeons and cardiologists. BMI does not routinely influence the decision making for cardiac surgery, and there are no guidelines to proscribe surgery in morbidly obese patients. Clinical characteristics and outcomes were retrospectively collected from computerised records.

Baseline characteristics were defined as follows. Angina was graded using the Canadian Cardiovascular Society Classification (CCS) and dyspnoea by the New York Heart Association Functional Classification (NYHA). Definitions of hypertension, define stroke, peripheral vascular disease and chronic respiratory disease are identical to the Society of Thoracic Surgeon’s (STS) definitions.\textsuperscript{29}

Hypercholesterolaemia referred to total cholesterol \( >5.0 \text{ mmol/L} \), on treatment to lower cholesterol before admission or a previous formal diagnosis. The Cockcroft-Gault formula was used to determine creatinine clearance from the last preoperative serum creatinine measurement. Logistic EuroScore, a cardiac operation risk score, was calculated for all patients.\textsuperscript{30}

The New Zealand Index of Deprivation 2006 (NZDep2006) was used as a measure of socioeconomic deprivation and categories with means analysed. New Zealand European and other European ethnicities were combined as Caucasian.

Preoperative troponin levels were split into three pre-specified categories:

- ‘Normal’ included patients with preoperative levels below the 99th percentile upper reference limit (URL) for the assay used, or with no troponin measurement and undergoing elective CABG.
- ‘Stable elevated’ included patients with elevated preoperative troponins above the 99th percentile URL, with at least two measurements within 48 hours of each other, and the final preoperative level either lower or less than 20% higher than the earlier measurement.
- ‘Unstable elevated’ are the remaining patients or lack of information about baseline troponin levels.

Postoperatively, high-sensitivity troponin T (hs-TnT) was routinely measured at 12-24 hours. The development of new Q-waves or left bundle branch block (LBBB) on ECGs or new regional wall motion abnormalities on postoperative echocardiograms were independently interpreted by two authors (TKMW and HDW).

The universal definition for perioperative (type 5) myocardial infarction\textsuperscript{31} was defined by postoperative hs-TnT>140 ng/L (10 times 99% upper reference limit) and the ECGs and/or echocardiographic criteria above. Postoperative complications (stroke, renal failure, deep sternal wound infection, ventilation>24 hours and return to theatre) were defined by the STS Score\textsuperscript{29} and their composite was determined. Mortality data were checked against the New Zealand’s national registry until 31 December 2012.

Our pre-specified outcomes were 30-day mortality, mortality during follow-up and composite surgical morbidity.
Statistical analyses—Continuous variables are presented as mean (standard deviation) and categorical variables as percentages (frequency). Statistical power of the study was not formally assessed. Univariate analyses were performed using the ANOVA test for continuous variables, Chi-squared testing or univariate logistic regression (if the Chi-squared test assumptions were not met) was used for categorical variables and log-rank (Mantel-Cox) test for time-to-event variables. Given the anticipated limited number of adverse events, we were strict with the selection of variables for multivariate analyses. Multivariate analyses using logistic regression and Cox proportional hazards regression was performed on variables with p<0.10 in univariate analysis. Other important variables included in the multivariate models were age, sex, ethnicity, New York Heart Association class IV, Canadian Cardiovascular Society class IV, inpatient operation, intra-aortic balloon pump, diabetes on insulin, estimated glomerular filtration rate, left main stem >50% stenosis, ejection fraction and cardiopulmonary bypass time. BMI was assessed as a continuous variable and in standard categories to assess whether BMI independently predicted outcomes. SPSS v17.0 (SPSS Inc., Chicago, IL, USA) and Prism v5 (GraphPad Software, San Diego, CA, USA) software were used for analyses. All tests were two tailed and p-value less than 0.05 were deemed statistically significant.

Results

A total of 181 (22.3%), 320 (39.6%), 205 (25.3%) and 103 (12.7%) CABG patients had BMI ≤25 (normal or underweight), >25–30 (overweight), >30–35(obese) and >35 (morbidly obese).

Baseline characteristics of patients in these four BMI categories are shown in Table 1. Only 14 patients were underweight with a BMI <20 so these were incorporated into the BMI ≤25 group.

BMI was positively associated with creatinine clearance (p<0.001) and negatively associated with age (p<0.001). Obesity (BMI >30 kg/m²) was associated with a higher proportion of patients of Māori or Pacific ethnicity (39.3% vs 16.0%, p<0.001) and with more patients with hypertension (77.6% vs 64.7%, p<0.001).

Morbid obesity was associated with female sex (35.9% vs 18.1%, p<0.001), higher mean New Zealand deprivation index (7.8 vs 6.2, p<0.001) and diabetes (52.4% vs 36.0%, p=0.002). The statistical significance of these findings was unchanged when the 14 underweight patients were removed from analyses.

Table 2 lists the operative and postoperative variables by BMI category. Obesity (BMI >30 kg/m²) was associated with fewer bypass grafts (p=0.038) and fewer saphenous vein grafts (90.0% vs 95.8%, p=0.002).

Morbid obesity (BMI >35 kg/m²) was associated with longer operation times (217 vs 203 minutes, p=0.042).

Rates of 30-day mortality (p=0.652) and postoperative complications (composite morbidity p=0.803) were similar across BMI categories, except for deep sternal wound infection being more prevalent in those morbidly obese (1.9% vs 0.1%, p=0.047).
Table 1. Baseline characteristics

<table>
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</tr>
</thead>
<tbody>
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<td>Number</td>
<td>181</td>
<td>320</td>
<td>205</td>
<td>103</td>
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<tr>
<td>Demographics</td>
<td></td>
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<tr>
<td>Age (years)</td>
<td>67.2 (9.9)</td>
<td>65.4 (9.8)</td>
<td>63.0 (9.7)</td>
<td>59.5 (9.3)</td>
<td>&lt;0.001</td>
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<tr>
<td>Female</td>
<td>21.5% (39)</td>
<td>16.6% (53)</td>
<td>17.6% (36)</td>
<td>35.9% (37)</td>
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</tr>
<tr>
<td>Ethnicity</td>
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<td>&lt;0.001</td>
</tr>
<tr>
<td>Caucasian</td>
<td>49.2% (89)</td>
<td>59.1% (189)</td>
<td>57.1% (117)</td>
<td>38.8% (40)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>4.9% (9)</td>
<td>5.9% (19)</td>
<td>12.2% (25)</td>
<td>28.2% (29)</td>
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<tr>
<td>Pacific</td>
<td>6.6% (12)</td>
<td>12.5% (40)</td>
<td>17.6% (36)</td>
<td>30.1% (31)</td>
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</tr>
<tr>
<td>Other</td>
<td>39.2% (71)</td>
<td>22.5% (72)</td>
<td>13.2% (27)</td>
<td>2.9% (3)</td>
<td></td>
</tr>
<tr>
<td>New Zealand index of deprivation (decile)</td>
<td>6.2 (2.8)</td>
<td>6.0 (2.9)</td>
<td>6.4 (2.9)</td>
<td>7.8 (2.4)</td>
<td>&lt;0.001</td>
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<td>Presentation</td>
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<tr>
<td>Canadian Cardiovascular Society class IV</td>
<td>38.1% (69)</td>
<td>37.8% (121)</td>
<td>33.2% (68)</td>
<td>39.8% (41)</td>
<td>0.609</td>
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<tr>
<td>New York Heart Association class IV</td>
<td>3.3% (6)</td>
<td>4.1% (13)</td>
<td>4.4% (9)</td>
<td>4.9% (5)</td>
<td>0.519</td>
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<tr>
<td>Myocardial infarction &lt;6 weeks</td>
<td>55.8% (101)</td>
<td>47.5% (152)</td>
<td>48.8% (100)</td>
<td>47.6% (49)</td>
<td>0.312</td>
</tr>
<tr>
<td>Intra-aortic balloon pump</td>
<td>11.1% (20)</td>
<td>7.8% (25)</td>
<td>6.3% (13)</td>
<td>6.8% (7)</td>
<td>0.354</td>
</tr>
<tr>
<td>Inpatient operation</td>
<td>81.8% (33)</td>
<td>80.3% (257)</td>
<td>78.0% (160)</td>
<td>75.7% (78)</td>
<td>0.601</td>
</tr>
<tr>
<td>Waitlist (days)</td>
<td>20.3 (46.4)</td>
<td>20.3 (47.8)</td>
<td>21.9 (44.7)</td>
<td>25.3 (49.8)</td>
<td>0.467</td>
</tr>
<tr>
<td>Past medical history</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>67.4% (122)</td>
<td>64.1% (205)</td>
<td>65.9% (135)</td>
<td>73.8% (76)</td>
<td>0.332</td>
</tr>
<tr>
<td>Percutaneous coronary intervention</td>
<td>9.4% (17)</td>
<td>10.0% (32)</td>
<td>13.2% (27)</td>
<td>12.6% (13)</td>
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<tr>
<td>Coronary artery bypass grafting</td>
<td>2.2% (4)</td>
<td>0.6% (2)</td>
<td>1.0% (2)</td>
<td>2.9% (3)</td>
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<td>Congestive heart failure</td>
<td>4.4% (8)</td>
<td>4.4% (14)</td>
<td>6.8% (14)</td>
<td>6.8% (7)</td>
<td>0.525</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>6.6% (12)</td>
<td>9.1% (29)</td>
<td>5.4% (11)</td>
<td>6.8% (7)</td>
<td>0.430</td>
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<tr>
<td>Diabetes</td>
<td>33.1% (60)</td>
<td>34.4% (110)</td>
<td>41.0% (84)</td>
<td>52.4% (54)</td>
<td>0.009</td>
</tr>
<tr>
<td>Diabetes on insulin</td>
<td>6.1% (11)</td>
<td>10.3% (33)</td>
<td>11.7% (24)</td>
<td>19.4% (20)</td>
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<td>Hypercholesterolaemia</td>
<td>87.8% (159)</td>
<td>92.5% (296)</td>
<td>93.2% (191)</td>
<td>92.2% (95)</td>
<td>0.225</td>
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<tr>
<td>Hypertension</td>
<td>60.2% (109)</td>
<td>67.2% (215)</td>
<td>74.1% (152)</td>
<td>84.5% (87)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Current smoker</td>
<td>17.1% (31)</td>
<td>11.3% (36)</td>
<td>14.6% (30)</td>
<td>20.4% (21)</td>
<td>0.087</td>
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<tr>
<td>Stroke</td>
<td>7.2% (13)</td>
<td>5.9% (19)</td>
<td>7.3% (15)</td>
<td>3.9% (4)</td>
<td>0.479</td>
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<td>Peripheral vascular disease</td>
<td>13.8% (25)</td>
<td>11.9% (38)</td>
<td>7.8% (16)</td>
<td>8.7% (9)</td>
<td>0.220</td>
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<tr>
<td>Chronic respiratory disease</td>
<td>18.2% (33)</td>
<td>13.8% (44)</td>
<td>18.0% (37)</td>
<td>23.3% (24)</td>
<td>0.131</td>
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<tr>
<td>Dialysis</td>
<td>3.9% (7)</td>
<td>3.1% (10)</td>
<td>2.4% (5)</td>
<td>1.9% (2)</td>
<td>0.774</td>
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<td>Investigations</td>
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<td>Coronary artery disease</td>
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<tr>
<td>Left main stem ≥50% stenosis</td>
<td>44.2% (80)</td>
<td>44.7% (143)</td>
<td>41.0% (84)</td>
<td>46.6% (48)</td>
<td>0.778</td>
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<tr>
<td>Number of coronary arteries ≥50% stenosis</td>
<td>0.6% (1)</td>
<td>0.6% (2)</td>
<td>0.5% (1)</td>
<td>1.9% (2)</td>
<td>0.381</td>
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<tr>
<td>2</td>
<td>15.5% (28)</td>
<td>15.9% (51)</td>
<td>22.4% (46)</td>
<td>19.4% (20)</td>
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</tr>
<tr>
<td>3</td>
<td>84.0% (152)</td>
<td>83.4% (267)</td>
<td>77.1% (158)</td>
<td>78.6% (81)</td>
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<tr>
<td>Ejection fraction (%)</td>
<td></td>
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<td>0.475</td>
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<tr>
<td>Normal (&gt;50%)</td>
<td>65.1% (118)</td>
<td>74.4% (238)</td>
<td>69.8% (143)</td>
<td>68.9% (71)</td>
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</tr>
<tr>
<td>Mild impairment (40-50%)</td>
<td>19.3% (35)</td>
<td>11.6% (37)</td>
<td>13.7% (28)</td>
<td>14.6% (15)</td>
<td></td>
</tr>
<tr>
<td>Moderate impairment (30-39%)</td>
<td>9.9% (18)</td>
<td>7.8% (25)</td>
<td>11.7% (24)</td>
<td>11.7% (12)</td>
<td></td>
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<tr>
<td>Severe impairment (&lt;30%)</td>
<td>5.5% (10)</td>
<td>6.3% (20)</td>
<td>4.9% (10)</td>
<td>4.9% (5)</td>
<td></td>
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<tr>
<td>Creatinine clearance (mL/min)</td>
<td>69 (28)</td>
<td>81 (29)</td>
<td>96 (36)</td>
<td>125 (49)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>Number</td>
<td>181</td>
<td>320</td>
<td>205</td>
<td>103</td>
<td>0.090</td>
</tr>
<tr>
<td>Preoperative troponin groups</td>
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<tr>
<td>Normal</td>
<td>38.1% (69)</td>
<td>40.0% (128)</td>
<td>42.4% (87)</td>
<td>50.5% (52)</td>
<td>0.075</td>
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<td>Stable elevated</td>
<td>28.2% (51)</td>
<td>31.9% (102)</td>
<td>26.3% (54)</td>
<td>16.5% (17)</td>
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<tr>
<td>Unstable elevated</td>
<td>33.7% (61)</td>
<td>28.1% (90)</td>
<td>31.2% (64)</td>
<td>33.0% (34)</td>
<td></td>
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<tr>
<td>EuroScore (logistic)</td>
<td>5.3% (5.3%)</td>
<td>4.5% (5.0%)</td>
<td>3.9% (4.7%)</td>
<td>3.8% (4.9%)</td>
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Table 2. Operative details and postoperative outcomes

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<th>Operation details</th>
<th>≤25</th>
<th>&gt;25–30</th>
<th>&gt;30–35</th>
<th>&gt;35</th>
<th>P value</th>
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<tr>
<td>Off-pump</td>
<td>1.1% (2)</td>
<td>3.1% (10)</td>
<td>2.4% (5)</td>
<td>0.0% (0)</td>
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<td>Number of distal anastomoses</td>
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</tr>
<tr>
<td>2</td>
<td>11.6% (21)</td>
<td>11.6% (37)</td>
<td>20.0% (41)</td>
<td>22.3% (23)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50.8% (92)</td>
<td>49.4% (158)</td>
<td>47.8% (98)</td>
<td>46.6% (48)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>32.0% (58)</td>
<td>29.7% (95)</td>
<td>26.8% (55)</td>
<td>26.2% (27)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.0% (9)</td>
<td>7.5% (24)</td>
<td>3.4% (7)</td>
<td>3.9% (4)</td>
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</tr>
<tr>
<td>6</td>
<td>0.0% (0)</td>
<td>1.3% (4)</td>
<td>0.0% (0)</td>
<td>1.0% (1)</td>
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<tr>
<td>Left internal mammary artery graft</td>
<td>97.8% (177)</td>
<td>98.4% (315)</td>
<td>97.6% (200)</td>
<td>97.1% (100)</td>
<td>0.824</td>
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<tr>
<td>Right internal mammary artery graft</td>
<td>3.9% (7)</td>
<td>8.4% (27)</td>
<td>5.9% (12)</td>
<td>2.9% (3)</td>
<td>0.089</td>
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<tr>
<td>Radial artery graft</td>
<td>19.3% (35)</td>
<td>22.8% (73)</td>
<td>24.9% (51)</td>
<td>28.2% (29)</td>
<td>0.289</td>
</tr>
<tr>
<td>Saphenous vein graft</td>
<td>94.5% (171)</td>
<td>96.6% (309)</td>
<td>89.3% (183)</td>
<td>91.3% (94)</td>
<td>0.005</td>
</tr>
<tr>
<td>Operation time (minutes)</td>
<td>198 (54)</td>
<td>206 (48)</td>
<td>204 (48)</td>
<td>217 (57)</td>
<td>0.030</td>
</tr>
<tr>
<td>Cardiopulmonary bypass time (minutes)</td>
<td>90 (27)</td>
<td>93 (25)</td>
<td>89 (25)</td>
<td>95 (30)</td>
<td>0.148</td>
</tr>
<tr>
<td>Cross-clamp time (minutes)</td>
<td>59 (21)</td>
<td>61 (20)</td>
<td>58 (28)</td>
<td>60 (22)</td>
<td>0.247</td>
</tr>
</tbody>
</table>

Postoperative outcomes

| Postoperative hs-TnT (ng/L) | 633 (1057) | 600 (908) | 535 (662) | 521 (687) | 0.597  |
| New ECG or echocardiographic changes | 11.0% (20) | 13.7% (43) | 14.8% (30) | 12.7% (13) | 0.785  |
| Perioperative myocardial infarction | 6.6% (12) | 13.2% (31) | 14.6% (22) | 15.1% (11) | 0.641  |
| Composite morbidity | 19.3% (35) | 18.1% (58) | 15.6% (32) | 17.5% (18) | 0.803  |
| Stroke | 1.7% (3) | 0.9% (3) | 1.5% (3) | 0.0% (0) | 0.580  |
| Renal failure | 1.1% (2) | 3.1% (10) | 1.5% (3) | 0.0% (0) | 0.373  |
| Ventilation >24 hours | 14.4% (26) | 13.4% (43) | 11.2% (23) | 14.6% (15) | 0.778  |
Mean follow-up was 1.4±0.6 years. Survival during follow-up for each BMI category is shown in Figure 1. There were no differences in survival across BMI categories (log-rank p=0.112). One-year survivals for the 4 BMI categories in ascending order were 96.5%, 97.2%, 99.0% and 95.4%.

Figure 1. Kaplan-Meier survival curves by BMI (kg/m\(^2\)) category

BMI = body mass index.
In multivariate analyses neither BMI as a continuous variable, nor any of the BMI categories were independently associated with any of the post-CABG outcomes (p>0.213 for all analyses). These findings were unchanged with exclusion of the 14 low BMI patients in the lowest quartile. Other important variables included in the multivariate models were age, sex, ethnicity, New York Heart Association class IV, Canadian Cardiovascular Society class IV, inpatient operation, intra-aortic balloon pump, diabetes on insulin, estimated glomerular filtration rate, left main stem ≥50% stenosis, ejection fraction and cardiopulmonary bypass time.

**Discussion**

Obesity or morbid obesity occurred in 38.0% of our patients. Several cardiovascular risk factors were associated with obesity, but surgical morbidity and mortality were not related to BMI.

**Baseline characteristics**—Obesity has been shown to be associated with baseline risk factors that may adversely affect outcomes after CABG.\(^{13–28}\) We found several associations between BMI categories and baseline characteristics that have been previously identified, including younger age,\(^{13–16,21,23–27}\) female sex,\(^{13–15,23–25,28}\) hypertension,\(^{14–18,20,23–25,27,28}\) diabetes,\(^{13–16,18,20,21,23,24,27}\) longer operation time\(^{13,27}\) and less renal impairment.\(^{15,20,24}\) Most of these factors except younger age and less renal impairment are risk factors for poor outcomes including higher mortality after cardiac surgery.

**Outcomes**—Several studies have found that only those who are underweight have higher mortality rates after CABG,\(^{15,16,18,25,28}\) while several studies have reported being overweight to be associated with lower rates of mortality than normal BMI.\(^{18,22}\) Some studies have found a U-shaped relationship: i.e. both the extreme ends of underweight and obese patients have higher mortality rates than those with normal BMI.\(^{20,21,24,26}\)

**Risk models and obesity**—In this study obese patients had a trend towards lower EuroScores despite having more cardiovascular risk factors. The main reason for this is that obese patients were younger and age is a major component of the EuroScore.

Our results suggest that being obese should not exclude a patient who would otherwise have been accepted for CABG. Our findings also do not support the incorporation of BMI into operative risk scores and the EuroScore and STS Scores do not include BMI as a parameter.\(^{29,30}\) Body surface area (BSA) however is part of the STS Score, with lower BSA giving a higher score. However, BSA differs from BMI because it rises with increases in both height and weight, so is potentially a better indicator of underlying malnutrition, and is also affected by ethnicity and socioeconomic deprivation.

**Surgical procedure**—Saphenous vein grafting was less frequent in obese and morbidly obese patients, and may be due to higher rates of varicose veins in obese patients. Operation time was prolonged in morbidly obese patients perhaps due to poorer access to the heart and difficulty with grafting.

**Wound infection**—We found obesity to be associated with deep sternal wound infection. This is supported by other studies.\(^{13–18,20,27}\) This may be attributable to a higher prevalence of diabetes impairing wound-healing, longer operation times,
mechanical tension of wounds and decreased perfusion of superficial tissues in obese patients. We did not find other complications that have been reported in obese patients, including prolonged ventilation\textsuperscript{14,15} and longer duration of intensive care, and hospital stay.\textsuperscript{14,15,23}

**Bleeding**—We did not find difference in bleeding rates in obese patients although decreased bleeding has been reported in other studies.\textsuperscript{13,17,18}

**Limitations**—This is a single-centred retrospective cohort study. Truncal obesity, BSA and body composition variables such as body fat and lean body mass were not determined. These as well as other unidentified variables could potentially confound or mask important associations. It is possible that there was a selection bias based on clinical judgment with surgeons selecting obese patients likely to do well after surgery. The number of participants and number of pre-specified end-points was limited (n=809), limiting our statistical power. In addition there were very few morbidly obese patients (BMI >45) and our findings may not apply to these patients. Comparative analyses conducted between 4 BMI categories may mask underlying small but significant differences. Outcomes after discharge such as re-admissions, symptoms, quality of life and adherence to medications were not obtained. Also follow-up time was restricted as this was a recent cohort.

**Conclusion**

Obesity was common and was present in over a third of our patients undergoing CABG with 13% of the entire cohort being morbidly obese. Obesity was associated with several demographic and clinical risk factors. However there was no relationship between BMI and postoperative outcomes including morbidity and mortality. Obesity should not exclude patients from undergoing CABG.

**Competing interests:** Nil.

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**References:**


Therapeutic options in the management of obesity

Richard W Carroll, Rosemary M Hall, Amber Parry-Strong, John M Wilson, Jeremy D Krebs

Abstract
In New Zealand 28.4% of adults now classify as obese, whilst a total of 63.8% are overweight or obese (BMI >25 kg/m\(^2\)). This presents an ever increasing social and economic burden to individuals, families and the healthcare system. Obesity is a major risk factor for cancer, cardiovascular, metabolic, and respiratory disorders. Preventing obesity is the optimal long-term population strategy and must be a government priority. There are many approaches which could be taken to facilitate this, however it is important not to forget those who are currently overweight or obese.

This review addresses the current therapeutic options in the treatment of obesity, focusing on lifestyle changes, medications, and surgery in New Zealand. It also presents a suggested algorithm for the clinician assessing and managing obese patients in New Zealand.

The prevalence of obesity is increasing at an alarming rate worldwide. Approximately 35% of the adult population of the United States are classified as obese (BMI ≥30 kg/m\(^2\)). Of more concern is that the average BMI of the US population is now 28 kg/m\(^2\), well above the “healthy” range of 19–25 kg/m\(^2\).

The picture in New Zealand is equally disturbing. The ‘Health of New Zealand adults’ survey of 2012 demonstrated that 28.4% of New Zealand adults now classify as obese, whilst a total of 63.8% would be considered overweight or obese (BMI >25 kg/m\(^2\)).

Of particular concern are the marked disparities in prevalence rates between ethnic groups in New Zealand, and the increased rates in high deprivation communities. The rates in Caucasians approximate to the national averages; however, the rates of obesity and overweight in Māori (44.4% and 75.3% respectively) and Pacific adults (62.1% and 84.8% respectively) place them amongst the most overweight groups in the world.

Whilst a multitude of factors contribute to the increasing rates of obesity, the major contemporary promoter is a marked increase in the intake of energy across almost all populations. At a fundamental level obesity results when energy intake exceeds energy expenditure over a prolonged period of time.

An increase in the consumption of high energy foodstuffs, both portion size and energy density, coupled with a reduction in exercise levels, has resulted in a population where obesity has surpassed tobacco smoking as the major cause of morbidity. Obesity-related comorbidity, well reviewed elsewhere, places an enormous burden on our health service and will only worsen unless measures are taken to reduce the obesity rate.
Of prime importance is effective public health measures aimed at obesity prevention. Such interventions may include targeting improved dietary patterns, reduced availability of nutritionally poor, high energy foods with increased availability of healthy choices, and improved physical activity levels.

Recent studies support the notion that instigating these interventions in childhood is effective, with the hope that behavioural changes made in childhood will be durable and lead to healthier lifestyle choices in adulthood.\textsuperscript{3,5} Overweight and obesity are a societal problem and therefore need a society wide solution. This must include changes in lifestyle at a personal level, but will also require community, council and governmental action for real success.

Whilst most would agree that prevention is the optimal long-term population strategy, it is important not to forget those who are currently overweight or obese. During an initial assessment it is important that overweight or obese patients are screened for the metabolic consequences of obesity and the presence of weight-related comorbidity (see Table 1).

In this review, we focus on the therapeutic options available to the New Zealand adult to achieve weight loss through lifestyle, pharmaceutical and surgical means, and suggest an approach to the management of weight loss in these individuals.

### Table 1. Metabolic and weight-related comorbidities that should be assessed at the initial clinical review of the overweight/obese patient

<table>
<thead>
<tr>
<th>Metabolic assessment</th>
<th>Comorbidities to be assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical examination</strong></td>
<td>Cardiac disease (ischaemia, LVH, arrhythmias)</td>
</tr>
<tr>
<td>Body mass index (BMI: weight (kg)/height(cm)\textsuperscript{2})</td>
<td>Sleep apnoea or hypoventilation</td>
</tr>
<tr>
<td>Age</td>
<td>Diabetes microvascular complications</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>Liver dysfunction including non-alcoholic steatohepatitis</td>
</tr>
<tr>
<td>Blood pressure (mmHg)</td>
<td>Gout</td>
</tr>
<tr>
<td><strong>Blood tests</strong></td>
<td>Arthritis</td>
</tr>
<tr>
<td>HbA1c</td>
<td>Incontinence</td>
</tr>
<tr>
<td>Cholesterol profile</td>
<td>Depression</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>Menstrual irregularities including PCOS</td>
</tr>
<tr>
<td>Uric acid</td>
<td></td>
</tr>
<tr>
<td>Thyroid stimulating hormone (TSH)</td>
<td></td>
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</tbody>
</table>

### Lifestyle strategies for the management of obesity

Lifestyle modification, a change in diet and physical activity to favour energy expenditure rather than energy intake, underpins the management of obesity. It is an essential component of all therapeutic options to reduce obesity and the most readily available option to New Zealanders. However, because alterations in dietary habits and physical activity require behavioural change in an individual, lifestyle modification may be the most difficult option to plan and implement. Despite this, extensive research has shown that persevering with lifestyle modification results in weight loss, and a reduction in risk factors for obesity-related disease.
Lifestyle assessment—The most important factor in developing a lifestyle modification strategy is to perform a thorough assessment of diet and physical activity habits. A diet history may be obtained by a recount of usual diet, or a recall of all food consumed in the previous 24 hours. Whilst these methods provide some insight into diet patterns there is likely to be substantial underreporting of food consumed.  

Although more time-consuming, completing a food and exercise diary, usually for 3 to 7 days, is an extremely valuable tool for the initial assessment of obesity and to develop a lifestyle modification plan. Most importantly, while completing the diary obese individuals may recognise factors in their diet which make a substantial contribution to their excess weight.

Influence of dietary macronutrients and fibre on weight loss—Whilst total energy intake is ultimately the critical factor, the macronutrient composition of the diet may influence weight loss by altering satiety and subsequent energy intake. Manipulating macronutrient composition as a percentage of total energy intake has attracted considerable research over the last 30 years.

Low fat diets, high protein diets and low carbohydrate diets have all been postulated to have advantages. A number of short-term studies have supported each as a means for achieving weight loss. Early studies demonstrated that substitution of carbohydrate for fat promoted reductions in energy intake and associated weight loss. This evidence has underpinned most national nutrition guidelines for several decades.

It is often forgotten that these early studies also had a focus on dietary fibre intake. It is now common for low fat:high carbohydrate diets to contain a high proportion of refined carbohydrate and relatively low fibre intake, which may explain the relative lack of efficacy when used as comparator diets.

More recently there has been a focus on protein. In short-term experimental studies, high-protein meals have been shown to increase satiety and reduce subsequent energy intake to a greater degree than isoenergetic high-fat or high-carbohydrate meals. Conversely, increasing dietary fat in a meal results in 'high-fat hyperphagia' with increases in hunger and total energy intake.

Low carbohydrate diets such as the “Atkins diet” have received much popular attention and in short term studies can be shown to be effective. However, many short term studies are conducted in highly controlled environments and do not represent what is achievable in more “real world” settings.

Longer-term studies may provide some insight into potential lifestyle modification strategies. Reductions in weight gain and increases in weight loss have been shown when low-fat, high-carbohydrate or low-fat, high protein diets are followed for 6 to 24 months, even when energy intake is not intentionally restricted.

There is a suggestion that high-protein diets may favour weight loss or prevent weight regain after weight loss and improve body composition and lipid profiles, thereby reducing the metabolic complications of obesity possibly due to increased acceptability of the study diet. However these findings are not supported by all studies.
From all of the dietary macronutrient research, there is no one approach which is clearly superior, but importantly all are able to promote modest weight loss over the short to medium term. Furthermore whatever the macronutrient composition a focus on a diet high in fibre enhances weight loss or prevents weight gain.10

**Adherence to lifestyle interventions**—What is most apparent in these studies is that compliance with the study diet is the key factor in successful weight loss. The importance of compliance was illustrated by Sacks et al (2009) with the inability to distinguish between two-year weight loss effects of four diets varying in protein, carbohydrate and fat composition.20 In this study the attendance at diet counselling sessions was the strongest factor associated with weight loss. Likewise, increased adherence to one of four popular diets was associated with greater reductions in weight and cardiovascular disease risk factors irrespective of the diet followed.21

Similar findings are reported in a series of recent meta-analyses of macronutrient modification trials reinforcing that identifying strategies to improve adherence is the main current priority. Because adherence to a diet is the most important and yet the most difficult component to successful weight loss a variety of strategies to increase the acceptability of altering energy balance have been proposed.

A recent approach has been to follow an intermittent fast, with energy intake reduced to 25% of an individuals recommended daily energy intake on 2 days per week and *ad libitum* eating on the other 5 days. This approach appears to be at least as effective as continuous energy restriction for achieving weight loss with further research underway.22

Another strategy is to participate in a commercial weight loss programme. Over twelve months, subjects attending the commercial programme Weight Watchers lost twice as much weight as those following standard care suggesting that this approach may be an effective alternative strategy for weight management that can be delivered on a large scale.23

A systematic review of reviews demonstrated the effectiveness of community based lifestyle interventions (based on the Diabetes Prevention Program24) with an average weight loss of 3-5kg at 12 months and 2-3kg at 36 months.25 Physical activity increased and factors that were important to the effectiveness of the intervention were identified—social supports, self-regulation and self-monitoring, behaviour change techniques, motivational interviewing and the use of pedometers, highlighting the importance of actively engaging individuals to adhere to lifestyle modification.

**Lifestyle interventions and risk of cardiovascular disease**—Although it is clear that following a lifestyle intervention results in modest weight loss, it is important to identify whether the weight lost leads to a reduction in risk factors for obesity-related disease. Perhaps the strongest evidence for this comes from the Diabetes Prevention Programme and the Diabetes Prevention Study.24,26 Both studies compared an intensive lifestyle intervention with standard advice in those with pre-diabetes and demonstrated a 58% reduction in the incidence of diabetes with lifestyle intervention compared to placebo over 4 years.

However the benefits of lifestyle intervention and weight loss on cardiovascular disease risk is less clear, particularly in light of the recent publication of the 10 year Look AHEAD data.27 The lifestyle intervention produced a significant and sustained
weight loss and a reduction in HbA1C but no difference was seen in the primary endpoint of a CV disease score. This study was complicated by fewer than expected CV incidents in the control group and a change in the definition of the CVD score during the study. What is clear is that this intensive lifestyle intervention was not detrimental to the risk for CV disease and produced effective weight loss and improvements in glucose metabolism.

**Influence of dietary patterns on weight, adherence and cardiovascular disease risk**—Dietary patterns have been explored to investigate whether a broader group of food or nutrients, rather than manipulation of specific dietary components, may be more closely associated with obesity.

Diets high in fat or sugar and low in fibre have been associated with obesity, while a change to a diet lower in fat and sugar and high in fibre over 10 years resulted in a reduction in BMI in obese women and less increase in BMI in lean women. In children, high fat, low fibre, energy dense dietary patterns are associated with an increase in fat mass and linked to excess gain in body mass.

Another example of a dietary pattern is the “Mediterranean Diet”, characterised by replacing most red meat with fish and poultry, including wine in moderation and ample vegetables, legumes, grains, fruit, nuts and olive oil.

Adopting a Mediterranean dietary pattern has been shown to reduce cardiovascular events in those at high risk when compared with a low fat dietary prescription. Favourable effects of the Mediterranean diet on glycaemic control (compared with the favourable effects on lipids with a low-carbohydrate diet for example) suggest that personal preferences and metabolic considerations might inform individualised tailoring of dietary interventions.

**Exercise as a component of lifestyle interventions**—A reduction in physical activity is associated with increasing rates of obesity, and overweight individuals often report low exercise levels. An increase in physical activity alone, without dietary adjustment is unlikely to have a significant weight loss effect, and may even promote weight gain through an increase in appetite. Thus, activity should be viewed as an adjunct to dietary interventions to achieve weight loss, but thereafter as a key factor in weight maintenance.

As with dietary change, the critical factor in the effectiveness of activity for weight control is adherence. Individuals should be encouraged to select their preferred form of exercise, recognising that exercise undertaken as part of normal daily activity (e.g. walking to work) is as effective for weight control as scheduled activity (e.g. gym classes). Furthermore, regular short bouts of exercise are comparable to the same intensity of exercise undertaken over longer periods. A pedometer is a useful self-monitoring tool, with a target of at least 10,000 steps per day during periods of active weight loss, and higher targets during weight maintenance when caloric restrictions may be relaxed. A full review of the role of physical activity in weight management is beyond the scope of this paper.

**Summary of lifestyle strategies**—Long-term lifestyle intervention studies show clinically significant, albeit quantitatively modest, reductions in weight which result in a reduction in risk for metabolic disease. Dietary modification and increased physical activity to achieve a reduction in total energy intake is critical, however
adherence to the intervention, and hence behavioural change, appears to be the predominant factor in producing successful long-term weight loss, rather than the nature of the dietary intervention. Therefore allowing an individual to choose from the range of available evidence-based interventions may be the most effective strategy.

**Pharmaceutical options in the management of obesity (see Table 2)**

Medical options for the management of obesity are currently limited, following the withdrawal of a number of previously used drugs as a result of significant side effects. The development of new agents has been protracted and is not without difficulty. Regulators are wary of the likely very high population exposure to anti-obesity agents that become available.

Previous guidelines have suggested the consideration of pharmaceutical agents for the treatment of obesity, alongside dietary and physical activity interventions, in those with a BMI >30 kg/m$^2$ or >27 kg/m$^2$ if obesity-related comorbidities are present. These criteria apply to an increasingly large proportion of the New Zealand population, and thus any unforeseen complications resulting from these medications would likely have a hugely significant adverse population health effect. Furthermore, it is likely that pharmaceutical therapy, once commenced, would need to be continued in the long-term unless significant alterations can be made to the lifestyle and other circumstances that lead to obesity in the first place. Thus the individual exposure to these agents would be significant.

Criteria for obesity drug licensing have tended to favour, but not enforce, placebo subtracted weight loss of >10%, on the basis that this degree of weight loss is required to gain health benefits. Currently only 2 anti-obesity agents (orlistat and phentermine) are available in New Zealand, and three new anti-obesity agents are either in use or are close to market internationally (Table 2). Additionally, existing medications such as the incretin mimetics have shown great promise as anti-obesity agents.

Whilst pharmaceutical agents could potentially target either energy intake or expenditure, no agent has yet been produced which can successfully increase energy expenditure without unacceptable side effects. Agents acting on energy intake can be divided between those resulting in reduced digestion or absorption of foods, or those acting on appetite or satiety.
Table 2. Overview of drug options in the management of obesity

<table>
<thead>
<tr>
<th>Drug</th>
<th>Usual dose</th>
<th>Mechanism</th>
<th>PSWL (kg)</th>
<th>Side effects</th>
<th>Licensed in New Zealand?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orlistat</td>
<td>120mg up to TDS</td>
<td>Lipase inhibitor</td>
<td>2.8</td>
<td>Oily stool, flatulence, change in bowel habit</td>
<td>Yes (NS)</td>
</tr>
<tr>
<td>Phentermine</td>
<td>37.5mg OD</td>
<td>Increased central noradrenaline activity</td>
<td>3.6</td>
<td>Tachycardia, palpitation, Hypertension, GI upset</td>
<td>Yes (NS)</td>
</tr>
<tr>
<td>Phentermine/topiramate&lt;sup&gt;3&lt;/sup&gt;</td>
<td>46/7.5mg OD</td>
<td>Increased central noradrenaline activity/6.7</td>
<td>Dry mouth, paraesthesia, constipation, respiratory infections</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Lorcaserin&lt;sup&gt;4&lt;/sup&gt;</td>
<td>10mg OD/BD</td>
<td>Hypothalamic Serotonin receptor agonism</td>
<td>2.9</td>
<td>Neuropsychiatric, cognitive-related adverse events</td>
<td>No</td>
</tr>
<tr>
<td>Naltrexone/bupropion&lt;sup&gt;5&lt;/sup&gt;</td>
<td>32/360mg OD</td>
<td>Opioid receptor antagonist/dopamine-noradrenaline reuptake inhibitor</td>
<td>2.9% (change in kg not reported)</td>
<td>Nausea, constipation, headache</td>
<td>No</td>
</tr>
<tr>
<td>GLP-1 receptor agonist&lt;sup&gt;6&lt;/sup&gt;</td>
<td>Exenatide 10mg BD/ Liraglutide up to 1.8mg OD</td>
<td>Increased central satiety/ Delayed gastric emptying</td>
<td>1.9</td>
<td>Nausea, vomiting</td>
<td>No</td>
</tr>
</tbody>
</table>

PSWL = Placebo subtracted weight loss; TDS = Thrice daily; OD = Once daily; BD = Twice daily; NS = Not subsidised.

1. Weight control in adults with initial BMI ≥30 kg/m², in conjunction with low fat, calorie controlled diet;
2. Short term adjunct to medical monitored comprehensive weight reduction regimen in obese patient (BMI ≥30 kg/m²);
3. Approved by the FDA as an anti-obesity agent in 2012 on the basis of a phase 3 randomised 56 week trial of 2 dose regimens versus placebo. Phentermine/topiramate 92/15 mg daily was associated with PSWL of -8.8 kg; however, depression and/or anxiety-related adverse events occurred at almost double the frequency seen with the lower dose (phentermine/topiramate 46/7.4 mg daily, PSWL -6.7 kg) where the frequency was similar to placebo. Thus, the FDA have approved phentermine/topiramate 46/7.5 mg daily for chronic weight management in obese patients (BMI >30 mg/kg² or 27 mg/kg² if obesity-related comorbidities are present) and suggest a review after 12 weeks of therapy;
4. Serotonin 2C (5-HT<sub>2C</sub>) agonist approved by the FDA in 2012 as an anti-obesity agent on the basis of a 12 month randomised trial of 2 dose regimens versus placebo, in conjunction with a nutritional and physical activity program. Subjects randomised to lorcaserin 10 mg BD achieved a modest mean PSWL of -2.9 kg, whilst lorcaserin 10 mg OD resulted in PSWL of -1.8 kg;
5. A phase 3 randomised study of naltrexone/buproprion (Contrave) slow release 32/360 mg versus placebo, in conjunction with lifestyle changes, demonstrated a PSWL of -2.9% in an intention to treat analysis. The FDA declined an application to approve this preparation in 2011 due to concerns about the longer-term cardiovascular safety concerns; a repeat application on the basis of further studies is likely in 2014;
6. GLP-1 acts centrally to increase satiety, and also delays gastric emptying further reducing appetite. A meta-analysis of nearly 3400 subjects enrolled in 21 studies, demonstrated a PSWL of -2.9 kg (CI -3.6 to -2.2), although the majority of these studies focused on obese patients with type 2 diabetes. When placebo controlled trials alone were considered (10 trials), the PSWL was a more modest -1.9 kg (-2.9 to -0.9).

Medications that effect fat absorption or metabolism—Orlistat, a gastric and pancreatic lipase inhibitor, is the most commonly utilised anti-obesity drug currently in New Zealand. Inhibition of fat digestion leads to a 30% decrease in absorbed fat thus reducing energy intake. The undigested fat is then excreted along with the drug in the faeces.
Weight loss is modest when combined with other dietary and physical activity interventions, with most randomised studies showing placebo subtracted weight loss (PSWL) of -2.9kg, equating to approximately 2–5% of total body weight.\(^{35,40}\)

Reduction in total cholesterol and LDL cholesterol have been reported in large randomised studies, as well as a modest reduction in progression to type 2 diabetes in those patients who already had evidence of glycaemic dysfunction.\(^{41}\)

Gastrointestinal side effects occur as a consequence of increased stool fat content. Increased flatulence, oily stool, faecal urgency are seen in up to 40% of patients, although drop-out rates in clinical trials do not exceed placebo.\(^{40,42}\)

The frequency of gastrointestinal side effects reduces with time, although patients should be prescribed fat soluble vitamins (A, D, E, and K) together with orlistat therapy to prevent deficiencies.\(^{41}\) The longest trials with orlistat are out to 4 years, with no clinical trial data of the effects of longer term use on weight or comorbidities beyond this.

**Medications that act on appetite or satiety**—The majority of anti-obesity drugs that affect food intake do so primarily by affecting central neurotransmitter physiology. The sympathomimetic phentermine was the first medication approved by the FDA specifically for the treatment of obesity in 1959, and remains licensed in New Zealand (but not subsidised) for the treatment of obesity.

Numerous others have come to market since but have been withdrawn following the documentation of severe side effects (fenfluramine and dexfenfluramine (valvulopathy), aminorex (pulmonary hypertension), phenylpropanolamine (stroke), rimonabant (suicidal ideation) and sibutramine (myocardial infarction and stroke) and will not be considered in this review.\(^{33}\)

Other drugs (e.g. topiramate), despite showing promise as weight loss agents, have been limited by poor tolerability at the required doses. Nonetheless, weight loss outcomes with these medications are often more significant than with other current pharmaceutical strategies; thus, recent approaches to obesity drug development have focused on either combined therapy (enabling exposure to lower doses of constitutive agents) or modifications of existing therapies (e.g. lorcaserin, see Table 2) so that negative effects are avoided.

Phentermine suppresses appetite primarily by increasing the hypothalamic release of noradrenaline. A meta-analysis of 6 randomised studies showed PSWL of -3.6 kg (95% CI, -0.6 to -6.0) when phentermine was administered to obese persons for a mean of 13 weeks alongside lifestyle and dietary changes.\(^{42}\) However it is important to note that there are no studies of long-term use of phentermine although one small study of 108 obese women followed for 36 weeks showed PSWL of > -7.8 kg.\(^{43}\) Thus, it is approved only for up to 12 weeks treatment as an adjunct to other measures.

Despite concerns about the potential for addiction (as seen with other amphetamines), phentermine does not appear to cause psychological dependence or drug craving when used at the doses suggested for weight loss therapy.\(^{44}\)

Three new anti-obesity medications have either recently been licensed in the United States (phentermine/topiramate, lorcaserin) as anti-obesity agents, or are likely to be submitted for approval in the near future (naltrexone/bupropion).
The mechanisms and effects of these agents are summarised in Table 2, and interested readers are directed to recently published randomised studies for further details. Each will be subject to extensive post marketing (phase 4) studies given the unfortunate unforeseen consequences of historical anti-obesity treatments, and it is likely to be some time before these agents are available for use by New Zealand clinicians.

**Surgical options in the management of obesity**

Surgical procedures aimed at producing weight loss are broadly divided into those that simply restrict the stomach volume, thus reducing the capacity for food intake, and those that induce malabsorption of ingested nutrients (see Figure 1). A multitude of additional mechanisms are likely to play a role in both initial weight loss and weight loss maintenance following bariatric surgery, and the reader is directed to a recent excellent review article.45

**Figure 1.** Graphic illustrating the anatomical changes associated with the common forms of bariatric surgery

![Graphic illustrating the anatomical changes associated with the common forms of bariatric surgery](image)

**Surgical notes:**

**Gastric banding** – A silicon based band is placed around the stomach within the perigastric pathway approximately 1cm inferior to the gastro-oesophageal junction, resulting in a gastric pouch above the band of approximately 15ml. A subcutaneous access port is sited and allows the injection of saline into the band resulting in band constriction. Most surgeons elect to leave the band deflated for at least 1 month after surgery to minimise band movement, with incremental intubations (via the injection of saline into the subcutaneous port) thereafter to achieve adequate restriction.

**Roux-en-Y gastric bypass** – The stomach is biseected and a small volume (15-50ml) pouch is fashioned. The jejunum is divided approximately 50cm below the pyloric sphincter, and the distal segment is anastomosed to the gastric pouch (the ‘Roux limb’). The distal end of the proximal segment (consisting of the remainder of the stomach, the pancreatic biliobiliary tree and the duodenal/proximal jejunum) is anastomosed back to the small bowel forming the ‘Y limb’. 50 to 150cm from the gastric/jejunum anastomosis. Thus, patients who undergo this surgery feel rapidly full, and ingested food is not exposed to the digestive secretion of the pancreatic bilobiliary tree, the proximal small bowel and the majority of the stomach until much later in small bowel transit. Additionally, these tissues are prevented from direct contact with ingested food which appears to have significant neuroendocrine consequences.

**Sleeve gastrectomy** – A bougie (dilator) is placed transorally through the pylorus. A starting point for resection is then chosen 5-10cm (proximal to the pylorus). A stapler is inserted and fired along the length of the bougie such that the bougie is enclosed by a formed gastric tunnel, and 75–80% of the entire stomach volume is resected.
The three most commonly performed bariatric procedures in New Zealand are laparoscopic adjustable gastric banding (LAGB, purely restrictive), sleeve gastrectomy, and Roux-en-y gastric bypass (RYGB, both restrictive and malabsorptive).

The majority of bariatric surgery in New Zealand is performed in the private sector, with access to publically funded bariatric surgery District Health Board dependent and on the basis of clear selection criteria. The majority of studies exploring outcomes following bariatric surgery have included patients with a BMI in excess of 35 kg/m². Most experts therefore recommend that a BMI greater than this is required for consideration of bariatric surgery, and the role of bariatric surgery in those patients with obesity-related comorbidities but a BMI lower than this threshold remains to be clarified.

Bariatric surgery results in more significant and durable weight loss than any other current therapeutic option, although it should be acknowledged that high quality randomised data reflecting longer term outcomes (>2 years) following bariatric surgery is lacking, especially in specific sub groups such as those with preoperative diabetes. Nonetheless, resolution of diabetes is seen in the majority of those undergoing bariatric surgery, although the effects on microvascular outcomes (retinopathy, nephropathy, etc) are unknown; thus, current practice is to continue regular review of micro/macrovascular risk factors in these patients.

Gastric banding was developed over 30 years ago as a weight loss therapy, and the procedure provided by most surgeons today has changed little in the last 20 years. Adjustable gastric banding is the least invasive of all bariatric surgery options and can nearly always be performed via a laparoscopic technique.

Average excess body weight loss (EBWL%) following LAGB has been shown to be in the order of 30–60% in most studies with maximal weight loss seen at 24–36 months post-surgery. A number of modified surgical approaches to achieve bariatric gastrectomy exist, with vertical sleeve gastrectomy (VSG) being the most commonly performed option. The average excess weight loss following this procedure is approximately 50-80%. RYGB is the most commonly performed bariatric operation in the United States and is widely performed internationally. The majority of studies comparing types of bariatric surgery have shown greater earlier and long-term weight loss following RYGB (approximately 70% EBWL%) than that seen with gastric banding, although few randomised trials have been performed.

In a recent randomised controlled study of bariatric surgery versus intensive medical therapy in obese patients with type 2 diabetes, weight loss following vertical sleeve gastrectomy was comparable to that seen following Roux-en-Y gastric bypass at 12 months. Subjects who underwent sleeve gastrectomy lost -24.7% of their bodyweight by 12 months (81% excess body weight loss), whilst those who underwent Roux-en-Y gastric bypass lost -27.5% of their body weight (88% excess body weight loss).
A similar study comparing outcomes following RYGB and biliopancreatic diversion (a more invasive malabsorptive procedure and performed only rarely in New Zealand) in obese patients with type 2 diabetes showed weight loss of -33% at 2 years in those undergoing RYGB (68% excess body weight loss). In both studies weight loss in the intensive medical therapy control groups was approximately 5%.

Early complication rates following laparoscopic banding are low with band slippage or port problems most commonly reported. Gastric erosions have been reported at alarmingly high rates in longer term follow up studies (1 in 3 patients), although other authors argue that more modern surgical techniques alleviate this problem.

Perioperative and short-term mortality rates are also favourable towards LAGB when compared with other bariatric procedures, although it should be noted that rates in well-selected patients are very low for all procedures (<0.2% for all procedures). Short-term complications occur in less than 10% post VSG or RYGB and include venous thromboembolism, infection, and perforation.

Dumping syndrome is very common following RYGB, and results from the movement of fluid into the intestinal lumen due to the increased osmotic potential of undigested carbohydrates. Patients are advised to avoid foodstuffs or situations that predictably provoke episodes and maintain a healthy fluid intake. As foodstuffs provoking dumping are often unhealthy choices, ‘dumping’ may act as a positive deterrent in some patients.

Many authors reporting on outcomes beyond 3-4 years have also suggested an increased risk of longer term complications with LAGB than with other bariatric procedures, and the high re-operation (approximately 60% and mostly related to weight regain) and band removal rate (approximately 50%) have resulted in cautions against recommending the wide spread use of LAGB as the bariatric procedure of choice.

Follow up of bariatric surgery patients—Increasingly, New Zealand clinicians will encounter patients who have previously undergone bariatric surgery, and an awareness of the side effects, intentional or otherwise, of surgery is required. Weight regain is particularly common following LAGB, but is reported in up to 50% during long-term follow up of all bariatric procedures.

Frequently, weight regain is associated with poor compliance with recommend dietary and physical activity practice post surgery, although a multitude of other physiological, surgical and genetic factors are likely to be important. Reinforcement of post surgery lifestyle recommendations via a multidisciplinary team skilled in the management of post bariatric surgery patients is advised but rarely available in New Zealand. There is little evidence to guide the use of pharmacological anti-obesity therapies in this context.

Consideration of a surgical cause of weight regain should be entertained when weight regain is refractory to further intervention. Re-operation rates specifically for this indication are higher with LAGB than they are with more invasive initial procedures.

Vitamin and mineral deficiencies, if untreated, should be expected to result following all malabsorptive bariatric procedures. Thus, the use of daily multivitamin tablets
incorporating recommended daily intake levels of vitamin D and folate amongst others is strongly recommended.\textsuperscript{56}

Menstruating women are at particular risk of iron deficiency, which should be prophylactically treated. Vitamin B12 deficiency, due to both reduced intrinsic factor production and B12 complex absorption, is common following RYGB, and replacement using oral, intranasal or injectable B12 preparations is recommended.

Protein deficiency, usually seen at 3–6 months post surgery, is the most serious potential malabsorptive issue. Dietary support, occasionally requiring hospitalisation for parenteral nutrition is required. Numerous groups have reported an increased incidence of secondary hyperparathyroidism following RYGB.\textsuperscript{54} The exact mechanism remains unclear, but an annual assessment of parathyroid hormone levels (± vitamin D) is advisable; bone mineral density scanning (DEXA) is recommended at 2–3 yearly intervals postoperatively.

Summary

Obesity is a long-term condition with many associated comorbidities. In this review we have summarised the evidence for weight loss from effective lifestyle, pharmacotherapy and surgical interventions. Whilst weight loss is achievable through these interventions there are strong physiological drivers which make weight loss maintenance a lifelong battle for individuals.

Figure 2. An approach to therapeutic weight loss in overweight/obese individuals
An approach to weight loss in overweight or obese individuals in New Zealand as developed by the Ministry of Health in 2010 (see Figure 2) must be centred on lifestyle changes primarily. The diet should be assessed ideally by a dietitian, with the immediate removal of high energy, nutritionally poor foodstuffs and an aim to reduce daily caloric intake to approximately 500 calories below the individuals recommended daily intake. The exact dietary prescription should be tailored to the individual, based on the most likely pattern that they can adhere to and sustain in the long-term.

Physical activity should be increased through whichever activity is most likely to be durable for that individual. For best results the increased physical activity should be built into normal daily activities. The patient should be counselled that both dietary changes and increased physical activity should be seen as long-term interventions. A comprehensive national strategy for implementation of these guidelines is urgently needed. Achieving comparable results to the diabetes prevention programme requires adequate resourcing for community based multidisciplinary teams to assist individuals with all of the elements of behavioural change described.

The additional use of pharmaceutical agents for weight loss may be considered in those with a BMI of >30 kg/m$^2$, although ideally the effect of lifestyle changes should be observed first. Bariatric surgery is generally reserved for those with a BMI >35 kg/m$^2$ who have been unable to lose weight through other methods.

Despite the above therapeutic strategies, the greatest effect New Zealand healthcare workers can have on the increasing obesity prevalence in New Zealand is to promote the lifestyle choices that help to prevent obesity developing in the first place.

**Competing interests:** Nil.

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Improving the New Zealand dairy industry’s contribution to local and global wellbeing: the case of infant formula exports

Judith A Galtry

Abstract

On narrow economic measures of wellbeing, New Zealand’s dairy industry is a huge success. Infant formula, in particular, is New Zealand’s ‘export superstar’. However, using a broader wellbeing lens, there is some public disquiet about environmental, human and animal wellbeing associated with the dairy industry.

This article questions whether New Zealand’s dairy industry is also undermining global ‘best practice’ infant feeding. It argues that while there is support for increased trade and exports, there are few voices promoting global infant health and that discussion is needed on this issue by the New Zealand public health community.

On a range of traditional wellbeing measures, such as export income, contribution to GDP and employment creation, the dairy industry underpins New Zealand’s economy. In particular, infant formula is New Zealand’s ‘export superstar’.

Global baby food sales are seen as largely recession proof, with a wide range of groups and individuals benefitting from this trade. These include New Zealand’s largest company, Fonterra, Chinese investors, former politicians, as well as Maori, both as dairy farmers and owners of new export enterprises.

However, wellbeing is increasingly being viewed in a wider context. For example, in 2009, the Stiglitz report on economic performance and social progress argued that ‘[t]he time is ripe for our measurement system to shift emphasis from measuring economic production to measuring people’s well-being.’ But what if New Zealand’s dairy industry, and especially infant formula exports, are examined using a broader wellbeing lens?

Milk, especially cow’s milk, is controversial. In recent years, New Zealand’s dairy industry has been the subject of not only praise, but also concern and criticism. Disquiet centres on human, environmental and animal wellbeing.

In 2007, Lincoln University scientist Keith Woodford’s book Devil in the Milk was published. Woodford argued that consumption of A1 milk, the main milk type currently produced in New Zealand, contributes to increased incidence of heart disease and Type 1 diabetes. He advised that the New Zealand dairy industry should transfer to A2 milk production.

Food allergies, including both gluten and lactose intolerance, are another influence on human wellbeing. While food intolerances are often subjectively determined, science has identified population groups with genetically-based lactose intolerance. This intolerance is thought to be due to long-term, natural selection processes.
Historically, animal welfare groups have questioned various common dairying practices. In the past, these included cow tail docking, but other practices associated with milk production, such as killing male calves within a few days of birth, are also perceived as cruel. Although rare, there have also been some high profile prosecutions for neglect of dairy cows.

Then, in 2012, the New Zealand dairy industry’s poor environmental record became the subject of international media attention based on the work of Massey University ecologist, Dr Mike Joy. Joy’s research criticised New Zealand’s dairy intensification, with the move towards higher herd numbers; more frequent milking; and greater use of fertilisers and supplementary feeds. In exposing the environmental costs of dairying to New Zealand, Joy was regarded by some as a traitor.

The use of palm kernel expeller, a waste product from palm oil production, as supplementary feed has also been criticised. Detractors include Greenpeace, who have raised concerns about sustainability and environmental impact in palm oil producing countries. Others have questioned whether this trade will lead to biosecurity breaches.

In 2013, there were a range of high profile, dairying incidents in New Zealand. These included the detection of low levels of the nitrification inhibitor Dicyandiamide (DCD) in some New Zealand milk powder; the supposed contamination of some Fonterra whey protein used in infant formula manufacture with traces of the toxic bacteria *Clostridium botulinum* (subsequently proved to be a false alarm); and Westland Milk’s lactoferrin incident. By claiming that New Zealand formula was ‘poisonous’, Chinese infant formula manufacturers and media attempted to use these events to turn consumers away from international to domestically produced brands.

A labour relations lens also highlights challenges within New Zealand’s dairy industry. While acknowledging the industry’s value to the New Zealand economy, researchers have questioned on-farm labour practices, particularly long working hours, low wages, as well as difficult, and sometimes dangerous, working conditions.

One result is that the industry has increasingly turned to the use of migrant workers, often with temporary work permits. These workers generally have more limited rights than New Zealand citizens and are potentially more vulnerable to abuse.

A further challenge has been the national anxiety generated over the sale of large dairy farms to foreign owners, especially Chinese investors.

But is the New Zealand dairy industry also undermining global ‘best practice’ infant feeding? And, if so, should New Zealand public health practitioners care?

**Infant formula exports to China: Big profits for New Zealand**

New Zealand is one of the world’s leading milk powder producers and exporters and infant formula is New Zealand’s export superstar. In 2009, formula exports were worth NZ$753 million to the New Zealand economy, increasing from NZ$63 million in 1999.

Business commentators suggest formula export income may now be around $1 billion. One of the strongest global infant formula marketing trends is companies...
increasingly focusing their efforts on large, expanding offshore markets, particularly in East Asia. This shift is attributed to East Asia’s high birth numbers and positive economic prospects, as well as the fall in sales in traditional markets such as Europe and North America, given their birth rate declines and greater promotion and uptake of breastfeeding.

After the USA, China was, in 2012, the second largest baby food and infant formula market (in the order of US$3–6 billion) in the world and projected to double in size by 2016. Various factors are driving China’s demand for imported breast milk substitutes. These include: urbanisation, an increase in maternal employment and higher disposable incomes. While more women enter the workplace, continuing to breastfeed after returning to work remains a challenge. Although China has provision for 98 days employer-insurance funded maternity leave, this is reportedly unavailable to many women in factories and precarious employment.

Other factors driving increased formula sales in China include: lack of women’s education; shortage of health workers resulting in poor support and education about breastfeeding’s benefits after childbirth; and, unethical infant formula marketing practices.

China’s implementation of the World Health Organization’s International Code of Marketing of Breastmilk Substitutes (the WHO Code)—the main global framework for protecting breastfeeding and controlling the marketing of infant formula—is also reportedly weak. A Save the Children survey in China showed that 40% of mothers interviewed reported being contacted directly by formula companies; half of them had been contacted in hospitals and over one-third by phone.

The vast majority reported company representatives recommending their companies’ products or giving them free samples. This supports China’s Consumer Association’s survey findings that over half of the country's mothers received information about alternatives to breastfeeding during pregnancy or while breastfeeding. Research in six Chinese cities also found that 16 of the 35 food stores surveyed promoted infant formula, e.g. through salespeople, posters and gifts.

Perhaps most importantly for New Zealand however, success in China’s infant formula market is reliant on consumer demand for a ‘safe’, premium product from perceived high-quality producers.

These heightened infant food safety fears are a legacy of the 2008 melamine scandal, in which locally produced formula from China’s biggest dairy processor Sanlu (43% owned by New Zealand’s dairy giant Fonterra) was contaminated with melamine (a compound used in plastics production which makes milk appear to have a higher protein content). Six babies died and an estimated 50,000 more were hospitalised, with thousands more affected. This disaster became the focus of international media attention largely due to the Chinese authorities’ delay in public notification and full product recall, but also the several week delay in Fonterra reporting this to New Zealand’s Prime Minister, Helen Clark, who then alerted Chinese authorities.
Consequently, in China, safety and quality, generally associated with imported brands, override price in artificial infant milk purchase.\textsuperscript{15} Trading on its ‘clean, green’ brand, some New Zealand product (costing approximately $20 a can in New Zealand) can sell in China for over $70 a can.

Despite the current domination of China’s marketplace by imported infant formula brands, there is some suggestion that Chinese consumers may eventually turn away from overseas brands due to: the tightening of marketing controls on foreign manufacturers operating in China; the development and upgrading of China’s own dairy industry and formula safety standards; and, in mid 2013, the launch of a nationwide breastfeeding promotion campaign.\textsuperscript{22}

In the meantime, New Zealand continues to benefit from China’s growing demand. In 2012, New Zealand was the second largest offshore provider of infant formula for the Chinese market (18% share), after Singapore (37% share), with Australia the third largest (15% share).\textsuperscript{23} This has been greatly facilitated by the 2008 New Zealand China Free Trade Agreement, which included a 5 to 6 year phase out of infant formula tariffs.

Multimillion dollar formula processing plants are being developed in New Zealand to manufacture formula for China’s rapidly expanding market. In 2011, a $100 million formula plant Synlait (51% Chinese owned) opened at Dunsandel, focussed on supplying China. Then, in April 2013, leading Chinese infant formula manufacturer Yashili International Holdings received approval to invest NZ$230 million in the construction of a formula processing plant south of Auckland. These developments have received high level political, business and sporting endorsement in New Zealand, with national sports teams’ sponsorships and government ministers, including the Prime Minister, John Key, attending various openings.

The potential adverse health effects of increased infant formula consumption have been largely overlooked or even positively portrayed in terms of health provision and food security, safety and quality. For instance, at Synlait Milk’s opening, its CEO stated that “Growing world-wide demand for high-value formulated milk powders designed to improve families’ normal diets and protect against health concerns drove the development.”\textsuperscript{24}

\textbf{The public health implications of increased infant formula exports to China}

International agencies, including UNICEF (2012) and Save the Children (2013), have expressed concern about sharply declining breastfeeding rates, including exclusive breastfeeding among infants younger than 6 months, in East Asia and China.\textsuperscript{25, 18} This concern also centres on the marketing and lobbying tactics used by formula marketers. Obtaining accurate nationally representative breastfeeding rates in China is difficult, but UNICEF reports that between 2005–2009, 41% of Chinese children commenced breastfeeding, with only 28% exclusively breastfed at 6 months.\textsuperscript{26}

Lack of exclusive breastfeeding increases the risk of infant morbidity and mortality; a risk that is greatly increased where water and sanitation for preparing formula is poor and parents may be illiterate and unable to read preparation instructions.\textsuperscript{27} In 2012,
UNICEF reported that good sanitation facilities were available, in 2008, to only 58% and 52% of China’s urban and rural populations respectively.28

In a survey showing decline in breastfeeding rates in central and western China, Guo29 et al note that promoting breastfeeding and other good child feeding practices may reduce not only infection-associated child mortality and morbidity in poor rural areas, but also the future incidence of various noncommunicable diseases.

In June 2013, WHO Director-General, Dr Margaret Chan, noted that:

"Efforts to prevent noncommunicable diseases go against the business interests of powerful economic operators. In my view, this is one of the biggest challenges facing health promotion. As the new publication makes clear, it is not just Big Tobacco anymore. Public health must also contend with Big Food, Big Soda, and Big Alcohol. All of these industries fear regulation, and protect themselves by using the same tactics.

Research has documented these tactics well. They include front groups, lobbies, promises of self-regulation, lawsuits, and industry-funded research that confuses the evidence and keeps the public in doubt. In the view of WHO, the formulation of health policies must be protected from distortion by commercial or vested interests... "These [tactics] include arguments that place the responsibility for harm to health on individuals, and portray government actions as interference in personal liberties and free choice."


This global health framework aims to protect breastfeeding and restrict how companies can market infant formula. New Zealand implements the WHO Code under three voluntary and self-regulatory codes as well as the Australia New Zealand Food Standards Code. New Zealand’s voluntary industry agreement applies within New Zealand to infant formula manufacture and importing, including restricting the marketing of infant formula for infants under 6 months.

As of mid-2013, industry standards for infant formula manufacture and marketing within New Zealand are stronger than those governing our exports. Export standards (under consideration) include some exemptions on formula composition and a blanket exemption on labelling, requiring only that these meet importing countries' requirements. Some New Zealand exporters targeting East Asian markets are promoting formula for babies.

In response to calls from within our dairy sector for ‘alignment’ of New Zealand’s infant formula standards, various changes have been made but concerns are solely trade related. They include the branding and marketing as ‘NZ-made’ formula produced in China by domestic companies, thus illegally trading on New Zealand’s ‘clean, green’ image. Another key concern is piracy of New Zealand produced infant formula to China, bypassing export regulations and tariffs. As a reaction to these developments, late 2012 saw the formation of the New Zealand Infant Formula Exporters Association to represent and protect the interests of infant formula manufacturers, including developing an accreditation process for approved export brands. In June 2013, the Ministry for Primary Industries (MPI) introduced a brand register for all infant formula produced in New Zealand intended for export to China.31
Concerns about unregistered exporters not adhering to New Zealand controls and giving New Zealand products a bad name are very real. But given little consideration are the ethical and public health implications for New Zealand as a major infant formula producer and exporter.

New Zealand promotes breastfeeding among its own population even though there are debates about the adequacy of national efforts. By contrast, along with certain other countries, New Zealand is potentially undermining breastfeeding practice in countries such as China where breastfeeding protection is weaker.

**Conclusion**

On narrow economic measures of wellbeing New Zealand’s dairy industry is a huge success. However, major challenges have been identified for broader wellbeing outcomes. New Zealand regulators and other stakeholders are endeavouring to improve outcomes in certain environmental and animal welfare areas, such as the Dairy and Clean Streams Accord.

By contrast, little attention has been paid to whether aspects of the dairy trade undermine best practice infant feeding. Potential adverse health effects associated with the decline in breastfeeding in other nations are possibly perceived as irrelevant to New Zealand. Some may also have been ‘cowed into silence’, fearing that to question New Zealand’s infant formula export bonanza, especially to China, may be perceived as economic treason.

As in fully industrialised countries, balancing good child health outcomes (including breastfeeding), maternal employment and gender equity will be complex in China. While New Zealand could show ethical leadership with regard to the marketing of infant formula exports, much of the solution lies with China. Improved maternity leave systems and WHO Code enforcement is required, along with implementation of WHO and UNICEF's Baby Friendly Hospital Initiative.

More discussion is also needed on these issues in New Zealand. In contrast to infant formula exporters’ profits and university researchers’ grants to improve infant formula composition to better ‘emulate’ human breastmilk, no one stands to profit from breastfeeding protection. Whereas various constituent groups, including environmentalists, trade advocates and animal welfare groups, have an interest in better dairying practices, only public health proponents are specifically concerned with improving infant and maternal health.

It is therefore important that the health and medical community (paediatricians, nutritionists, midwives, child health advocates, and communicable and non-communicable disease experts) pays more attention to the potential and actual impact of dairy industry practices and regulations on infant and child wellbeing so that, on all measures New Zealand’s dairy industry is successful.

**Note:** Statements or opinions expressed in the Journal reflect the views of the author(s) and do not necessarily reflect official policy of the New Zealand Medical Association unless stated as such.

**Competing interests:** Nil.

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A glucose meter evaluation co-designed with both health professional and consumer input

Harmony Thompson, Huan Chan, Florence J Logan, Helen F Heenan, Lynne Taylor, Chris Murray, Christopher M Florkowski, Christopher M A Frampton, Helen Lunt

Abstract

Health consumer’s input into assessment of medical device safety is traditionally given either as part of study outcome (trial participants) or during post marketing surveillance. Direct consumer input into the methodological design of device assessment is less common. We discuss the difference in requirements for assessment of a measuring device from the consumer and clinician perspectives, using the example of hand held glucose meters.

Around 80,000 New Zealanders with diabetes recently changed their glucose meter system, to enable ongoing access to PHARMAC subsidised meters and strips. Consumers were most interested in a direct comparison of their ‘old’ meter system (Accu-Chek Performa) with their ‘new’ meter system (CareSens brand, including the CareSens N POP), rather than comparisons against a laboratory standard.

This direct comparison of meter/strip systems showed that the CareSens N POP meter read around 0.6mmol/L higher than the Performa system. Whilst this difference is unlikely to result in major errors in clinical decision making such as major insulin dosing errors, this information is nevertheless of interest to consumers who switched meters so that they could maintain access to PHARMAC subsidised meters and strips. We recommend that when practical, the consumer perspective be incorporated into study design related to medical device assessment.

New clinical measuring devices are usually introduced because they have advantages over the established measuring devices, such as lower cost, greater ease of use and/or greater accuracy and precision. Before introducing new measuring devices, regulatory authorities usually require some form of method comparison assessment.

This article discusses the general principles of method comparison, based on an example using glucose meters. Following the input of consumer representatives, methodology for the current study does however follow a slightly different approach compared to the usual assessment of glucose meters. We also discuss consumer insights into interpretation of study results and how this might influence future study design.

General approach to method comparison

Whilst results from a new device should correlate highly with the established reference method of measurement, a high correlation does not automatically imply good agreement between the two methods. Results can be highly correlated but nevertheless show systematic bias, for example the mean (average) result obtained from one method may differ from the mean result obtained by the second method.
In method comparison studies of measuring devices, assessment for possible bias may be undertaken using Bland Altman plots. On a classical Bland Altman plot, the x axis shows the average value obtained from the two methods under consideration, or alternatively the value obtained from a reference method (“gold standard”).

The difference between these two methods is plotted on the y axis. The Bland Altman 95% limits of agreement as shown in Figures 1a, 2a and 3a is defined as the mean difference ± 1.96, multiplied by the standard deviation of the differences. This represents a measure of the scatter or variability of the paired results, such as paired results from two different meters.

If the Bland Altman plot shows evidence of slight bias, a second problem now exists for the patient and their clinician. Is this bias clinically significant? For example does it result in a change in clinical management such as a change in medications and/or trigger a need for a clinical assessment?

PHARMAC recently implemented a major change to a single supplier of glucose test strips and meters, with exceptions for occasional patients with specific clinical needs. We discuss approaches to assessing patients’ glucose meter performance within the context of this recent switch in glucose meters, undertaken by an estimated 80,000 diabetic patients in New Zealand who want to obtain ongoing supplies of subsidised strips.

Most of patients switching from their ‘old’ meter system, most commonly the Performa (Accu-Chek Performa) meter, onto the ‘new’ CareSens system (CareSens II, CareSens N or CareSens N POP), may not have formulated questions about comparing results from different meter systems in the way we discuss above, but they nevertheless want to know if the performance of their ‘old’ and ‘new’ systems is similar and if not, whether or not these differences are clinically significant.

A visual method for assessing the clinical significance of glucose meter performance relative to the reference method that is intuitively easy to understand and which complements Bland Altman plots, is the Consensus error grid (see Figures 1b and 2b below). In brief, the error grid assumes that minor biases at the extreme ends of glucose values are not clinically important. For example, a broadly similar clinical treatment decision would be made for high glucose values irrespective of whether the value was high or very high.

Conversely a patient suffering a glucose value that is clearly in the hypoglycaemic range should be treated and reassessed, irrespective of the exact value of the measured glucose. A close agreement of the measured capillary glucose value with the reference value is however particularly important at the borderline between the low and normal glucose range, because of the impact on small variations in decision making, in this glucose range.

**Patient feedback suggests that the “new” meters read higher than their “old” meters**

During the current transition period from the ‘old’ to the ‘new’ meter systems, anecdotal reports emerged from patients and their clinicians that the new meter was reading higher than the old meter. This was generating anxiety amongst some individuals and/or their caregivers.
Two consumer representatives from a local diabetes lay society therefore co-designed the below study, together with clinical researchers. They requested that the capillary glucose reading from the ‘old’ Performa meter be used as the reference value, thereby allowing a direct comparison of Performa capillary results with those of the CareSens N POP meter/ CareSens N strip system. The study has Health and Disability Ethics Committee (New Zealand) approval; HDEC number 12/STH/22/AM01.

**Combined clinician and consumer approach to defining methodology and interpreting results**

The methodology used to prepare samples was similar to that described previously, with the exception that antecubital fossa venous samples were placed into plasma separator tubes and spun immediately after collection, thereby minimising pre-analytical glycolysis in the laboratory measured venous plasma glucose samples.

Two meters of each type (Performa, CareSens N POP) were used, thus a total of four capillary samples were obtained from each patient. Meters were rotated during the assessment period to eliminate time dependent analytical bias. Participants were recruited from diabetes outpatients and 105 patients took part in the study (see Table 1 below).

**Table 1. Characteristics of study population (N=105)**

<table>
<thead>
<tr>
<th>Gender % (number of patients)</th>
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<tbody>
<tr>
<td>Male</td>
<td>59% (62)</td>
</tr>
<tr>
<td>Female</td>
<td>41% (43)</td>
</tr>
</tbody>
</table>

| Median age, years (range)     | 54 (19 -88) |

<table>
<thead>
<tr>
<th>Diabetes type % (number of patients)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>32% (34)</td>
</tr>
<tr>
<td>Type 2</td>
<td>68% (71)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity % (number of patients)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>76% (80)</td>
</tr>
<tr>
<td>Maori</td>
<td>12% (13)</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>4% (4)</td>
</tr>
<tr>
<td>Asian</td>
<td>7% (7)</td>
</tr>
<tr>
<td>Other</td>
<td>1% (1)</td>
</tr>
</tbody>
</table>

Haematocrit range was 0.34–0.51, thus haematocrit values fell within the manufacturers’ recommended range for both brands of glucose meter.
Figures 1 and 2 present results in a traditional way, by comparing the venous plasma reference value against the Performa and the CareSens N POP capillary values, respectively. The mean and 95% CI (confidence intervals) for [capillary – venous plasma] glucose difference were as follows: The Performa mean (95% CI) was -0.25 (-0.04 to -0.46) mmol/L and the corresponding value for the CareSens was +0.26 (+0.43 to +0.08).
There was therefore evidence of minor systematic bias only, in this aspect of the experiment. These findings are not inconsistent with earlier local meter assessments, as subtle differences in findings between studies are to be expected, in relation to slight differences in participant characteristics between studies, including differences in glucose range.

Of greater relevance to consumers is the comparison of the first Performa capillary value obtained from each patient with the equivalent CareSens N POP value, shown in Figures 3a and 3b.

These findings confirm consumers’ experience that the CareSens N strips read higher than the Performa (see the horizontal line in the Bland Altman plot of Figure 3a, which shows that the mean capillary glucose [CareSens-Performa] difference is 0.59mmol/L with the 95% confidence interval for this point estimate spanning from 0.42mmol/L to 0.77mmol/L.

The current (2013) ISO standards for glucose meter assessment consider glucose values less than 5.6mmol/L to be sufficiently critical in clinical decision making, that the glucose differences between the reference and test glucose values should be small (±0.83mmol/L).

We therefore undertook a secondary analysis looking at the capillary-venous difference in the eleven participants with laboratory glucose results <5.6mmol/L. Mean (95% CI) difference between the first glucose readings from the two meters (N=11) was 0.38 (0.09 to 0.67), compared to 0.59 (0.42 to 0.77) for the group as a whole (N=105, see previous paragraph). The glucose values obtained from the two meter types therefore appears to show closer agreement at lower glucose values.

The CareSens’s ‘over-read’ relative to the Performa meter is however unlikely to result in major clinically significant errors of self-management (see Figure 3b; Consensus grid). Summarising the results illustrated in these three Figures, the Performa tended to read slightly low and the CareSens read slightly high, when compared to plasma venous glucose, thereby producing a summative error when looking at the direct comparison of the Performa with the CareSens meter/strip systems (Figure 3a).

Figure 3. Comparison of Performa against CareSens (first capillary sample)
Does one brand of meter/strips give results that, on repeat testing, seem more variable that those of the alternative brand of glucose meter?

The above question is of interest to both clinicians and consumers and is answered by measuring the CV (co-efficient of variation %), which is the ratio of the standard deviation of the repeat measurements (SD) to the mean ($\bar{x}$), calculated as $[SD/\bar{x}] \times 100\%$. A lower CV is associated with greater precision of measurement, i.e. less variability. The % CVs for the paired capillary values for the two Performa samples and CareSens samples were 5.3% and 5.3% respectively.

The precision shown by the two different meter/strip systems was therefore both small and also similar. The first capillary value obtained from each of the Performa and CareSens N strips (i.e. Performa/CareSens comparison) had a CV of 6.8% demonstrating that the variability in results obtained using a strip from each of the two different meter systems was about the same as comparing two strips from the same system.

**Study limitations—the consumer’s perspective**

Although the study described above utilises standard meter assessment methodology, the consumer representatives identified several limitations.

Firstly, it was undertaken by a research team familiar with meter assessment, thus it lacks a real world element to it. For example, the likelihood of inadvertent end user error in field conditions such as problems associated strip fill functionality (over- or underfill), although likely to be small, was not formally assessed.

Secondly, it does not assess clinical questions around meter features related to usability that are especially important to the end user, such as use at colder temperatures.

Thirdly, although the research team attempted to select and obtain written consent from patients at risk of hypoglycaemia, we were unable to obtain many results from asymptomatic hypoglycaemic patients, thus there are limited comparisons in the critical glucose range of <5.6mmol/L.

Arguably, it would have been informative to include patients with plasma glucose levels in the hypoglycaemic range, but there is no single glucose value that defines hypoglycaemia. Samples with low glucose values could have been obtained by various alternative means, for example by delaying laboratory analysis of samples so that glucose values are lowered due to pre-analytical glycolysis, or by including samples from fasting healthy volunteers.

The relationship between prandial status and capillary and venous plasma glucose is complex and there is no evidence that the behaviour of samples that have been manipulated or are from healthy volunteers, mimics the behaviour of those with established diabetes. For this reason, we decided to collect samples only from patients with established diabetes.
Another study limitation identified by consumers is that combining the findings from 105 patients undergoing a single assessment does not inform patients about the theoretical possibility that occasional individuals might run with measured glucose values that are persistently much higher (or lower) with one meter/strip system compared to another, because of the possibility that interfering substances in their blood interact differently with the different enzymes systems used by different brands of meter/strip systems. For this reason and also so that familiarity and confidence can be developed with a new meter system that gives subtly different results, many patients undergoing the process of meter change-over have chosen to undertake a personal series of duplicate tests on the ‘old’ and ‘new’ meters, ‘just to be sure’.

Some of the meter assessment limitations identified by consumers might be best addressed using a program of active, structured post marketing surveillance designed to monitor the specific concerns mentioned above, with findings being linked to a mechanism for device co-development with the manufacturer in situations where this is both possible and appropriate.

Conclusion

In conclusion, undertaking a method comparison study using a study design that was clinically meaningful from a consumer perspective demonstrated that patients’ perceptions of meter performance were correct; the ‘new’ CareSens N POP meter read higher than the ‘old’ Performa meter. This systematic bias is however, unlikely to result in major errors in clinical decision making.

This study also highlights the need to develop future study methodologies that provide a high proportion of glucose samples in the hypoglycaemic range, which directly reflect the physiology of samples from those with diabetes.

The need to spend the New Zealand health dollar wisely may require more changes in measurement technologies. We recommend that if method comparison studies of measurement devices are to be presented in a way that is meaningful to consumers, study design is best undertaken in conjunction with the consumer.

Competing interests: Helen Lunt and Chris M Florkowski have previously undertaken meter validation studies on behalf of PHARMAC.

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Acknowledgement: Harmony Thompson undertook this study as part of a University of Otago Christchurch summer studentship.

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References:


Angiostrongylus meningitis associated with intraparenchymal cerebral haemorrhage

Nikola Lilic, Ben Addison

Abstract

*Angiostrongylus cantonensis* (*A. cantonensis*) is a nematode parasite found in Southeast Asia, Australia and the Pacific that is the most common cause of eosinophilic meningitis.

We report a case of intraparenchymal cerebral haemorrhage associated with *A. cantonensis* meningitis. This complication has not previously been reported in the literature.

*Angiostrongylus cantonensis* (*A. cantonensis*) is a nematode worm that is the most common cause of eosinophilic meningitis (see Figure 1). It is principally found in Southeast Asia, Australia and the Pacific. Recent media attention regarding the difficulties in diagnosing *A. cantonensis* meningitis highlights the need for medical practitioners to be aware of the disease.

Figure 1. *Angiostrongylus cantonensis*

Case report

A 51-year-old man of Tongan ethnicity presented to the Emergency Department with a 3-week history of right-sided headache and two episodes of nausea and vomiting on the day of presentation. The headache was constant with variable severity and exacerbations to 9 out of 10 primarily experienced in the right peri-auricular occipital and temporal areas. There was no history of trauma, hearing loss, ear discharge, photophobia, or rash.

Two weeks before presentation he had returned from Tuvalu where he had been living for the preceding 3 months. He had seen his family doctor three times for this illness and had been treated for a presumed viral illness with paracetamol.

His past medical history includes obesity, hypertension, type 2 diabetes mellitus, hyperlipidaemia and gout. His regular medications are metformin 1 g BD, Quinapril 20 mg BD, simvastatin 40 mg nocte and felodipine ER 10 mg mane.

On examination he was afebrile and other vital signs were normal. He was alert and orientated. Examination of the cardiovascular, respiratory and abdominal systems was normal. His neurological exam was normal including a normal cranial nerve exam and there were no signs of meningism. He had no skin lesions or rashes. There was no lymphadenopathy.

A CT of the head was performed to exclude an intracranial haemorrhage in the emergency department. There was no haematoma present but fluid in the right mastoid cavity was noted. He was referred to otorhinolaryngology (ORL) for presumed mastoiditis.

On ENT review his left ear appeared normal but the right tympanic membrane was moderately retracted with evidence of effusion. There was no erythema overlying the mastoid and no mastoid tenderness. He was treated with antibiotics for presumed acute otitis media. However he then proceeded to have a seizure-like episode and was referred to the general medicine department.

Relevant blood tests that were performed are shown in Table 1.

Table 1. Blood tests that were performed are shown in Table 1.

<table>
<thead>
<tr>
<th>Blood test</th>
<th>Result</th>
<th>Reference range</th>
</tr>
</thead>
<tbody>
<tr>
<td>White blood count</td>
<td>14.53</td>
<td>4–11 (E+9/L)</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>10.61</td>
<td>1.9–7.5 (E+9/L)</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>0.78</td>
<td>0–0.5 (E+9/L)</td>
</tr>
<tr>
<td>CRP</td>
<td>16</td>
<td>0–5 (mg/L)</td>
</tr>
<tr>
<td>ESR</td>
<td>5</td>
<td>0–20 (mm/hour)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>41</td>
<td>20–40 mmol/mol</td>
</tr>
</tbody>
</table>

A lumbar puncture was performed with an opening pressure of 54cm (n 10–20cm) and the CSF was clear and colourless. The CSF contained 270 WBC × 10^6/L (7%
polymorphs, 70% lymphocytes, 5% monocytes, 18% eosinophils) and a glucose of 3.2 mmol/L (normal 2.8–4.4 mmol/L) and protein of 0.73 g/L (normal 0.15–0.45 g/L).

No organisms were seen on Gram stain and there was no growth after 5 days incubation.

CSF histology and cytology revealed a lymphocytosis and eosinophilia with no evidence of malignant cells. *Mycobacterium tuberculosis* DNA was not detected on nucleic acid amplification assay nor on Ziehl-Neelsen staining.

The CSF was negative for *Streptococcus pneumoniae* on immunochromatographic test. The CSF was also negative for *Enterovirus* and *Cryptococcal antigen*. *A. cantonensis* serology is pending.

An LP was performed 7 days later. The CSF contained 140 WBC × 10⁶/L (1% polymorphs, 60% lymphocytes, 4% monocytes, 35% eosinophils) and a glucose of 2.6 mmol/L (normal 2.8–4.4 mmol/L) and protein of 0.6 g/L (normal 0.15–0.45 g/L).

His symptoms improved immediately following both lumbar punctures. MRI showed no evidence of dural venous sinus thrombosis.

Based on the history, the elevated WBC with eosinophilia, the CSF showing a high WBC with eosinophilia and increased protein, a diagnosis of *Angiostrongylus cantonensis* eosinophilic meningitis was made.

Unfortunately he presented 3 days following discharge with decreased GCS and right arm weakness. CT and MRI revealed a 7 × 2.5 × 3cm strip of haemorrhage within the left temporal lobe. There was intraventricular blood with mild hydrocephalus and midline shift to the right of around 12 mm. There was no mass lesion, vascular malformation, or venous thrombosis identified as a cause for the haemorrhage (see Figure 2).

**Figure 2. CT of patient’s head showing acute left temporal haemorrhage with intraventricular blood**
Discussion

This is the first reported case of *A. cantonensis* meningitis complicated by an intraparenchymal cerebral haemorrhage. In 1982, Kliks et al. reported one case of subarachnoid haemorrhage presumed to be due to *Angiostrongylus* meningitis, but case reports and reviews of *Angiostrongylus* meningitis have not revealed any other cases complicated by intracranial haemorrhage.\(^5,6\)

Diagnosis of *Angiostrongylus* meningitis is based on a history of possible exposure e.g. consumption of unwashed lettuce in an endemic region, clinical findings and CSF eosinophilia.\(^1\) Definitive diagnosis, such as serologic tests, are available but are rarely used due to price and poor specificity. Direct identification of the *Angiostrongylus* parasite in humans has not been described in the literature.\(^1\)

The main differential diagnosis of parasitic eosinophilic meningitis is *Gnathostoma* meningitis. This usually presents with more severe disease and may affect the viscera and skin along with the CNS, elevated opening pressures are less common and imaging may reveal nodular lesions, CNS haemorrhage or hydrocephalus.\(^1,6–8\) However *Gnathostoma* meningitis is not found in the Pacific and therefore it would be very unlikely to be the cause of this patient’s haemorrhage.\(^1\)

Another possibility is that consequences of the metabolic syndrome caused this patient’s intracranial haemorrhage, however he does not have evidence of ischaemic heart disease or cerebrovascular disease.

This case highlights the difficulty of diagnosing this condition. The patient was reviewed a number of times prior to presentation and treated for a presumed viral illness. Furthermore, incidental findings on the first set of imaging distracted the consulting physician from the diagnosis. Therefore it is important that medical practitioners in the primary and hospital sectors have a broad differential diagnosis for any unwell returned traveller.

**Learning points:**

- Develop a broad differential diagnosis for unwell returned travellers
- Think of diagnoses outside of your specialty when assessing patients
- The commonest cause of eosinophilic meningitis is a parasitic infection
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References:

Portal vein thrombosis as a complication of laparoscopic sleeve gastrectomy

Robert Lopez, Richard Flint

Abstract
Laparoscopic sleeve gastrectomy (LSG) is a popular form of weight loss surgery in New Zealand. The current case report describes an incident of portal vein thrombosis (PVT) following this surgery and serves to increase the understanding of the unique risks of this operation.

Case report
A LSG was performed on a 40-year-old woman with a BMI of 46 (kg/m$^2$), weight 131 kg and associated gastro-oesophageal reflux disease, stress urinary incontinence, joint pain, trigeminal neuralgia and depression. She had been taking the oral contraceptive pill (OCP) and omeprazole 20 mg daily but no other medications. She had had no previous surgery and no prior thromboembolic events.

She had a standard LSG over a 36F bougie, and was discharged on the second postoperative day. At 6 weeks she suddenly developed constant epigastric pain which radiated to her hypochondria and back. Laboratory tests revealed mildly elevated AST (62), ALT (98) and CRP (15).

An urgent ultrasound revealed PVT and an in-hospital CT scan confirmed PVT extending into the left liver along with thromboses of the superior mesenteric and splenic veins. There was no identifiable cause such as intra-abdominal sepsis (e.g. from a leaked staple line), malignancy, cirrhosis or pancreatitis.

The patient was anticoagulated with therapeutic subcutaneous enoxaparin and rehydrated with intravenous fluids. Although her pain increased over the next 3 days her condition remained stable so a thrombolysis or thrombectomy was not necessary. By the fifth day her discomfort resolved.

Warfarinisation was then commenced and maintained for 6 months. An ultrasound 3 months later revealed recanalisation of the portal vein and no evidence of portal hypertension. Thrombophilic screen did not reveal any hypercoaguable syndromes.

She has since returned to normal activities with advice to avoid the OCP.
Discussion

The LSG is gaining prominence in the field of bariatric surgery as it is perceived to have a better safety profile than the gastric bypass but with similar results. The first report of PVT as a complication of this operation was in 2009 when Berthet et al\(^1\) described this event in a patient with Factor 2 Leiden deficiency. Since then case series have been presented (seven patients by Kenfield et al,\(^2\) 17 patients by Salinas et al\(^3\)) suggesting that this was not an isolated occurrence and not restricted to those with...
thrombophilic disorders. Furthermore it appears that this complication is not common to all types of weight-loss surgeries. In their case control study comparing 811 LSG with 786 case-matched gastric bypasses, Boza et al describe 17 (1%) patients with PVT following LSG but none following the gastric bypasses.

The unique pathophysiological features of the LSG that leads to PVT are yet to be elucidated. The usual factors associated with other forms of laparoscopy include reverse Trendelenberg positioning, carbon dioxide insufflation, perioperative dehydration, and the prothrombotic status associated with obese patients. However the delayed onset of the current case is similar to others described (Kenfield et al report onset between day 18 and 40) and suggest that factors other than intraoperative splanchic perfusion changes are responsible.

As intra-abdominal sepsis has been implicated in episodes of spontaneous PVT, the authors strongly recommend that a leaked staple line is considered at the initial presentation as these can often occur in a similar timeframe.

Fortunately this current patient (like 75% of patients) responded to anticoagulation and the portal vein recanalised. In those patients that continue to deteriorate invasive options such as percutaneous transjugular catheterisation of occluded veins, and local thrombolytic therapy can be considered.

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References:

Pure red cell aplasia associated with recombinant erythropoietin: a case report and brief review of the literature

M Atif Mohd Slim, Riaz Shaik

Abstract

Pure red cell aplasia (PRCA) is a rare adverse effect of recombinant erythropoietin (rEPO). Affected patients rapidly become transfusion-dependent, with many requiring immunosuppressive therapy for remission. We report a confirmed case in an elderly female, possibly the first of its kind in New Zealand, who was started on rEPO for anaemia of chronic kidney disease. We also briefly review current literature on rEPO-associated PRCA.

Pure red cell aplasia (PRCA) is a rare adverse effect of recombinant erythropoietin (rEPO), and first came to worldwide attention following a flurry of reports in the early 2000s.1 Due to the exclusive loss of erythroid precursor cells in the marrow, patients rapidly become transfusion-dependent, with some requiring intensive immunosuppressive therapy for remission.2

We report the case of an elderly female who was admitted under General Medicine at Waikato Hospital for erythropoietin-resistant anaemia of chronic kidney disease (CKD), later diagnosed with PRCA. To our knowledge, this is the first report of confirmed rEPO-associated PRCA in New Zealand.

Case report

Mrs A was an 89-year old New Zealand European woman who presented to our hospital in April 2013 for the second time in 2 months with erythropoietin-resistant, transfusion-dependent chronic symptomatic anaemia of Stage IV CKD secondary to renovascular disease.

She denied pain, symptoms of gastrointestinal bleeding, or regular use of non-steroidal anti-inflammatory drugs apart from aspirin. Her background included double-mastectomy for non-metastatic breast cancer, and partial pelvic clearance with formation of an ileal conduit urostomy for transitional cell cancer. She was otherwise well and active, with no significant active comorbidities. She was not on dialysis.

In August 2012, Mrs A was started on NeoRecormon® (Roche, Germany), a recombinant erythropoietin (rEPO) product, at 6000 U subcutaneously once weekly. However, her haemoglobin continued to deteriorate from 92 g/L pre-treatment, to 52 g/L in February 2013, which led to the first hospital admission.

Despite increasing the dose to thrice weekly at the time, she experienced minimal symptomatic improvement, and was again referred to the hospital in April 2013. On presentation this time, her haemoglobin was 46 g/L, 7 months after commencing rEPO.
Physical examination was unremarkable save for marked pallor. She was haemodynamically stable. Blood tests showed normocytic normochromic anaemia and isolated reticulocytopenia (2x10⁹/L) with an unremarkable blood film. Iron studies showed elevated ferritin (909 ng/mL) and increased transferrin saturation (98%). Her creatinine was 261 micromol/L, with an estimated glomerular filtration rate of 13 mL/min.

Further tests, including B12, folate, and a screen for myeloma and haemolysis, were negative for other causes of rEPO-resistant anaemia of CKD. Subsequent bone marrow trephine revealed complete absence of erythroid precursors, but normal findings for other cell lineages, and normal marrow iron stores.

A provisional diagnosis of pure red cell aplasia (PRCA) secondary to rEPO was made, and administration of the drug was ceased. She was discharged on two weeks of high dose corticosteroids for haematological follow-up, where this was discontinued and weekly doses of rituximab were started for a month.

However, Mrs A continued to be transfusion-dependent. In June 2013, we sent a blood sample to Germany (MicroCoat Biotechnologie GmbH, Bernried) for anti-EPO testing. Enzyme-linked immunoabsorbent assay confirmed circulating anti-EPO at a titre of 16, 282 ng/mL, 3 months following cessation of NeoRecormon®, effectively establishing the diagnosis of rEPO-associated PRCA. Sadly, Mrs A died in August 2013 due to unrelated urosepsis.

Discussion

The pathogenesis of anaemia in CKD is multifactorial, reflecting dysfunction in erythropoiesis and iron regulation. Features include decreased erythropoietin production, marrow hyporesponsiveness to erythropoietin, decreased red blood cell (RBC) lifespan, increased hepcidin levels, and impaired reticuloendothelial release of iron. Treatment options where other causes for anaemia have been excluded include iron supplementation, rEPO, blood transfusions and renal transplantation.

rEPO resistance occurs in up to 10% of CKD patients treated for anaemia. Common causes for rEPO-resistance that should be considered include chronic occult bleeding, iron deficiency, nutritional deficiency (specifically folate and B12), inflammation, use of angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, hyperparathyroidism, haemolysis, malignancy (especially haematological), and aluminium toxicity.

PRCA is a rare blood disorder typified by severe, sudden-onset normocytic normochromic anaemia with isolated reticulocytopenia. Bone marrow examination by trephine or aspirate characteristically show exclusive absence of erythroid precursor cells with preservation of other lineages. Iron studies may show markedly elevated ferritin and high transferrin saturation due to the arrest of erythropoiesis and subsequent build-up of iron stores.

Clinical progression of the disease may be rapid with loss of haemoglobin up to 1g/L/day, reflecting RBC lifespan. Virtually all patients become transfusion-dependent. PRCA is more commonly a primary disorder, but acquired forms have also been recognised as secondary to infection (particularly parvovirus B19), malignancy, haemolytic syndromes, autoimmune disease, seropositive arthritides, and
medication, including rEPO. PRCA can also be the early manifestation of some forms of leukaemia.

With an estimated incidence of 0.02 to 0.03 per 10000 patient-years, rEPO-associated PRCA is a rare but nevertheless significant adverse effect. First coming to worldwide attention following a case series published in 2002, it presents clinically as rEPO-resistant anaemia up to 25 months following commencement of regular treatment. Initially associated with epoietin-α (Eprex®; Johnson & Johnson, Puerto Rico), it is now a recognised adverse effect in other forms of rEPO available in the market, including epoietin-β (NeoRecormon®).

Subcutaneous preparations have been implicated in the vast majority of rEPO-associated PRCA, theorized to be due to a greater immunogenic response via this route compared to intravenous. However, rEPO-associated PRCA has also been reported with exclusive intravenous administration. Additional hypotheses as to possible causes include immunogenic non-active constituents of the preparation (such as polysorbate-80), and the use of rubber plungers. Eprex® and NeoRecormon®, in subcutaneous and intravenous preparations, are funded in New Zealand.

Given the rarity of rEPO-associated PRCA, its diagnosis in the setting of rEPO-resistant anaemia of CKD remains primarily that of exclusion. An international working group in 2004 recommended both a bone marrow biopsy (trephine or aspirate) and an anti-EPO titre to establish diagnosis. As of the time of writing, standardized and commercially available assays for the antibody have not yet been developed. Nonetheless, evidence is lacking as to how diagnosis will necessarily influence management. Certainly the cessation of rEPO is mandatory in the management of rEPO-associated PRCA. However, recovery is seldom spontaneous, and in many patients, significant anti-EPO titres can still be detected months after cessation, necessitating repeated blood transfusions.

Although there have been isolated reports of spontaneous remission in rEPO-associated PRCA, the mainstay in treatment is similar as in primary and acquired PRCA, being immunosuppressive therapy in addition to addressing the underlying cause in acquired forms. The level of evidence for therapy primarily comprise of retrospective analyses of individual case reports due to the rarity of rEPO-associated anaemia. There is subsequently paucity of data to recommend one immunotherapy over another.

In one study of 47 European patients, untreated patients who survived to a 12-month median continued to exhibit reticulocytopenia. Recovery rates were 56% for corticosteroid treatment with or without adjunctive intravenous immunoglobulins, 67% for cyclosporine alone, 87% for corticosteroids plus cyclophosphamide, and 100% for renal transplant.

A separate US-based study of 191 international patients similarly reported only 1 spontaneous recovery out of 62 who received no treatment, whilst 57% of patients treated with one or more immunosuppressive therapy fully recovered. 56% of patients re-challenged with rEPO in the study exhibited returned responsiveness to erythropoietin (the median time post-cessation prior to re-challenge was not reported), and 95% of patients who underwent renal transplantation achieved transfusion-dependence.
Evidence for rituximab is similarly limited, but the literature is promising with reports of remission within a maximum of 4 weeks in some patients with non-rEPO-associated PRCA. Success has also been reported in at two recent cases of PRCA associated with epoietin-α.

Both epoietin-α and epoietin-β are short-acting rEPO and have the same sequence of amino acids as human erythropoietin, with minor variations in the degree of glycosylation. As such, molecular structure is unlikely to account for their antigenicity and there is consequently no evidence as of time of writing for changing to a different brand in the treatment of rEPO-associated PRCA.

In summary, corticosteroid monotherapy is generally considered as first-line in PRCA, but in rEPO-associated PRCA, current evidence appears equivocal for either combination steroid therapy or cyclosporine. Rituximab may be considered. Renal transplant confers the best chance for recovery, although it is not known if the effect is necessarily due to the transplant itself, or the high-dose immunosuppressive therapy routinely used in the post-transplantation period.

A European review recommended intravenous rEPO re-challenge as a viable option in management provided that patients are monitored for anti-EPO titres, reticulocytopenia, and systemic immunological reactions.

**Conclusion**

At the time of writing, the Centre for Adverse Reactions Monitoring (Dunedin) has not received any reports of drug-induced PRCA in New Zealand when contacted. To our knowledge, Mrs A is the first reported case of rEPO-associated PRCA in the country. She was first diagnosed with CKD about 18 months prior to her presentation, with symptomatic anaemia being the primary feature.

Following the diagnosis of PRCA, her rEPO treatment was ceased. Three months later, Mrs A continued to exhibit reticulocytopenia, although she was minimally symptomatic and was able to cope with normal daily activities. To avoid continued transfusion-dependence, intravenous rEPO rechallenge would have needed to be considered. No further interventions for PRCA were initiated prior to her death.

This case report highlights a very rare adverse effect of rEPO. It is important for New Zealand physicians to consider this diagnosis in patients who develop PRCA whilst on treatment, and to be aware that avenues are available for further investigation.

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**Acknowledgements:** Roche New Zealand sponsored the anti-EPO assay performed in Germany, including courier costs from New Zealand. Waikato Hospital medical staff Dr Elizabeth Phillips and Dr Samuel Whittaker were involved in the direct care of the patient during this admission; Dr Sarah Hartley was consulted for bone marrow biopsy; and Dr Stephen Du Toit and RN Wendy Shaw provided assistance in coordinating the off-site blood test for anti-EPO, including sample pre-processing and patient contact.
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References:

An unusual case of melaena

Judy Huang, Robert Cunliffe

Learning points

Metastatic melanoma can present with non-cutaneous symptoms even after several years of remission.

Although poor prognosis, surgical resection and arterial embolisation can provide effective symptom palliation.

A 73-year-old man presented to hospital with melaena. He had a previous history of cutaneous melanoma with left axillary nodal metastases, treated with axillary lymph node dissection and radiotherapy 2 years previously. Clinical examination and laboratory investigations suggested upper gastrointestinal haemorrhage. On this admission, there was no evidence of recurrent cutaneous or nodal disease.

Endoscopy was performed to investigate his melaena. It showed multiple large gastric polypoid lesions up to 60 mm in diameter, some of which were oozing blood (Figure 1). Biopsies were taken and histology was consistent with metastatic melanoma (Figure 2). Computed tomography of the abdomen showed multiple large pedunculated gastric polyps (Figure 3).

The patient received blood transfusions, and also palliative radiation with a view to preventing further bleeding from the gastric lesions, but this was unsuccessful and the patient died 3 days later.

Figure 1. Endoscopic view of the gastric polypoid lesions
Figure 2. Biopsy histology from the gastric polypoid lesions

Note: 40× magnification of melan-A red chromogen stain. Metastatic melanoma is histologically confirmed by positive S100, melan-A and CD117 staining.

Figure 3. Large pedunculated gastric polyps on computed tomography
Discussion

Primary malignant melanoma in the gastrointestinal tract is extremely rare, but primary cutaneous malignant melanoma is one of the most common malignancies which metastases to the gastrointestinal tract. Symptoms may include gastrointestinal bleeding, abdominal pain, and small bowel obstruction or perforation. Prognosis is poor with a median survival of 4 to 6 months.1,2

Surgical resection for bleeding provides effective symptom palliation and in some cases improves mortality.3 Medical adjuvant therapies including chemotherapy, and also radiotherapy, have not demonstrated survival benefit.2 Arterial embolisation has been used effectively as a palliative measure to control bleeding in gastrointestinal malignancies, but less invasive measures are generally preferable in the first instance.4,5

Metastatic melanoma can present with non-cutaneous symptoms after several years of remission. Metastatic melanoma of the gastrointestinal tract should be considered in patients with a history of cutaneous melanoma who present with gastrointestinal symptoms.

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References:

Drowning terminology: not what it used to be

With the New Zealand summer soon upon us, health professionals may be called upon to assist at the scene of a drowning incident. This letter seeks to update readers on current internationally accepted drowning terminology.

Drowning is a leading cause of unintentional injury resulting in death in New Zealand.\(^1\) Despite a declining drowning toll (n = 98 in 2012), New Zealand’s drowning rate is still higher than Australia (2.3 vs. 1.27 per 100,000), the United States and Great Britain. In 2012, 176 patients required hospitalisation (>24hrs) for drowning.\(^2-4\) On New Zealand beaches last year, surf lifeguards performed 1,645 rescues and almost 350,000 other safety interventions.\(^5\)

In 2002, the World Congress on Drowning was held in the Netherlands. This meeting involved a wide range of experts in the fields of water safety, lifesaving, and resuscitation (both pre and in-hospital basic and advanced life support). Several taskforces were formed with the aim of developing an international consensus on a number of issues around the management of drowning.

Prior to this conference there was no real agreement on terminology between countries or organisations, making it difficult to interpret research or compare data. The first of the 13 major recommendations of this group was that there should be a single universal definition for drowning.

This recommendation was subsequently adopted by the International Liaison Committee on Resuscitation (ILCOR) and in 2003 a glossary of terms and definitions for a revised Utstein template, along with guidelines for the uniform reporting of data from drowning was published.\(^6\) Although endorsed by the World Health Organisation in 2005, this terminology has yet to be fully adopted by all health professionals, academics, researchers, those working in the aquatic safety field and mainstream media.\(^7-10\)

<table>
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<td><strong>Drowning</strong></td>
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<tr>
<td>Drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid.</td>
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<tr>
<td><strong>Non-fatal drowning</strong></td>
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<tr>
<td>Survival after drowning. This is further classified as non-fatal drowning with morbidity or no morbidity.</td>
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<tr>
<td><strong>Fatal drowning</strong></td>
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<tr>
<td>Death due to drowning</td>
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<th>Other (accepted) terminology</th>
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<tr>
<td><strong>Submersion</strong></td>
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<tr>
<td>The whole body is under water.</td>
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<tr>
<td><strong>Immersion</strong></td>
</tr>
<tr>
<td>Part of the body is covered in water (for drowning to occur the face and airway would have to be immersed).</td>
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<tr>
<td><strong>Witnessed</strong></td>
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<tr>
<td>Drowning episode is observed from the onset of immersion or submersion.</td>
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<tr>
<td><strong>Unwitnessed</strong></td>
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<tr>
<td>Victim found in water, no-one saw the event.</td>
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<td><strong>Dry and wet drowning</strong></td>
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<td>As all drownings occur in liquid, they are by definition wet. It is impossible to tell at the scene whether water has been aspirated into the lungs (and in most drowning incidents it has anyway); these terms are redundant.</td>
</tr>
<tr>
<td><strong>Active or passive drowning</strong></td>
</tr>
<tr>
<td>Replaced by Witnessed or Unwitnessed.</td>
</tr>
</tbody>
</table>
Secondary drowning

Used previously to describe both the events precipitating a drowning episode and the development of post drowning effects on the lung. Now descriptions of such events are to be explicit and this term has become redundant.

Near-drowning

This term has been used for both survivors of drowning and for those that died at some point in time after initial resuscitation was successful, creating confusion. This term should not be used as people either survive the drowning episode or they do not (see above). The international drowning prevention community have regarded this term as obsolete for over 10 years since drowning was defined as a process rather than a product. Just as you wouldn’t say someone had a ‘near-asthma attack’, so too with drowning.

Implications for clinical practice/recommendations—As healthcare professionals we have a responsibility to promote the use of internationally agreed terminology to the public, in our practice, in medical reports and through the media. Part of this is demonstrating that we are up to date with current international thinking. This will also help to improve the quality of the data we are able to collect about drowning and our ability to contribute to improvements in resuscitation techniques through research. We strongly encourage all healthcare professionals to start using the current terminology.

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References:


Helmet use by skiers and snowboarders in New Zealand

A recent request made under the Official Information Act to the Accident Compensation Corporation revealed that during the period 2008 to 2012, the mean number of new claims per year for head injuries due to skiing and snowboarding accidents was 280 and 277, respectively. However, wearing a helmet while skiing or snowboarding may prevent between 15 and 66% of all snow-sport head injuries.1-3

Helmet use by skiers and snowboarders is often quite low; for example, in the US rates of 12.1%, 19.8% and 40% were reported, in 2001,4 2002,4 and 2006–2007,5 respectively, while on New Zealand ski-fields, an Otago University thesis estimated a rate of 57% during 2010.6

Frequently cited reasons for not wearing helmets include: i) the extra weight may increase the risk of neck and cervical spine injury; ii) they may increase skiers and snowboarders’ propensity to take risks (because they feel protected); and iii) they may reduce peripheral vision and insulate users from environmental cues of danger (e.g., the shouts of an out-of-control snowboarder behind). However, evidence does not support these three possibilities.e,g.,1,7,8

The opportunity arose to replicate and extend the unpublished Otago University thesis, and investigate the rate of helmet use of skiers and snowboarders using lifts to access beginner, intermediate, and advanced levels of a North Island ski-field at both the beginning and the end of the 2013 ski season. Specifically, we sought to determine whether helmet use varies by: i) type of snow-field user (skier vs. snowboarder; ii) the level of the mountain being accessed (our measurement was unfortunately somewhat blunt, as those accessing the beginner level may have been en-route to the intermediate or advanced level); and iii) whether it was early or late season (and perhaps complacency and/or warmer weather led to a lower rate of helmet use).

On four weekdays when all areas of the ski-field were open (two close to the beginning of the ski season and two close to the end of the season), between 11am and 12pm we observed the riders of 100 chairs on lifts serving the three levels of the ski-field and recorded whether skiers and snowboarders were wearing helmets. On all days the weather was fine and the visibility unlimited.

Of 4057 people observed, 2633 (64.9%) wore helmets while 1424 (35.1%) did not. The odds ratio for helmet use (skier vs. snowboarder) was 1.21 (95%CI, lower=1.055, upper=1.384); 68.2% of skiers and 62.0% of snowboarders wore helmets, respectively. Binary logistic regression to predict helmet use (yes/no), with categorical covariates Type (ski vs. snowboard), level (low, mid, high) and season (early vs. late), revealed that only Type significantly predicted helmet use (β=0.194, p=0.006).

The rate of helmet wear compares favourably with those reported in other studies.e,g.,4,7,8 Nevertheless, if the non-users also wore helmets, it may help to reduce the number of traumatic head injury claims made to ACC each year. Indeed, when cycle helmets became mandatory in New Zealand, their rate of use rose immediately to more than 90% (for adults) from just 39% 2 years earlier.9
One limitation of this brief observational study is that, due to resourcing constraints, it was conducted at just one of approximately 30 ski-fields in New Zealand; caution must therefore be shown if making generalisations.

As the advantages of wearing helmets\(^1\) likely outweigh any disadvantages, e.g.,\(^1,7,8\) the majority of ski-field users already wear them, and their cost is relatively cheap, making helmet use mandatory may help reduce the number of head injuries attributable to winter sports at little cost or discomfort to the user.

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Leading the way with a health research repository

As an advocate of the growing movement towards open and free access to data and information, both in the publication arena, as well as other information initiatives such as those put forward by David Healey (RXisk.org) and Ben Goldacre (alltrials.net), I’d like to put forward a suggestion to New Zealand based on recent experiences. I’m a first-year PhD student, exploring the relationship between research practices, the research environment, and health equity.

Naturally, my first step in this process was to try and gain a picture of what research has occurred in New Zealand (generally, and more specifically clinically) over a specific time period and explore how that research was generated in terms of funding, participants, methodologies, etc.

My observations have been the following:

- Data is fragmented. Various bits of information are available from various sources, but no one source can be consulted to investigate health research activity in New Zealand.
- Data is not robust. Multiple sources consulted including both government and private organisation websites have shown to have errors in their records, some to the extent that an entire year’s entries are mislabelled, some lists have omissions, double-ups, or incomplete entries.
- Data is not accessible in a user-friendly manner. While I recognise the sources accessed were not designed for my specific purposes, there are still issues in finding information. If I imagine, myself a public enquirer, professional, or researcher wanting to get information on a condition, then this task is not an easy one, if at all achievable.

A compulsory, centralised databank logging all health research from bench to bedside, including both qualitative and quantitative work would be an asset to New Zealand. We could lead the way with a “trial-registry” like system for all our health research. Each entry could have a simple entry “cover-page” (investigators/institution, title, start date, list of included supplements), plus compulsory supplementary documents, and the data set with data dictionary once completed.

Supplementary documents would include (where applicable): research protocol/study design, ethics application and outcome, data analysis plan, information sheet and consent form, Maori consultation, declaration of funding and conflicts of interest, log of adverse advents (personal information redacted) and list of associated publications. This list is debatable and not exhaustive, but the idea would be to have a single source for research study information from inception to close.

This repository could be created in something as easy as D-Space (www.dspace.org, an open source repository application—so free) for example and administered ideally by the Ministry of Health. Records that are commercially sensitive could have
everything, but their cover page embargoed (some IT applications allow for this). Data-sets could be available on request rather than by default.

The benefits of creating this kind of repository are manifold:

- The PUBLIC have easy access to current research activity in New Zealand allowing them to know what is happening for a condition of interest, or follow-up on the outcomes of a trial they participated in.

- HEALTH PROFESSIONALS have a transparent view of research activity which is comprehensive, allowing them to look into particular conditions or search trials recruiting relevant to their patient(s).

- The GOVERNMENT have access to a complete picture of research activity – this enables better strategic planning, better audit, analysis of practice, targeting of funding, etc.

- The RESEARCH COMMUNITY has a complete record of their work in one place, which they can direct enquires to, reference in their publications, and they can also more easily access other’s work to inform their own studies and combine data or learn from other’s practices.

It would be hoped that such a repository would go some way to helping create a greater balance between collaboration and competition, where a collaborative environment could be seen as a more effective approach to limited funding. It allows researchers to avoid unnecessary double-up or crossover of work (aside from replication studies), and identify areas that need more exploration more readily.

Objections regarding the conflict with publications, costs, and practicalities could all be worked out with discussion. For example, the repository does not negate the need for publication (publication still promotes results within the research community), but what it does do is offer transparency of all work whether published or not. An entry log tally of the use of individual entries in the repository could be added to research performance metrics and may represent an additional means of assessing impact.

The details of this recommendation need to be debated, but as a recommendation, a comprehensive, open access, research activity repository in New Zealand seems to offer many positives and would be world-leading.

I look forward to hearing the opinions of others on whether such a repository has merit or not.

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(Supervisors: Dr Simon Walker; Prof John McMillan)

Reference:
50th anniversary of the modern use of intravenous regional anaesthesia

2013 marks 50 years since the publication of C. McK. Holmes’ practice-changing publication *Intravenous Regional Analgesia: A useful method of producing analgesia of the limbs*.\(^1\)

This article led to world-wide use of the technique, first described by August Bier in 1908, of producing regional neural blockade by injection of local anaesthetic into a tourniquetd limb.

The importance of intravenous regional anaesthesia (IVRA, also known as ‘Bier’s block’) rests in its relative simplicity, and safety—especially compared with general anaesthesia.\(^1,2\)

After reading of Bier’s original report, Dr Holmes undertook preliminary research into the technique in the early 1960s while an Anaesthetic Registrar at Dunedin Hospital. He followed this with further work at Oxford while a Nuffield Dominion Scholar (at the same time that Sir Robert Macintosh, a fellow New Zealander and inventor of the Macintosh laryngoscope, held the inaugural Nuffield professorship).\(^3\)

Today with a slight change in terminology from the original article, intravenous regional anaesthesia is still widely used and valued for the rapid, safe, and effective anaesthesia it provides.\(^2\)

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**August Bier (1861–1949)**
(Source: Wikimedia Commons public domain)

**Intravenous regional anaesthesia procedure**
(Author & Source: MrArifnajafov @ Creative Commons)

**Mack Holmes (1935–)**

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References:
The elderly locum

During my 38 years in general practice, I often went to New South Wales, and I did some locum work off and on. On one occasion I worked for 4 weeks in an isolated area, relieving a doctor who needed time off in order to address his alcohol addiction. Getting registration as a medical practitioner in the state of New South Wales was easy. The experiences were enriching.

In retirement, which began when I was 60, I did locum work for periods of one day up to one month, in many parts of New Zealand. Adding them all up, they come to about thirty-five or more different practices. That is to say, 35 doctors who could take a break. I was made aware of just one complaint against me, and that arose when an incompetent nurse failed to give me an item of information.

When I was 65, a solo GP in the Hutt Valley rang me to say that he had tried all over, and that unless I could do a couple of weeks for him, he would be unable to have a summer holiday. More recently I talked to a young doctor in solo practice in an adjacent area. He told me what he was obliged to pay a locum for 1 day’s work and the figure was not far short of what I used to be paid for 3 days. That’s inflation, up to a point, but there is more to it than that.

Older doctors like me began to move out when re-accreditation moved in. Neither the Medical Council, having entered into an expensive unholy alliance with bpac, nor the Royal New Zealand College of General Practitioners, bent on turning doctors into angels of light and learning at a price, thought things through. Older GPs might need cataract surgery and a hearing-aid, but they do not need any more tick-a-box education. One general practitioner, himself old and desperate for relief, told me that he would hire for a short time anyone who could demonstrate his ability to hold a pen. In a group practice, one can ask another doctor for advice, there is the chemist along the street, and the practice nurse, and short-term locums almost never have to initiate a long-term treatment.

I’m long gone, and locums may be in plentiful supply, but I now have some idea what they charge, and that has to show up in the fee demanded of the patient. An older doctor might settle for less, and he’ll be no better for being pumped up on bpac. However, he doesn’t need the money from the job, he only wanted to get out of the house, and now that he’s been bpacked off the Medical Register, he’ll be off to the beach.

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Missed tobacco tax revenue from ‘foreign’ packs in New Zealand: results from a discarded pack collection study

Duty-free and smuggled tobacco are a public health problem because they lower the average price of tobacco. This undermines the impact of high tobacco product taxes in promoting smoking cessation and reducing smoking initiation. Wilson et al carried out a discarded pack collection study in New Zealand in 2008/09 to assess the proportion of discarded packs which were foreign (duty-free, foreign normal retail and smuggled) and to estimate the missed Government tax revenue. \(^1\) We performed a similar pack collection project between November 2012 and January 2013, allowing us to draw comparisons between the two studies.

**Methods**—A total of 1776 packs were collected from 7 locations across New Zealand, with the majority collected in the Christchurch, Wellington and Nelson/Marlborough regions. ‘Foreign’ status was determined by:

- A lack of the distinctive graphic health warnings required in New Zealand; and
- The lack of the use of Māori language as part of the warning.

As in the 2008/09 study, we assumed that any foreign packs found represented a pack not bought in a New Zealand store, therefore representing lost Government revenue.

We estimated lost Government revenue by multiplying the 2012 total tobacco tax take of $1242 million of excise/customs duty, plus estimated goods and services tax (GST) of $294 million (total $1536 million) by the proportion of foreign packs collected. We used the mid-range (55\%) of the New Zealand’s Treasury’s estimate that tobacco excise is approximately 50\%-60\% of the total GST-inclusive retail price of tobacco to estimate GST revenue from tobacco products. \(^2\)

**Results & Discussion**—In 2012/13 there were 1673 (94.2\%) ‘New Zealand’ packs, and 103 (5.8\%) foreign packs. In comparison in 2008/9, 42 out of 1310 NZ (3.2\%) were foreign packs. Australian packs were the most common in both studies (45\% of foreign packs in 2008/9 and 39\% in 2012/13). The second commonest country of origin was China. The proportion of foreign packs from China in 2012/13 (26\%) was greater than in 2008/9 (17\%). The remainder of the packs came from a diverse range of countries, with between one and four packs each from 14 different countries. In 12 cases (12\%) the origin of the pack could not be determined. There was no obvious clustering among the foreign packs collectively or by country of origin by manufacturer or brand, but it was noteworthy that of the Australian origin packs, over half (57\%) were manufactured by Chinese tobacco companies.

Over half (53\%) of the foreign packs collected were from Christchurch (9.5\% of packs collected here were foreign), and in particular from Riccarton Road where there is a high density of Asian cuisine restaurants. In this area, just over 29\% of collected packs were foreign, with most (69\%) being Chinese foreign packs or Chinese manufactured packs from Australia (13\%).
We estimated a loss of $89.1 million tobacco-related revenue per year for 2012. The equivalent estimate from the 2008/09 study was $36 million. Due to an underestimate in that study of the amount of tobacco-related GST revenue, which has since emerged, we now estimate this to be $38 million.

Both these estimates of lost revenue are conservative as they do not include the excise duty and GST lost due to duty-free tobacco bought in New Zealand airports by arriving passengers. These packs will have standard New Zealand health warnings and hence are indistinguishable from other packs sold with duty paid in New Zealand.

Some foreign packs may have been the current pack bought overseas and brought into the country by short-stay tourists and so less clearly represent lost revenue. However, this will be a very small contribution particularly as our main collection areas—Wellington and Christchurch regions (86% of packs collected)—are not top tourist areas.

A possible bias is that the high proportion of foreign packs found around the Riccarton Road, or more generally in Christchurch, may have caused an overestimate of tax lost. This would occur if the pattern of packs collected was not representative of the prevalence of foreign packs used elsewhere in New Zealand. Excluding packs collected in Christchurch reduced the proportion of foreign packs to 3.9% and the estimate for revenue lost to $59.9 million.

Since the previous pack collection study in 2008/9, there have been several hikes in tobacco taxation. With higher tax rates, every foreign pack represents a greater loss of potential revenue, so this partly explains the increase in estimated tax revenue lost in 2012/13. However, we also found a greater proportion of foreign packs in this study which also contributed to the higher estimate. This could result from the increase in tobacco tax causing a hike in cigarette prices, resulting in more New Zealand smokers purchasing cheaper cigarettes when travelling overseas.

The commonest foreign pack was Australian. Although the percentage of foreign packs which were Australian slightly decreased from 2008/09 to 2012/13 (45.2% and 38.9% respectively), they still make up a significant proportion of foreign packs collected. Australia would be a highly unlikely place to bulk buy cigarettes for personal consumption or illicit sale in New Zealand, given that their prices are slightly higher than ours, so most of the Australian packs are likely to be bought duty-free at Australian airports.

In conclusion, we conservatively estimate that the New Zealand Government loses between $59.9 and $89.1 million in tax revenue due to tobacco brought into New Zealand from overseas. Much of this is likely to have been bought duty-free in non-New Zealand airports.

Additional revenue will be lost from the purchase of duty-free cigarettes by arriving passengers at New Zealand airports, so this figure is likely a significant underestimate of lost revenue. The availability of cheap tobacco products also undermines the impact of tax increases and the ability to achieve the Government’s goal of a smokefree New Zealand by 2025.

This revenue loss and undermining of efforts to achieve the Smokefree 2025 goal could largely be prevented by abolishing or greatly reducing tobacco allowances (e.g.
to zero or one pack). This would be consistent with a recommendation for investigation into duty-free allowances in the report on the tobacco industry by the Māori Affairs Select Committee\(^3\) and recommendations in the Framework Convention On Tobacco Control\(^4\) (article 6.2) of which New Zealand is a signatory.

Singapore and Australia are examples of countries which have recently abolished (Singapore) or greatly reduced (Australia) duty-free allowances, and whose example New Zealand should follow.

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Acknowledgements: We acknowledge the help of the many colleagues who helped with collected discarded packs for this study.

References:


Editorial: dyspepsia or indigestion (part 2)


Far from the difficulties of the matter ending in diagnosis, treatment is also a subject of much perplexity. We assume that few members of the profession will rest content at the stage of giving Bismuth and Soda, if this fails, an acid mixture, and as a last resort recommending a long, sea voyage. Certainly bismuth and soda, and the acids are the main medicinal agents in treatment.

We have no drug, not even nux vomica, which can stimulate the gastric muscle equal to the action of digitalis on the heart. Massage is useful, not so much for the effect upon the stomach itself, but upon the abdominal walls. As to diet, there is a great diversity of opinion, and no uniform feeding can be recommended. It is a wise proverb that asserts “at the age of forty, a man is either a fool or a physician.” In other words, if he has any common-sense, he knows what food agrees with him and also what does not.

We believe that seldom in nature one single cause operates alone to produce a final result. In cases of dyspepsia there is a great variety of causes, and of resulting types, and it is not likely that the matter of diagnosis, classification and treatment will ever be simple. The great sheet-anchor of the profession in dealing with the dyspeptic is the exercise of common-sense. One may possess the science of a Harvey, the art of a Sydenham, and the manners of a Chesterfield, and yet fail if lacking in a good store of common-sense.

The personality of the doctor is even more important than the medicine chest. For the patient, faith in the pharmacopeia (fides) is not so helpful, by any means, as faith in the doctor himself (fiducia). There is an obvious reason, for the greatest number of cases of functional dyspepsia are of nervous origin, and to be explained by that blessed word neurasthenia.

This is a dyspeptic age—the stress and strain of life to-day is much too great. One is tempted to be laudator temporis acti. In Rome functional dyspepsia was cured with a feather in the vomitoria, and with it purge in Merrie England, and over-eating was the main cause of the disorder.

At the present time, there are many people who are dyspeptic from their mother’s womb, both mentally, physically and sometimes morally. Starvation will cure a few, but a tranquil mind and a good meal will cure a legion of those who think that Providence intended that their scanty meals were only sign-posts to indicate that they were to take their medicine either before or after.
Proceedings of the Rhise Group Symposium, Friday 22 November 2013

After the catastrophic earthquake in Christchurch, New Zealand, on 22 February 2011, the Rhise Group (researching the health implications of seismic events) was formed by Professor Michael Ardagh.

The main objective of the group was to facilitate understanding of the health impacts of the Christchurch earthquakes and, specifically, to enable collaboration and sharing of resources where appropriate. This has been achieved through the occasional forum and a shared website, able to be accessed by the 219 members of the group. In addition, the group encouraged a dedicated funding round for earthquake research from the Health Research Council of New Zealand and the Canterbury Medical Research Foundation.

This symposium is the most significant event hosted by the Rhise Group to date and allows the recipients of that funding round, and other researchers from within the Rhise Group, to present the current state of their research. Thanks go to the Emergency Care Foundation, Lane Neave Lawyers, University of Otago, Christchurch, Canterbury District Health Board, Canterbury Medical Research Foundation, and Emergency Care Co-ordinations Teams for sponsoring the symposium.

Within the wider, loose collaborative of researchers making up the Rhise Group is a small ‘working group’ based in the Emergency Department of Christchurch Hospital, and the University of Otago, Christchurch. The working group coordinates the activities of the Rhise Group and includes Professor Ardagh, Dr Joanne Deely, Ms Alieke Dierckx, Dr Sandra Richardson and Dr Martin Than.

Particular thanks go to Dr Deely and Ms Dierckx for putting this symposium together and Dr Deely and Professor Ardagh for editing the proceedings.
How did the earthquakes change health service utilisation in Canterbury?

David Meates  
Chief Executive Officer, Canterbury and West Coast District Health Boards

The earthquakes of 2010 and 2011 have changed the way the Canterbury health system is organised and services are provided. While many changes and much of the infrastructure and relationships had been developed prior to the earthquakes, the February quake resulted in further innovation resulting in new initiatives (e.g. eSCRV, CREST, medication management). These have further emphasised the role of keeping people well in their own homes and communities.

The combination of earthquakes, system changes and new approaches has significantly changed health service utilisation in Canterbury. The initial reduction in people accessing all services has been replaced by decreasing growth in the rate of acute admission as more people are looked after in the community. Decreases in acute care growth are strongest among the over 65-age group, where the population has increased. While these changes are not attributable to the earthquakes, these seismic events have acted as a catalyst to drive the system changes.

David Meates is Chief Executive of the Canterbury and West Coast District Health Boards (DHBs)—responsible for the health services for over 550,000 New Zealanders, and the leadership of over 9,500 direct employees and thousands more non-governmental organisation health sector workers contracted by the DHB. He is a big picture thinker and has particular skills in leading change, and motivating and mobilising others to be part of the transformation. David is passionate about health and what’s possible when people grasp the vision and work collectively for the greater good. The achievements of the Canterbury Health System are testimony to his leadership. Originally from Canterbury, David has worked in both the private and public sectors, in NZ and the UK. He has also led and been involved on a number of national groups ranging from workforce negotiations to CEO alliances. Recent experiences in Canterbury have shown David is adept at managing large teams through a crisis and developing and implementing robust recovery plans.

The initial health system response to the Christchurch earthquake

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A total of 182 people died and 6659 were treated for injuries during the first day following a violent earthquake that struck Christchurch city at 12.51 on 22 February 2011. A combination of huge peak ground accelerations, time of the day, and collapse of major buildings contributed to the numbers of people injured. We report on the injury burden of the Christchurch earthquake and the initial health system response.

175 of those killed died before arriving at hospital. Of the 6659 people injured, 2032 (31%) were male and 4627 (69%) female, and 2752 (41%) were between the ages of 40 and 59 years. Eighty-seven (1%) were children under the age of 10 and 950 (14%) adults over the age of 70 years. 142 people were admitted to hospital including 18 to the Intensive Care Unit. Fourteen people were treated for crush injury syndrome, six of whom required renal replacement therapy and a small number of people required amputations.

Experiences suggest that hospitals should prepare for: patients arriving on mass by extraordinary means, patients arriving with no pre-hospital care, loss of electronic registration and tracking of patients, patient unwillingness to come into hospital buildings, loss of all electricity, many unexpected willing helpers, loss of communication, media intrusion, and maintaining teamwork with explicit leadership.

Follow up research is concentrating on understanding the demographic distributions and causes of the injuries. (See abstracts by Johnston et. al. and Standing et al. in these proceedings.)


Michael Ardagh is a fellow of the Australasian College for Emergency Medicine and has a PhD in Bioethics. He is Professor of Emergency Medicine at the University of Otago, Christchurch, and Specialist in Emergency Medicine at Christchurch Hospital. He is National Clinical Director of Emergency Department Services (a position also known as ‘Target Champion’), to assist with implementation of the ‘Shorter Stays in the Emergency Department’ health target. He is Chair of the Rhise Group (Researching the health implications of seismic events) which was formed to encourage collaborative research regarding the Christchurch earthquakes of 2010 and 2011. Michael was made an Officer of New Zealand Order of Merit (ONZM) for services to medicine in 2012.

The 2010/2011 Canterbury earthquakes: context and cause of injury

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Little is known about the relationship between human behaviour and risk of injury during earthquakes. We aimed to fill this gap by analysing the New Zealand Accident Compensation Corporation database for causes and context of injury during the Canterbury earthquakes. The total injury burden was analysed for demography, context of injury, causes of injury, and injury type.

Three times as many people were injured in the Christchurch earthquake (22 February 2011) as in the Darfield earthquake (4 September 2010: 7171 vs 2256). Primary shaking caused approximately two-thirds of the injuries from both quakes. Actions during the main shaking and aftershocks led to many injuries.

Many people were injured after shaking stopped in both events. Most of these people were injured during clean-up. In both earthquakes: more females than males (1453 vs 803 Darfield; 4646 vs 2525 Christchurch) were injured; trip/fall was the most common cause of injury; and soft tissue injuries was the most common type of injury.

The findings of this study suggest that where people were and their behaviour during and after earthquakes influenced their risk of injury.

David Johnston is a senior scientist at GNS Science and Director of the Joint Centre for Disaster Research at Massey University. His research focuses on human responses to disasters, crisis decision-making, public education, and building community resilience and recovery. David is Chair of the international Integrated Research and Disaster Risk Scientific Committee. He is also on New Zealand’s Royal Society Social Science Advisory Panel, and the editor of the Australasian Journals of Disaster and Trauma Studies, and founding editor of the Journal of Applied Volcanology.

Spatial variations in stress-related health compared to earthquake exposure: preliminary results and future directions
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Fourth September 2010 saw the start of a series of destructive earthquakes around the city of Christchurch, New Zealand (pop 350,000). These left the region with widespread damage to the city and its infrastructure including: major liquefaction (the process by which the ground turns to liquid); 70% of the central city needing to be rebuilt; 20,000 homes needing to be pulled down; and 100,000 homes needing repairing.

The aftershocks are ongoing with over 13,000. It is hypothesised that all this will have an ongoing impact on those living in and around the city. The aims of this study were to identify whether adverse stress-related health outcomes were greater among people
who have experienced greater physical damage to their communities than those who have experienced less damage, but who also live in the region. Exposure to earthquake damage through amount & extent of liquefaction and land 'colour' (land colour coded according to whether it can be used in the future) was estimated.

Emergency department data was collated for chest pain and anxiety for a period of 6 months before and 18 months after the start of the earthquakes. Exposure was related to health. For the period from 1May 2010 to 30 April 2012, there were 9,807 chest pain and 524 anxiety hospital attendances. Those people living in areas of greater earthquake related damage and those living closer to more damaged areas had greater levels of stress-related ill health.

It is concluded that there is preliminary evidence that those living in and nearer to areas of greater earthquake impact have greater levels of stress-related ill-health. Further research funded by the Cooperative Research Centre for Spatial Information (CRCSI) is developing more indicators of earthquake impact such as: extent of home damage; infrastructure service closures and restriction, community disruption e.g. school & shop closure; extent of home damage; and magnitude of shaking. In addition population mobility is being included in this analysis.

Simon Kingham is Professor of Geography and Director of the GeoHealth Laboratory at the University of Canterbury, in Christchurch, New Zealand. He has carried out research in health and environment issues for over 20 years, specifically looking at environmental exposure. He is a Director of the GeoHealth Laboratory which is funded by the Ministry of Health to undertake applied research in the areas of health geography, spatial epidemiology and Geographical Information Systems. He has published his research widely and has a BA (Hons) and a PhD in Geography from Lancaster University, UK.

The role of Public Health in building resilience: from pandemics to earthquakes

Alistair Humphrey
Medical Officer of Health for Canterbury

Following the enactment of the 2002 New Zealand Civil Defence and Emergency Management Act in 2002, the Ministry for Civil Defence and Emergency Management (MCDEM) led local agencies in developing strategies for building resilience among Canterbury communities. With the looming spectre of “bird flu” (classification – H5N1), primary care led a multiagency approach to preparing for a pandemic.

Representatives from health, government agencies, non-government agencies and private business including media met monthly from August 2005 onwards to develop a strategic approach towards building resilience. One example was the development of the Pandemic Roadshow by MCDEM, Canterbury District Health Board and Science Alive museum.

The 2008 MCDEM national survey demonstrated that Cantabrians were more aware of the pandemic threat and generally better prepared for all hazards than other parts of New Zealand. Consequently, Canterbury performed well in response to the 2009 H1N1 pandemic. When struck by the earthquakes a year later, the issues promoted
during pandemic preparedness were equally pertinent: hand-washing, availability of sanitiser, water and food supplies and knowing your neighbours. Community briefings reinforced these messages, but were also promulgated using other media.

Water and sanitary health services were severely compromised after the 22 February aftershock; hand-washing, a boil water notice and provision of portaloos were key operational and communication issues for many weeks. However, community surveys showed that nearly 90% of Christchurch residents adhered to boiling water more than six weeks after the earthquake, which bought valuable time for the authorities to chlorinate the city water supply and prevent water borne disease. A heightened surveillance system revealed no increase in enteric disease after the earthquake.

Promotion of personal hygiene, emergency preparedness and social capital for an anticipated pandemic brought direct benefits to the Christchurch community following the earthquake. Broad interagency collaboration and sophisticated communication strategies facilitated this, and need to be maintained to sustain community resilience.

Alistair Humphrey is a Public Health Physician and GP in Christchurch. As Medical Officer of Health for Canterbury, he is designated by and responsible to the Director General of the Ministry of Health. Alistair is on the national pandemic preparedness group for New Zealand and the national group looking at the health effects of climate change (HAIFA). In 2011/2012, Alistair addressed the United Nations International Strategy for Disaster Reduction (UNISDR) global platform, the Towards a Safer World (TASW) group and the Global Risk Forum One Health Summit and other international meetings. He assisted the WHO Emergency Risk Management group in the development of their Safe Hospital Initiative and was an evaluator for the WHO’s Emergency Risk Framework exercise. Alistair holds a senior lectureship post at the University of Otago Medical School. He is a Fellow of the Australasian Faculty of Public Health Medicine, Royal Australian College of General Practitioners, Australian College of Rural Medicine, and a member of the UK Faculty of Public Health.

Earthquake stress and broken hearts

Cameron Lacey
Māori Health, University of Otago, Christchurch

Stress cardiomyopathy has been associated with stress and a large increase in the number of people presenting with this condition was seen following the earthquakes. The cause of this condition remains unknown, but psychiatric illnesses have been proposed as risk factors. We systematically assessed for antecedent psychiatric risk factors in two groups of cases (people who developed sporadic and earthquake-related broken heart syndrome) and compared them to a control group of healthy volunteers. We found that often psychiatric risk factors examined, only ‘neuroticism’ significantly differed between participants with broken heart syndrome and healthy volunteers. This suggests that the clinical assessment of psychiatric risk factors is unlikely to assist identification of patients at increased risk of broken heart syndrome. This presentation will also provide an overview of our efforts to identify a genetic risk for this condition.

Cameron Lacey is a consultation-liaison psychiatrist with a strong research interest in identification and treatment of psychiatric and cultural factors in medical illness. He is the principle investigator of a team of University of Otago Christchurch researchers including Prof R Mulder, Prof M Kennedy, Prof V
Cameron, J Zarifeh and Dr P Bridgman. This group has been investigating factors that contribute to the risk of developing stress cardiomyopathy.

‘It’s a thing you’ve got to sort of learn to live with really’: the findings from the Shaken Up study of older adults aged over 75 years following the seismic events in Christchurch, New Zealand, 2011

Kathy Peri
School of Nursing, Auckland University

This project aims to explore the ongoing impact of the Christchurch earthquakes on older peoples’ health in primary health care one year post Christchurch earthquakes. The participants were part of the BRIGHT (Brief Risk Identification Geriatric Health Tool) Trial which had been underway since 2007 and in total 1095 older adults aged 79 and over (31 are Maori aged 69 years and over) were enrolled.

The Shaken Up study proposed to re-interview these 1095 older adults to investigate their health status in the recovery phase 12 months after their 36 month BRIGHT trial interview, (up to 2 years after the earthquakes), meaning a total of 4 years follow up will be available. Pre-existing status and factors related to earthquake exposure will be examined as predictors of follow up status to identify predictors of poor outcome after earthquake.

The main outcomes measured health-related quality of life, NEADL (Nottingham Extended Activities of Daily living), depression, standard of living, family and social support and life satisfaction before, between, and post-earthquakes. Relationship with trajectories of health status (improved, maintained or declined) over the same and subsequent period will be explored.

Understanding population-level health of older people with primary care utilisation through the disaster period and 12 months subsequent will enable identification of particularly vulnerable groups of older age. This is internationally relevant as detailed health data before, during and after the disaster is seldom available. It is nationally relevant to enable appropriate planning for ongoing support for older people in Christchurch and other areas, should more disasters occur.

Kathy Peri is a registered nurse, senior lecturer and research Fellow at the School of Nursing, University of Auckland, and works two days a week at the Counties Manuka District Health Board as the Clinical Nurse Director for Health of Older People, New Zealand. Her research interests are centred on improving health outcomes for vulnerable older people and she is currently involved in a number of research projects including health robotics, non-pharmacological dementia interventions. Kathy was the Director of Nursing at the Princess Margaret Hospital in Christchurch during the earthquakes and has over the past two and half years been awarded three research grants to explore the impact of the Canterbury earthquakes on the quality of life in community dwelling older people over the age of 75 years. Kathy will present the results of the Health Research Council funded research project today.
Learning from Canterbury communities: factors that help and hinder community resilience

Louise Thornley¹, Emma Rawson²

¹. Quigley and Watts Ltd
². Community and Public Health, Canterbury District Health Board

Increasing community resilience is vital – disaster experts, central and local government, non-government organisations, and communities themselves all agree on this point. We know that building stronger communities is important, but how should this be done? This presentation will discuss findings from qualitative research with Canterbury communities after the 2010 and 2011 earthquakes. It will focus on the key role of pre-existing community infrastructure (e.g. local leaders, networks, and marae) in helping communities to adapt post-disaster and to build resilience to future crises.

Almost a third of participants in our research were Māori, mostly Ngāi Tahu. Our work highlighted marae as key hubs for emergency support and hosting people in need. Māori participants emphasised that iwi and marae infrastructure helped marae to respond quickly and effectively. Building stronger communities needs to be an everyday activity not an optional extra. Connected communities with good local infrastructure are healthier, recover faster from disasters, and are better prepared for future crises.

Louise Thornley is a social researcher specialising in public health. She contracts part-time to Quigley and Watts Ltd, an independent Wellington-based research company, and has recently started as Family Planning’s Research and Policy Advisor. Louise’s previous work experience is in government, university and community sectors. Before joining Quigley and Watts Ltd in 2006, she was a Senior Policy Analyst for the National Health Committee, and Research Fellow for Otago University, Wellington. Her background is in youth work and community development. She worked in Christchurch’s community sector for five years.

Emma Rawson, Ngati Ranginui, Ngai te Rangi, Raukawa, is a Māori Health Promoter based at the Canterbury District Health Board in Christchurch. Emma’s passions are Māori workforce development and Te Reo Māori as an important leadership tool for change, enhancing identity and wellbeing. She is a recent graduate of Leadership Training for Māori in Public Health, holds a B.A. Maori, University of Canterbury, Post Graduate Certificate in Public Health, University of Otago and is working on gaining a Masters in Health Science. Emma is currently working on projects in Christchurch that support wellbeing and resilience in Māori communities and building sustainable community infrastructure in vulnerable communities.

Occupational health of front line workers in Christchurch

David McBride¹, Kirsten Lovelock¹, Daniel Shepherd², Rex Billington²

¹. Department of Preventive and Social Medicine, University of Otago, Dunedin
². Department of Psychology, Auckland University of Technology

Front-line disaster workers are exposed to potentially disturbing events and hazardous exposures, and are potentially at risk of physical and emotional harm. As members of the community they also have to contend with ‘dual jeopardy’, death or injury in their
own family and damage to their personal property. This was a cross sectional study measuring the health status of responders and ‘significant others’ using the World Health Organisation (WHO) Health Related Quality of Life (HRQOL) questionnaire with additional instruments to identify (for example) post-traumatic stress symptoms, burnout and fatigue. Eligible participants were Christchurch residents living there on the 4 September 2010.

The survey was self-administered, facilitated through the various unions representing these occupational groups or CEOs for non-unionised workplaces. Power considerations indicated that 1,100 responses would allow adequate power. Our response rate was less than the 1,100 that we had aimed for: a total of 370 participants, 200 workers, 130 controls and 40 ‘significant others’.

Workers experienced, and reported dual jeopardy; reduced physical exercise; sleep deprivation; increased alcohol consumption and imbalance between job demands and decisional latitude, the latter leading to stress. Ambulance workers and fire-fighters reported sensitisation, mediated physiologically (elevated heart rate and blood pressure) and associated with increased anxiety, when responding to ‘everyday’ emergencies following the February earthquake.

Our research also provides further evidence that social support from family, peers, colleagues and wider social networks are central to maintaining resilience and reducing vulnerability. Significantly, existing and pre-existing employment relations are central to the nature of how front line workers initially respond to a natural disaster; cope in the aftermath of the disaster and try to remain healthy.

David McBride is an occupational physician who did his initial training with the British Coal Corporation as a Medical Officer. His responsibilities were collieries in the Staffordshire and Lancashire coal fields, the Mines Rescue Station at Boothstown and an experimental coal liquefaction plant in North Wales. He did his academic training at the University of Birmingham, and then was appointed Clinical Lecturer in 1991. He was appointed Senior Lecturer in Occupational Health at the University of Otago in 1995 and Associate Professor in 2011. He has been in the army as a reservist since 1973 and has some knowledge of ‘conflict medicine’, having served with the New Zealand Defence Force (NZDF) in Timor Leste and Afghanistan. On volunteering for another engagement with the NZDF serendipity must have been a factor in his posting as a Medical Officer to Burnham Camp over the period November 2010–December 2011. He then found himself on another ‘tour’ of Afghanistan in January 2012.

Facing the unexpected – health care workers and the emergency department response to 22 February earthquake

Sandra Richardson
Centre for Post Graduate Nursing Study, University of Otago, Christchurch

This study identifies the experiences and impact of the 22 February 2011 earthquake on those staff who contributed to the Emergency Department response. While there are individual reports from various natural disaster settings identifying personal reactions and perceptions, there is very little reported about the experience of health care providers who are both responders to and part of a disaster event.
The focus on health care responders is typically centred on the provision of care and ability to maintain normal services, with little exploring what it means to be part of a disaster situation, coping with competing personal, professional and family commitments.

This study commenced in the week following the February event, and involved one on one qualitative interviews with over 90 individuals who were involved in the emergency department response at this time. Given the presence of so many staff and volunteers from a wide range of backgrounds, it was intended to include a multidisciplinary perspective. As a result, interviews were undertaken with staff from medical, nursing, social work, blood bank, orderlies, Maori health and radiology, amongst others. Interviews were reviewed and core themes identified, which allow a clearer understanding of the experience of individuals, and the implications for professional groups and health care planners. A summary of issues and recommendations is presented resulting from this process.

Sandra Richardson is a Senior Lecturer with the Centre for Post Graduate Nursing Study at the University of Otago, Christchurch and Nurse Researcher in the Emergency Department, Canterbury District Health Board. Sandra’s research interests include Emergency Department crowding, advanced nursing practice and the impact and experience of the Canterbury Earthquake events.

Shaky times – the Canterbury earthquakes and all that has followed

Caroline Bell
Department of Psychological Medicine, University of Otago, Christchurch

Since 4 September 2010 there have been three major earthquakes and over 13,000 aftershocks in Christchurch inflicting substantial damage to the city. Widespread economic and practical consequences, particularly with insurance companies and the Earthquakes Commission (EQC), have created significant secondary stressors further compounding the difficulties of many. This has resulted in people presenting with a broad spectrum of psychological responses. A specialist team was set up by the Canterbury District Health Board to treat people with significant post-traumatic stress and anxiety and this team is continuing to see new presentations.

This paper will discuss the ongoing research of people presenting with post-traumatic stress disorder (PTSD) and those identifying as resilient. Two broad lines of research will be presented that aim at understanding the treatment and neurobiology of people with PTSD and those self-identifying as resilient.

Caroline Bell is a consultant psychiatrist and senior lecturer at the University of Otago in Christchurch with an expertise in anxiety. She has had a role in managing the psychosocial responses to the Canterbury earthquakes across the community and is the clinical lead of a treatment team for people with severe Post Traumatic Stress Disorder from the earthquakes.
The impact of Christchurch Earthquake on availability of diagnostic-test results

Kevin Taylor¹, Peter George¹, Joanne Deely²

1. Canterbury Health Laboratories, Canterbury District Health Board

2. Independent Contractor, Canterbury District Health Board

Between 60–70% of medical decisions are based on laboratory test results. With both community laboratories (MedLab South and Southern Community Laboratories) destroyed in the Christchurch earthquake, the performance of Canterbury Health Laboratories was integral to how the health system delivered care to Canterbury after the disaster.

This study assessed the effects of the Christchurch earthquake on turnaround times (TATs) at Canterbury Health Laboratories (CHL). We retrospectively examined 709,786 potassium and 196,795 urine-culture TATs from February 2010 to January 2013. Potassium was chosen for its low TAT (approximately 1.5 hours) and urine culture for its longer TAT (approximately 20 hours). Hospital and community data were evaluated separately and compared with the transport, registration, and analysis time phases.

From March 2011 through to June 2012, CHL undertook most of Canterbury’s community specimen testing in addition to the hospital testing. Monthly test numbers increased 30-fold for potassium and 60-fold for urine cultures. Transport times from the community increased by >20 hours (90th percentile) during the first few days when most courier fleets stopped operating in the city. Community transport time remained 2–3 hours above pre-quake levels during the main response period from March 2011 through to June 2012. Registration time increased by 10–20 minutes (hospital specimens) and 30–45 minutes (community specimens) for a short period when the system was overloaded. Community-urine-culture analysis time increased by >50 hours (90th percentile) during the first three months after the earthquake, when methodology needed revision to meet the demand. The increase in specimen numbers affected short- and long-duration test turnaround times differently.

Streamlining and automating processes reduced registration and analysis times. Increased transport time was outside the control of the laboratory.

Kevin Taylor is the Business and Innovations Manager at Canterbury Health Laboratories. He was part of Canterbury Health Laboratories earthquake response team. He is a medical laboratory scientist, specialising in laboratory quality management and solving problems with unique and novel outcomes.

Peter George is Clinical Director of the Canterbury Health Laboratories. He is a consultant to nine private and public hospitals in both the North and South islands of New Zealand. He is the recipient of over 30 major research grants. His research interests are molecular pathology of human disease and the development, translation and application of advanced methods for the diagnosis of disease, and cardiac risk.

Joanne Deely is a scientist and medical writer. She was commissioned by Canterbury Health Laboratories to document the impact of the Christchurch earthquake on the laboratories. She is a member of the Rhise working group, Emergency Medicine and Nursing Research Group, Medical Writers Association Australasia (MWAA), and Technical Communicators Association, New Zealand (tcanz), and Royal Society of New Zealand (MRSNZ).
The 22 February 2011 Christchurch Earthquake: a gender disparity amongst earthquake victims

Sarah Standring\textsuperscript{1}, Michael Ardagh\textsuperscript{2}, Joanne Deely\textsuperscript{3}, David Johnston\textsuperscript{4}, Viki Robinson\textsuperscript{5}, Sandra Richardson\textsuperscript{6}, Martin Than\textsuperscript{5}, Pauline Gulliver\textsuperscript{7}, Alieke Dierckx\textsuperscript{3}

1. School of Medicine, University of Auckland
2. Department of Surgery, University of Otago, Christchurch
3. Independent Contractor, Canterbury District Heath Board
4. Joint Centre for Disaster Research, GNS Science/Massey University
5. Emergency Department, Christchurch Hospital
6. Centre for Post Graduate Nursing Study, University of Otago, Christchurch
7. Injury Prevention Research Unit, University of Otago, Dunedin

A magnitude 6.3 earthquake struck Christchurch on 22 February 2011 at 12.51pm. In the first 24 hours, 182 people were killed and 6659 people injured.\textsuperscript{1} A significant gender disparity was observed within the injured population with nearly twice as many females injured as males.

The aim of this study was to investigate the demography of patients injured. The study was divided into two parts. Firstly, the nature of the gender disparity amongst the hospitalised earthquake victims was stratified for injury severity. Gender distributions within these groups were then examined. Secondly, demography of injured patients was compared with baseline population demographics and possible causes of injury. A ratio of approximately 2:1 females to males was found in both parts of this study. Preliminary results suggest a relationship between the gender disparity and actions taken during the shaking.


Sarah Standring is a fourth year medical student studying at the University of Auckland, based at Auckland City Hospital in 2013. For the past three summers, she has worked under the guidance of Professor David Johnston and Professor Mike Ardagh on projects investigating injuries resulting from the major earthquakes in Christchurch. She is interested in emergency medicine and medical teaching, but would also like to become more involved in research in future.
Behavioral responses to immediate shaking in earthquakes in Christchurch, New Zealand and Hitachi, Japan
Michael Lindell\textsuperscript{1}, Carla Prater\textsuperscript{1}, Shih Che Wu\textsuperscript{1}, Shih-Kai Huan\textsuperscript{1}, David Johnston\textsuperscript{2}, Julia Becker\textsuperscript{2}, Hideyuki Shiroshita\textsuperscript{3}

1. Hazard Reduction & Recovery Center, Texas A&M University
2. Joint Centre for Disaster Research, GNS Science/Massey University
3. Faculty of Safety Science, Kansai University

This study compared people’s immediate responses to earthquakes in Christchurch, New Zealand, and Hitachi, Japan. 257 people in Christchurch and 332 people in Hitachi were surveyed for their emotional reactions, risk perceptions, and immediate protective actions during the shaking. In both cities, respondents’ physical, household, and social contexts were similar. In Hitachi, residents reported slightly higher levels of emotional reactions and risk perception than did Christchurch residents.

Contrary to the advice of emergency officials, the most frequent response in both cities was to freeze. Christchurch residents more often dropped and took cover than Hitachi residents. Hitachi respondents more frequently immediately evacuated from buildings than Christchurch respondents. There were small correlations between immediate behavioural responses and demographic characteristics; previous earthquake experience; and physical, social, or household context.

David Johnston is a senior scientist at GNS Science and Director of the Joint Centre for Disaster Research at Massey University. His research focuses on human responses to disasters, crisis decision-making, public education, and building community resilience and recovery. David is Chair of the international Integrated Research and Disaster Risk Scientific Committee. He is also on New Zealand’s Royal Society Social Science Advisory Panel, and the editor of the Australasian Journals of Disaster and Trauma Studies, and founding editor of the Journal of Applied Volcanology.

Human response to earthquake shaking: analysis of video footage of the 2010–2011 Christchurch earthquake sequence
Emily Lambie\textsuperscript{1}, Thomas Wilson\textsuperscript{1}, David Johnston\textsuperscript{2}, Steven Jensen\textsuperscript{3}, Erik Brogt\textsuperscript{4}

1. Department of Geological Sciences, University of Canterbury
2. Joint Centre for Disaster Research, GNS Science/Massey University
3. Preparedness, Health and Safety Services, California State University
4. Academic Development Group, University of Canterbury

The influences on human behaviour during earthquake shaking include the environment the individual is located in immediately before and during the earthquake; who the individual is with at the time of the earthquake; individual characteristics, such as age, gender, previous earthquake experience, etc.; and the intensity and duration of earthquake shaking. However, little research to date has systematically analysed the immediate observable human responses to earthquake shaking, mostly due to data constraints and/or ethical considerations. Research on
human behaviour during earthquakes has relied on simulations or post-event, reflective interviews and questionnaire studies, often performed months or years following the event. Such studies are therefore subject to limitations such as the quality of the participant's memory or realism of a simulation.

The aim of this research is to develop a robust coding scheme to analyse human behaviour during earthquake shaking using video footage. This allows actual observations of individuals during real earthquakes. The coding scheme was developed in a two-part process, combining a deductive and inductive approach. Previous research studies of human behavioural response during disasters and other crisis events provided the basis for the coding scheme. This was iteratively refined by applying the coding scheme to a broad range of video footage of people exposed to strong shaking during the Canterbury earthquake sequence. The aim of this was to optimise coding scheme content and application across a broad range of scenarios, and to increase inter-rater reliability. The methodology developed will enhance objective observation of video footage to explore: reaction time, patterns of behaviour, and social, environmental and situational influences of behaviour. This will provide guidance for building configuration and design, and evidence-based recommendations for public education about injury-preventing behavioural responses during earthquake shaking.

Emily Lambie is currently studying towards her Masters degree at the University of Canterbury. Her research topic is developing a methodology to analyse immediate behavioural response to earthquake shaking, using video footage from the recent Christchurch earthquake sequence. Her interests are natural hazards, risk assessment and communication and disaster risk reduction.

**Smoking, relapse and the Christchurch earthquakes**

**Vivien Daley**

*Smokefree Manager, Canterbury District Health Board*

The magnitude 7.1 Canterbury earthquake in September 2010 and associated aftershocks caused untold damage, drastically changed residents' living, working, and social conditions, and took the lives of 185 people. A local study has shown that the prevalence of smoking increased following both the September 2010 and the February 2011 quakes, mainly attributable to ex-smokers relapsing.

Tobacco consumption in those currently smoking increased. The normalisation of smoking as a valid response to the stress caused by a traumatic event is discussed. This presentation outlines the need for disaster planning to include initiatives to ensure that access to Nicotine Replacement Therapy (NRT) is available for people making quit attempts following a disaster and to ensure that relevant public health messages around smoking are promoted and distributed.

Vivien Daley is the Smokefree Manager of the Canterbury District Health Board, with responsibility for developing the strategic direction for Smokefree in the Canterbury District Health Board area. Her current focus is the implementation of the ABC Strategy for Smoking Cessation across primary and secondary care, and the community. Her previous work history includes some years at Pegasus Health as Population Health Manager, time at the Christchurch School of Medicine conducting research in the adolescent sexual health area, and many years working in health promotion in the community. Vivien
is a current member of the National Smokefree Working Party. She has held the role of Vice-President of the Public Health Association of New Zealand and was a Council member of the Health Promotion Forum (NZ) for many years. Vivien is a past Chairperson of Smokefree Canterbury.

The challenges for general practitioners (GPs) following the 2010/2011 Canterbury earthquakes

Sarb Johal, Zoe Mounsey, Robyn Tuohy, David Johnston
Joint Centre for Disaster Research, Massey University

This research aimed to explore how GPs coped with the dual challenges of personal and work demands during disaster response and recovery in Canterbury. The study was qualitative using semi-structured interviews with eight GPs from the Christchurch area exploring their experiences. The interviews revealed that the GPs faced a range of challenges including dealing with a different and increased workload. Some practices experienced higher workloads due to population migration whereas other GPs found themselves without a job.

GPs engaged a wide-range of coping behaviours including accessing peer support, taking time away from work, and avoidance of news media. Many GPs experienced significant increases in workload indicating a need to coordinate locum support after disaster. GPs identified a number of effective coping behaviours though some only in hindsight. It is likely that greater awareness of self-care strategies such as part-time working would benefit GPs responding to disasters. This study has workforce planning implications.

Sarb Johal is Associate Professor of Disaster Mental Health, Joint Centre for Disaster Research, School of Psychology, Massey University. Sarb’s research interests include psychological impacts of and recovery from disasters.

The participation and quality of life outcomes following physical disability as a result of an earthquake: a systematic review

Joanne Nunnerley¹, Gary Hooper¹, Tim Woodfield¹, Kathryn McPherson², Jennifer Dunn¹

1. Department of Orthopaedic Surgery & Musculoskeletal Medicine, University of Otago, Christchurch
2. Health and Rehabilitation Research Institute, Auckland University of Technology

In 2011 approximately 14,629 people worldwide were injured in earthquakes. Earthquakes produce a unique injury picture, but little is known about the health and wellbeing outcomes of individuals injured in earthquakes. The primary aim of this review was to quantify levels of participation and Quality of Life (QOL) in individuals with earthquake related injuries.

This systematic review was based on the guidelines from the National Health Service Centre for Reviews and Dissemination. A literature search was conducted on the
following databases: Ovid on Medline, Embase, PsycINFO (American Psychological Association database), CINAHL (Cumulative Index to Nursing and Allied Health), and AMED (Allied and Complementary Medicine Database). Inclusion criteria were limited to studies involving participation or QOL outcomes in adults with physical injury sustained in an earthquake. One researcher undertook the search, screening and appraisal using the Critical Appraisal Skills Programme (CASP) to assess quality with 10% of the articles independently reviewed for reliability by two other researchers. Data from the included studies was extracted on: the intervention aims, study aims, study design, methods used, characteristics of participants, characteristics of the study setting, outcome measures used, and reported findings. Of 414 identified articles, only four articles meet the inclusion criteria. The included articles reported outcomes from the 2001 Gujarat, and 2008 Sichuan earthquake.

The results from these studies from earthquakes occurring in developing countries indicated that victims, who experienced Spinal Cord Injury or fractures, continued to have limitations in function, participation and reduced QOL between 1.5 and 2 years post injury. The research into participation outcomes following physical disability from earthquake injury is limited and has methodological limitations.

The results indicate potential benefit from participation focused rehabilitation for individuals with earthquake related trauma, which may include international assistance in developed countries. More research is required into participation and QOL outcomes for people injured in earthquakes in developed countries.

Joanne Nunnerley graduated as a physiotherapist in the UK in 1996. She has worked at the Burwood Spinal Unit in Christchurch since 2001, and part time as a clinical researcher for the Burwood Academy of Independent Living since 2007. Joanne is currently a PhD candidate at the University of Otago, Christchurch.

Lessons from the February 2011 earthquake for the training and preparation of post graduate year-one doctors

Dale Sheehan1, John Thwaites1, Blair York2, Alex Lee2

1. Medical Education and Training Unit, Canterbury District Health Board

2. RMO Unit, Canterbury District Health Board

On that fateful day in February there was considerable distress and damage throughout the three hospitals which impacted on the junior medical workforce working on the wards and in clinics. The study was undertaken to document and describe postgraduate year 1 (PGY1) house officer’s personal and professional experience of the Christchurch earthquakes. This retrospective study used a mixed methods design and is part of the Researching the Health Implications of Seismic Event group (RHISE).

While the Canterbury District Health Board did have and does have a current disaster plan, improved training for junior doctors is required to ensure that they have a clearer understanding and awareness of disaster management at both a professional and a personal level.1 In addition, qualitative data from the survey and thematic analysis of the narratives shows that few doctors were emotionally prepared for the events of 22
February 2011. This poster focuses on the qualitative data, which provide an insight into the experience and reminds us of the personal impact of any disaster on a workforce. After the event, house officers reported feeling shocked, vague and tired, and some were worried about making good judgements. One respondent said ‘It was just hard, everything was much more emotional and intense and at work you can’t just fall apart, so you just focus on doing your job’.

Ways in which House Officer’s found work difficult in the weeks following the earthquake included lack of sleep because of aftershocks, distressed patients, altered living conditions, travel problems and the fact that they had a run (ward) change a week after the event. We hope this study can contribute to and spark interest into further exploring the emotional impact of such events within the health research community.

Reference: 1NZMJ 2013;126:93–94.

Dale Sheehan is Medical Education Coordinator, Medical Education and Training Unit, CDHB and Senior lecturer in clinical teaching and supervision, School of Health Sciences University of Canterbury. Dale’s interests are in junior doctor education, clinical teaching and supervision. John Thwaites is Director of Clinical Education, Medical Education and Training Unit, CDHB. As well as being a physician John has a strong research and practice interest in medical education at all stages of the medical education continuum. Blaire York and Alex Lee where PGY1 House Officers at CDHB at the time that this work was undertaken.

Costs and effects: analysing the social costs of the Canterbury earthquakes

Ann Brower¹, Josh Flores², David Johnston³, Kelvin Berryman⁴

1. Faculty of Environment, Society and Design, Lincoln University
2. BEMP candidate, Lincoln University
3. Joint Centre for Disaster Research, GNS Science/Massey University
4. Natural Hazards Research Platform, GNS Science

On 22 February 2011, the built environment of Canterbury caused 183 deaths¹ (of 185 in total) and 3127 injuries (of 7171 in total). In the case of many seismic retrofits and make-safe actions, the owner pays the costs of an upgrade, while the public pays the cost of failing to upgrade. This privatises the cost of action, while socialising the risk of inaction. Our research aims to contribute to national dialogue around building safety by examining the social costs of failing to act to retrofit or make-safe, more specifically by:

- Quantifying the financial costs of injuries and opportunity costs of fatalities caused by the built environment on the 22 February earthquake
- Quantifying a proxy for the economic contribution of the buildings involved by using sales history and government valuations
- Analysing these data spatially via GIS

Our poster elaborates on a snapshot of one building, showing the data we are collecting around the city. Fortunately, it is not a representative sample of the city.
We use it to illustrate what analysis is possible, with the hopes of generating suggestions from colleagues about questions to ask, data to include, methods to pursue, and pitfalls to avoid.

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http://www.nzsee.org.nz/db/SpecialIssue/44(4)/0227.pdf

Ann Brower is a Senior Lecturer in Environmental Policy in the Department of Environmental Management at Lincoln University. She holds a PhD in Environmental Science, Policy, and Management from the University of California Berkeley. She also holds a Masters degree in Forest Science from Yale University, and Political Science from the University of California Berkeley. Her specialty is environmental policy, especially as it relates to state-owned lands and natural resources in the US, Australia, and New Zealand. She is the author of ‘Who owns the high country?’ (Craig Potton Publishing, 2008), which stimulated a national debate about the ongoing South Island land reform that is transforming the landscapes of the Southern Alps. Borrowing from Wildavsky (1973), her book aims to uncover how great expectations in Wellington were dashed in Wanaka. She has published in numerous journals, including the Georgetown International Environmental Law Review, Conservation Letters, NZ Journal of Ecology, and Land Economics.

Crisis leadership in an acute clinical setting: Christchurch Hospital Intensive Care Unit, February 2011

Lev Zhuravsky
Charge Nurse Manager, Day Stay Unit, Christchurch Hospital

An Intensive Care Unit (ICU) is a geographically distinct area of a hospital where critically ill and injured patients undergo continuous monitoring and support of failing organ systems. Leadership in the ICU, both in the routine environment and crisis situations is critical. The health response to the Christchurch earthquake was unique because this city with an urban population of about 400,000 people has only one hospital with an emergency department and intensive care unit.

The main purpose of this study was to investigate if shared leadership is possible and warranted during a crisis engendered by a natural disaster, through an exploration of the nature of both specialist and nursing leadership in the Intensive Care Unit of Christchurch Hospital within the first seventy two hours of the earthquake. This qualitative study explores the Intensive Care’s staff experiences and adopted leadership approaches to manage the large scale crisis resulting from the city-wide disaster. Indepth interviews were conducted with ten members of the ICU team. Thematic analysis of the verbatim transcriptions revealed three main global themes: core formal leadership competencies, a role of informal leadership in crisis, and a contribution of shared leadership approach to an overall management of a crisis.

This research highlighted the importance of main formal leadership competencies such as decision making abilities, ability to remain calm and effective.
communication. A contribution of an informal leadership focussed on motivation to lead, autonomy and emotional support. Shared leadership played an important role in managing a complex critical situation triggered by a natural disaster. The results of this research could potentially add value to the research field of crisis leadership and contribute to the development of professional and personal capacity building programmes and interventions aiming to assist existing and future leaders in managing complex crises.

Lev Zhuravsky is a nurse manager with particular expertise in crisis leadership, trauma, critical care nursing, and project management. He has worked in trauma ICU at one of the largest trauma centres in Israel. From 2002–2008, Lev worked in the ICU of Christchurch hospital. In a capacity of CNM of medical ward Lev was actively involved in relocation and re-establishment of acute medical services after the Christchurch earthquake. In 2013, he completed his Masters on crisis leadership in the intensive care unit of Christchurch Hospital during February’s earthquake. Lev’s main research and project development interests include: creating competency-based crisis leadership training programmes, motivation to lead, fostering and support of informal leadership in crisis, shared leadership in critical situations, crisis and disaster management. He received a Christchurch Earthquake Award for Service in 2012. Contact: Lev.zhuravsky@cdhb.health.nz

The value of integrated midwifery care in natural disasters

Rose Barker¹, Samantha Burke², Margaret Kyle³, Claire MacDonald³

Midwife, Canterbury District

1. Director of Midwifery, Women's & Children's Health, Christchurch Women's Hospital

2. Co-Chair, Canterbury & West Coast Region New Zealand College of Midwives

This poster demonstrates the effectiveness and resilience of the New Zealand maternity system throughout a time of natural disaster, the Christchurch Earthquake in February 2011 and in the weeks and months following this.

The maternity system and midwifery care continued with little change for women with midwives continuing to provide care throughout pregnancy, labour and birth and in the postnatal period. Midwives continued to provide care in the woman’s home, in clinics or in hospital. For some women, and their whanau, the midwife visiting them at home was the first ‘official’ person they saw following the earthquakes. Some women chose to leave Christchurch after the earthquakes. Midwives from around New Zealand were willing to provide care for women who arrived in their area, usually at short notice, and at any stage of pregnancy. Most women in Christchurch have midwifery notes which they carry throughout their pregnancy, birth and postnatal period. These are standardised maternity notes developed by the Midwifery and Maternity Providers Organisation (MMPO), which was established by the New Zealand College of Midwives in 1997 to provide its Lead Maternity Carer midwives with a supportive practice management and quality assurance structure and a business framework.

The effectiveness of this system was also demonstrated following the earthquakes when women leaving Christchurch were able to leave with a record of their care and
history. This meant that their midwifery care could be provided in a seamless manner by midwives, throughout New Zealand who continued to provide their care.

This poster was put together in a joint initiative by the Canterbury / West Coast Region and National Office of the New Zealand College of Midwives and by staff from Women’s and Children’s Health, Canterbury District Health Board. The New Zealand College of Midwives is the professional organisation for midwives, representing nearly 90% of practising midwives in New Zealand. It offers professional information, education and advice to women, midwives, District Health Boards, workforce unions, schools of midwifery and the Ministry of Health regarding midwifery and maternity issues. The College sets professional standards, provides continuing education for registered midwives and conducts the Midwifery Standards Review process for all practising midwives in New Zealand. To maintain its woman-centred focus, the College works in partnership with women by encouraging consumer membership and involvement in the development and maintenance of the midwifery profession. Women and Children’s’ Health, Canterbury District Health Board has a range of maternity services including pregnancy and parenting classes, pregnancy testing and post-natal care. Women can birth at Christchurch Women's, Burwood, Ashburton, Lincoln and Rangiora hospitals. Christchurch Women’s Hospital provides a tertiary level maternity service and the other units provide primary care with the midwives employed within the CDHB providing 24 hour care for the woman’s postnatal stay. They also provide back up and support for the woman’s Lead Maternity Carer whilst the woman is in labour and birthing her baby.

Resilience of the Canterbury hospital system to the 2011 Christchurch Earthquake

Jason McIntosh1, Caitlin C Jacques2, Sonia Giovinazzi3, Thomas D Kirsch2, Thomas Wilson1, and Judith Mitrani-Reiser2

1. Department of Geological Sciences, University of Canterbury
2. Department of Civil Engineering, Johns Hopkins University
3. Department of Civil and Natural Resources Engineering, University of Canterbury

This research analysed the performance of the Canterbury hospital system during to the 2010–2011 Canterbury earthquakes in New Zealand using a holistic and multidisciplinary approach. The aim was to identify the resilience factors that allowed the compromised system to adapt and continue to provide health services in the emergency and recovery phases, and to translate them into metrics and models that might be used worldwide to assess and compare alternative resilience enhancement strategies for hospitals. Data on the performance of the physical, human and organizational infrastructures of the Canterbury hospital system were collated in an integrated and geocoded database. A fault-tree analysis method that forecasts loss of hospital services as a function of loss of critical utilities was developed based on physical relationships within a hospital, and tested using the aforementioned data. Two new resilience metric equations, for quantifying hospital residual capacity and quality of care, were proposed and calibrated on the collected data.

Sonia Giovinazzi’s expertise and research activities focus on seismic risk analysis and damage scenarios, toward seismic risk mitigation and management and post-disaster resilient recovery at regional scale. Sonia is currently a Research Fellow in Risk Management at the Civil and Natural Resources Engineering Department, at University of Canterbury, NZ. In the aftermath of the
Canterbury earthquakes, Sonia led different projects funded by the Natural Hazard Research Platform of NZ, to provide on-the-ground support to the initial recovery phase for multiple end-users and agencies, including the Canterbury Health District Board. Sonia acted as a consultant for the Canterbury Earthquake Recovery Authority (CERA) on decision support tools for post-disaster reconstruction planning at the urban scale.

Software in hard times: creating a disaster response application for health systems

Jacob DuVal\textsuperscript{1}, Dominic Johnpillai\textsuperscript{1,2}

1. Iron Wing medical software company, Christchurch
2. Faculty of Medicine, University of Cambridge

The frequency and magnitude of major emergencies are on the rise. Larger buildings, populations, lifeline, and transportation systems increase the risk posed by natural disasters or human errors/intent. Response systems must compete with this growth in risk, and technological innovation is undeniably essential to success.

This project aims to accelerate existing disaster response systems by creating a website and mobile application. Activation of the Response Plan will push notifications to personnel via the app and allow the user to indicate safety and availability. Individual profiles will allow the system to automatically assign available professionals to specific controller or team roles based upon specialty and seniority. Relevant sub-plans will then be instantly delivered to a professional’s phone. It will also display patient numbers per triage category and emergency department/intensive care unit bed availabilities, and information entered by controllers using the web system.

This design will facilitate a rapid, effective response despite chaos and a ticking clock. Future expansion will leverage internal messaging to enhance dynamic control, GPS location of team members within the hospital and even provide ‘off-line’ use.

Dominic Johnpillai is a final year medical student at University College London and is conducting emergency response research in his hometown, Christchurch, during his elective there. He graduated from pre-clinical medicine at the University of Cambridge in 2011, the same year he received the Pathology Dissertation Prize for research in public health. He is co-founder of Iron Wing, a medical software development company.

Jacob DuVal is an intermediate software engineer currently working at Canterbury Business Solutions. Since graduating from Canterbury University, he has played pivotal roles in developing large social media platforms as well as in medical software. Jacob is a regular speaker at the .Net User Group and is also a co-founder of Iron Wing.
UC CEISMIC: a federated database for post-disaster research and information management

Paul Millar, James Smithies, Christopher Thomson
School of Humanities and Creative Arts, University of Canterbury

Following the earthquake that struck Christchurch on 22 February 2011, staff in the School of Humanities at the University of Canterbury initiated a digital archive project to create an open-access repository of information about the earthquakes and their impacts upon the Canterbury region.

Building upon overseas models, such as the 9/11 Digital Archive and the Hurricane Memory Bank, the project quickly grew into a Consortium of regional and national cultural heritage institutions, using a federated database architecture to create and aggregate multiple collections of digital objects and websites. By engaging with New Zealand’s existing national digital infrastructure and services – notably DigitalNZ, a unit of the National Library of New Zealand – UC CEISMIC has created a broad-ranging collection of primary and secondary materials relevant to the Canterbury earthquakes, and is working to enable discovery and re-use of this digital content. To address the need for a dedicated research node within UC CEISMIC’s federated database, the University of Canterbury built a digital object repository, QuakeStudies that provides a dedicated space for research files and data as well as large collections of documents, images and video.

About 200 organisations and individuals have contributed to the approximately 40,000 records UC CEISMIC makes available to the public, and more than 50% of these are stored in QuakeStudies. A programme office has been established at the University of Canterbury to work with individuals, community groups, local and government agencies, and businesses to build the archive still further. Health research has been identified as a significant gap at present, but there is strong potential to remedy this by connecting the work of the Rhise group with UC CEISMIC.

Paul Millar coordinates the University of Canterbury's English, Cinema and Digital Humanities programmes. He researches and teaches in the areas of New Zealand Literature and Literary Biography, and has published extensively on the poetry of James K. Baxter. His most recent book is the co-authored study The Snake-Haired Muse: James K. Baxter and Classical Mythology (VUP, 2011), and his acclaimed literary biography No Fretful Sleeper: A Life of Bill Pearson (AUP, 2010) was a finalist in the New Zealand Post Book Awards. Millar has twice judged the New Zealand Book Awards, and in 2000 he was awarded a Fulbright Fellowship to teach and research at the University of Hawaii at Manoa. Millar's long association with digital humanities projects dates back to 2001 when he co-founded the New Zealand Electronic Text Centre (www.nzetc.org).

James Smithies was the project manager for UC CEISMIC from inception through to go-live. Now the programme is operational, he's developing the UC Digital Humanities Programme. He completed a Ph.D. in the history of New Zealand literary-cultural criticism in 2002, and has worked as a technical writer, senior business analyst and IT project manager. His research focuses on the history of literature, technology and ideas. His current research project explores the literature, culture and technology of nineteenth century New Zealand. He is involved in several digital humanities initiatives, including the UC CEISMIC Digital Archive, http://humanitiesmachine.org.nz and academicami.org.

Christopher Thomson is the UC CEISMIC Programme Office Manager. He completed a Ph.D. at the University of Canterbury and has taught there regularly as a fixed-term lecturer and teaching assistant. He has also worked in the fields of audio transcription and e-learning. He is currently working on editing and publishing WWI letters as part of the WW100 ‘Life 100 Years Ago’ project, and he is a
‘Ripple effects’ on older people of the Canterbury earthquakes: results from a national longitudinal study

Sally Keeling1, Fiona Alpass2, Christine Stephens2, Brendan Stevenson3

1. Department of Medicine, University of Otago, Christchurch
2. School of Psychology, Massey University
3. Centre for Maori Health Research and Development, Massey University

The timing of the 2010 and 2012 surveys conducted by the New Zealand Longitudinal Study of Ageing provides a clear “before and after” dimension to the exploration of the impacts of the Canterbury earthquakes on the study population of older people. Our data shows some effects (after controlling for baseline differences) on measures of living standards, as well as on physical and mental health, according to location, and degrees of recorded direct and indirect exposure to the Canterbury earthquakes. In particular, the aspects of control and self-realisation within the quality of life measure show different trends based on location and exposure to earthquake effects. Other psychosocial measures of loneliness and depression also show regional differences. These differences are not unidirectional or consistently negative, to the extent that some exposure suggests positive outcomes on some measures. The relevance and value of these findings in terms of policy will be further enhanced by our future ability to continue to track such effects over the longer term, in light of the scale and duration of the Canterbury recovery process, and of other emerging phases of this country’s exposure to a potentially hazardous seismic environment.

This paper comes from the Health and Ageing Research Team (HART), which was established in 2004 in the School of Psychology, Massey University and includes Professor Fiona Alpass, Professor Chris Stephens, Dr Joanne Taylor, Dr Rachael Pond, Mr Brendan Stevenson, & Ms Vicki Beagley from Psychology; Professor Steve La Grow, Dr Mary Breheny, Dr Andy Towers, & Dr Polly Yeung from Health and Social Services; Dr Juliana Mansvelt from People, Environment and Planning; and Dr Sally Keeling from the University of Otago, Christchurch. Among the projects HART has led, is a longitudinal study of older New Zealanders begun in 2006 which has encompassed numerous research partners (Research Centre for Māori Health and Development; New Zealand Institute for Research on Ageing; Family Centre Social Policy Research Unit), four discrete data collection waves, and over 8000 participants. HART data from the 2012 data collection included a number of Christchurch earthquake specific questions allowing changes in participants status due to the Christchurch earthquakes to be assessed.

Sally Keeling is a social scientist who works as a Senior Lecturer in the Dept of Medicine, University of Otago, Christchurch. Her research interests for the last 20 years have explored the social context of ageing in New Zealand, through involvement with several longitudinal interdisciplinary studies of ageing, health and wellbeing, with a particular focus on social support and family caregiving, and implications for policy and practice.
The influences on return to employment/productivity for people injured as a result of the Christchurch 22 February 2011 earthquake: a grounded theory study

Joanne Nunnerley¹, Jennifer Dunn¹, Kathryn McPherson², Tim Woodfield¹, Gary Hooper¹

1. Department of Orthopaedic Surgery & Musculoskeletal Medicine, University of Otago, Christchurch
2. Health and Rehabilitation Research Institute, Auckland University of Technology

Return to work (RTW) following injury improves quality of life, restores important pre-injury roles and is a means of social interaction. Despite the importance of employment, the RTW rate in spinal cord injury (SCI) and other trauma populations is comparatively low. A systematic review of the literature showed low RTW following injury in an earthquake in a developing country, but no studies investigated these outcomes in a developed country.

The aim of this study was to explore factors that influenced return to employment/productivity (such as home making, school or education programs, community organisation and leisure time activities) for individuals with moderate or severe injuries requiring hospitalisation as a result of the 22 February Christchurch earthquake. Semi-structured Interviews of 14 people with moderate or severe injuries were performed at two time points. In addition professionals involved in the RTW process were interviewed (n=12). The study used a constructivist grounded theory methodology in keeping with Charmaz’s approach.

Data Analysis focussed on the differences in the RTW processes and outcomes as a result of the earthquake. Preliminary results show good RTW rates in the injured individuals from the Christchurch earthquake. There are unique factors influencing RTW in individuals injured in the Christchurch earthquake compared to other trauma populations. The themes identified include the shared experience of being involved in the earthquake, the secondary effects of the earthquakes, and the uniqueness of the injury.

The return to employment/productivity following traumatic injury as a result of an earthquake is complicated by ongoing environmental factors. However the positive influences on RTW could be utilised in the non-earthquake related trauma population to improve employment/productivity outcomes.

Joanne Nunnerley graduated as a physiotherapist in the UK in 1996. She has worked at the Burwood Spinal Unit in Christchurch since 2001, and part time as a clinical researcher for the Burwood Academy of Independent Living since 2007. Joanne is currently a PhD candidate at the University of Otago, Christchurch.
Employee resilience and organisational factors: the workplace as a venue for building community resilience

Katharina Näswall¹, Sanna Malinen², Joana Kuntz¹

1. Department of Psychology, University of Canterbury
2. Department of Management, University of Canterbury

To date, the resilience literature mainly focuses on the clinical notion of coping with challenging life circumstances, and views the construct as primarily dispositional. However, recent research has proposed a departure from the trait-like approach, suggesting that resilience can be cultivated, and that successful adaptation to adversity or change is symptomatic of its developable nature. Despite the likely connections to positive responses in changing environments, the investigation of resilience in the workplace is largely limited to an organisation-level assessment, or to the trait-based approach, without looking at the aspects of resilience among employees which can be facilitated by the organization. Also, research to date has yet to investigate the association between employee resilience and important work-related outcomes.

The present study aims to introduce a measure of employee resilience, developed to assess the interplay between employee and the organization in facilitating proactive and adaptive behaviours during organisational change. The study also aims to investigate the relationship between employee resilience and organizational factors, such as organizational support and participation as predictors of employee resilience, and work-related attitudes as outcomes of resilience. The data was collected in a New Zealand professional organization. The context includes both internal (changes to workload and performance management) and external challenges (economic turbulence and the parts of the country recovering from natural disaster). The preliminary results indicate that the newly developed measure of employee resilience indeed captures something that is not a trait or a coping strategy.

Results of regression analyses indicate that employee resilience is related to important work-related attitudes such as higher job satisfaction and engagement, and lower turnover intention. Even though the results of the present study are preliminary in that the research questions are only tested in a cross-sectional sample and thus cannot allow for causal inferences, they are promising by their indicating that employee resilience can be affected by organizational factors such as support and participation, and that it relates to positive outcomes which benefit both the employee and the organization. In turn, employee resilience and facilitating organisational factors will contribute to the resilience of the community.

Katharina Näswall, Senior Lecturer, Department of Psychology, University of Canterbury. She is interested in employee and organisational resilience, job insecurity, employee wellbeing and health, boundaryless working life, and research methods.
Voices of resilient five-year olds

Annabel Carter
Department of Health Sciences, University of Canterbury

Christchurch has experienced a series of over 13,500 earthquakes between September 2010 and January 2012. Some children who have been exposed to earthquakes may experience post-traumatic stress disorder (PTSD) symptoms including difficulty concentrating, feeling anxious, restlessness and confusion. Other children may be resilient to the effects of disaster.

Western models of resilience relate to a child’s social support and their capacity to cope. The Māori model of wellbeing relates to whanau (family), wairua (spiritual connections), tinana (the physical body) and hinengaro (the mind and emotions). Children’s concepts of helping, caring and learning may provide insight into resilience without introducing the topic of earthquakes into the conversation, which in itself may provoke an episode of stress. Many researchers have studied the effects of earthquakes on children. However, few studies have examined positive outcomes and resilience or listened to the children’s voices.

The objective of this study was to listen to the voices of children who experienced the Canterbury earthquake period in order to gain a deeper understanding of the ideas associated with resilience. Individual interviews were conducted with 17 five-year-old participants during their first term of primary school. After the interviews, the teacher shared demographic information and reports on the children’s stress and coping. Six children were identified as New Zealand European and eleven children identified as New Zealand Māori. Children had different views of helping, caring and learning. Themes of resilience from Western and Kaupapa Māori models were identified in transcripts of the children's voices and drawings. Māori children voiced more themes of resilience associated with the Western model, and in the Tapa Whā model, Māori children's transcripts were more likely to be inclusive of all four components of wellbeing.

How five-year-old children, having experienced an earthquake disaster during their preschool years, talk or draw pictures about helping, caring and learning can provide insight into resilience, especially in situations where it is not advisable to re-traumatise children by discussing the disaster event.

Annabel Carter is completing a Masters in Child and Family Psychology. Her interests are psychology and helping and teaching children and young people. In 2012, she worked in Melbourne on a project for diverse populations, funded by the Royal Commission following the 2009 bushfires disaster. She has worked in both education and social services in New Zealand. Currently she is working for the Ministry of Education in a Primary school in Christchurch. Annabel’s current research studies young children’s concepts of helping, caring and learning, in children who experienced the earthquakes during their preschool years. Her Masters’ thesis is on resilience and wellbeing of new entrant children attending a primary school in an Eastern suburb of Christchurch. She completed a literature review of the effects of earthquakes and natural disasters on children’s mental health. She is keen to pursue further study in Child and Family Psychology and to continue research on longitudinal changes in children’s mental health, post-earthquake.
Participatory research with children on their earthquake experiences

Carol Mutch
University of Auckland

The findings presented here are part of a study funded by UNESCO (United Nations Educational Scientific and Cultural Organization) and the University of Auckland which focused on the role of schools in supporting their communities through the Canterbury earthquakes. The larger project was a series of indepth school case studies in which principals, teachers, school support staff, students, parents, and other family members shared their experiences through audio and video interviews and arts-based activities. This was supported by document, visual and electronic media analysis.

The case studies used a participatory approach whereby each school could negotiate the focus, participants, data collection, analysis strategies, and the format in which they wanted the findings to be presented. One of the key principles underpinning the research was to make children’s stories a central focus. Each school chose to do this differently. The differences led to the lead researcher theorising around the way in which the different approaches engaged children in research that was for, about, with, or by them. For this poster presentation three primary school projects (Hillview, Riverside and Beachlands – not their real names) are described in depth to illustrate three places along a continuum of engagement of children in research that relates to them. Hillview School created a book about children’s experiences.

Riverside School created an earthquake memorial with children and at Beachlands School a documentary was made by children. Two key themes drawn from the findings relating to children’s engagement in earthquake-related research are (a) the framing of children as participatory actors and (b) the provision of safe emotional processing opportunities for children.

Carol Mutch is an associate professor in the School of Critical Studies in Education, in the Faculty of Education, at the University of Auckland. She is the director of the Te Whakatere au Papori (Navigating Social Currents) Research Unit. Her teaching, research and writing is in educational policy, research and evaluation methodologies, and social and citizenship education. She is a Christchurch resident who commutes to Auckland weekly. Following the earthquakes she undertook research into the role of schools following the earthquakes. This research is ongoing as she follows schools through the post-earthquake school closures and amalgamations. She has recently co-edited a special issue of the journal Disaster Prevention and Management on different disciplinary lenses on the Canterbury earthquakes.
The psychology of earthquake stress cardiomyopathy, non-cardiac chest pain and myocardial infarction

Julie Zarifeh¹, Roger Mulder², Andrew Kerr³, Christina Chan⁴, Paul Bridgeman¹

1. Psychiatric Consultation/Liaison Service, Canterbury District Health Board
2. Department of Psychological Medicine, University of Otago, Christchurch
3. Department of Cardiology, Middlemore Hospital
4. Department of Cardiology, Christchurch Hospital

Stress cardiomyopathy is the classic psychologically precipitated physical illness. The September 2010 Christchurch earthquake provided a unique opportunity to compare the psychological factors underlying this condition, plus myocardial infarction and non-cardiac chest pain.

We hypothesized that patients with non-cardiac chest pain or stress cardiomyopathy may be more psychologically vulnerable than those with myocardial infarction (heart attack). In the week following the earthquake, cardiology admitting staff prospectively identified female patients with earthquake precipitated chest pain, all meeting strict diagnostic criteria for one of the three conditions. Seventeen consenting patients were interviewed by a senior clinical psychologist. Premorbid psychological factors, experience of the earthquake and psychological response to the earthquake were assessed using validated tools. Earthquake experiences were notably similar across the groups. Patients with non-cardiac chest pain scored high on the HADS (Hospital Anxiety and Depression Scale), the Eysenck neuroticism scale and the Impact of Event scale. Women with stress cardiomyopathy scored as the most psychologically robust; depression and extroversion scores were the same across groups.

Stress cardiomyopathy following an earthquake does not appear to be specific to psychologically vulnerable women. Women presenting with non-cardiac chest pain have both higher health anxiety, and generalized anxiety, and score more highly on neuroticism scales, when compared with women diagnosed with either myocardial infarction or stress cardiomyopathy.

Julie Zarifeh is a Senior Clinical Psychologist working across Psychiatric Consultation-Liaison Service/Cardiology Departments. Her role is to undertake assessments and psychological interventions for Canterbury District Health Board (CDHB) patients suffering significant comorbid physical health and emotional health symptoms. This work is across the disciplines of Oncology, Cardiology, Nephrology, Dermatology, Medical/surgical specialities and other fields. Julie also undertakes teaching and liaison with medical/allied health CDHB staff, as well as the Cardiac-Rehabilitation service and other community non-governmental organisations. Following the Sept 2010 Christchurch earthquake Julie was part of a small multidisciplinary research team who investigated the potential role of psychological factors as having played a role in the presentation of a noticeable increase in the number of (mostly) women who were admitted to Christchurch Hospital with ‘Broken Heart Syndrome,’ (Takotsubo Cardiomyopathy).
Slipping between the cracks: metacognitive therapy for earthquake-related post-traumatic stress disorder: a case study

Jennifer Jordan
Department of Psychological Medicine, University of Otago, Christchurch

The active earthquake sequence since 4 September 2010 has had profound effects on those who live in Christchurch. Many experienced acute stress symptoms immediately after the February quake, however most in the community appeared to be recovering. After major aftershocks though, waves of referrals were made for psychotherapy for earthquake-related distress, particularly after two large aftershocks in June 2011, highlighting the development of chronic PTSD (post-traumatic stress disorder).

This case study illustrates the application of Wells and Sembi’s metacognitive therapy for PTSD. A brief history will be followed by presentation of the metacognitive formulation, a description of treatment techniques used and response to treatment. Pre and post self-report measures will be reported. The client responded well to metacognitive therapy (MCT) for PTSD, achieving significant reduction in symptoms with very brief therapy. Metacognitive therapy appears to be an effective treatment for earthquake-related PTSD as illustrated by this case. MCT may have a particular salience for PTSD symptoms.

Jennifer Jordan is a senior research fellow and clinical psychologist working in the Clinical Research Unit at the Department of Psychological Medicine at the University of Otago, Christchurch, New Zealand. She also works for the Canterbury District Health Board at a specialist Anxiety Disorders Service and in the CDHB Adult Speciality Service Earthquake Treatment Team (ASSETT). She has been an investigator and therapist in a series of randomised clinical trials, evaluating different psychotherapies for serious mental disorders including eating disorders, depression and latterly post-traumatic stress disorder (PTSD) related to the Christchurch earthquakes. She is the principal investigator of a pilot study (still recruiting participants) of metacognitive therapy vs. cognitive behaviour therapy for earthquake-related PTSD.

PTSD symptoms and coping in children beginning school: preliminary findings

Kathleen Liberty¹, Sonja Macfarlane¹, Arindam Basu¹, Jeff Gage¹, Maureen Allan²

1. School of Health Sciences, University of Canterbury
2. Te Pārea Resource Teacher: Learning and Behaviour (RTLB) services, Christchurch

We are beginning a mixed method study to follow a community sample of five-year-old children who experienced the September 2010 earthquake aged between 12 and 42 months. Natural disasters are thought to disrupt neural development with potential long-term impacts. The ages of 12–60 months are sensitive periods for cognitive, language and emotional development and thus likely to be particularly vulnerable to the effects of disasters.
Although it is commonly believed that younger children would be more resilient, and/or ‘forget’ disasters, research has shown this to be false, or a product of developmentally inappropriate assessment, and new PTSD diagnostic criteria for young children have consequently been introduced in May 2013.

The aim of our proposed study is to conduct a mixed-method longitudinal study of stress and coping in children who experienced the Canterbury earthquakes (EQ) during their preschool years. This would be the first longitudinal study of young children post-EQ.

The quantitative methodology of our study will address the question: will children who experienced the EQ ages 12–48 months show PTSD symptoms, coping and/or post-traumatic growth during the beginning years of primary school? The qualitative methodology will explore the views of whānau/family on the child’s wellbeing during and since the EQs, and how the family/whānau have supported their child over this time, as these factors have been identified as crucial for resilience and post-traumatic growth. We began our study this year, and are working with four primary schools, with decile ratings of 2, 4, 5 and 10 on the east side of Christchurch. Initial study data will be compared with similar data from our preEQ study of Christchurch five-year-olds (N=298), completed in 2009. In the present study, we have reviewed school reports on an initial group of 110 children who have started school this year, and preliminary results from these children will be presented on our poster.

Kathleen Liberty is Associate Professor of Early Intervention in Health Sciences, University of Canterbury. Kathleen’s research interests include early intervention in public health, children's learning, health and wellbeing, disability and disorders of childhood and adolescence.

Psychological effects of the 2010 and 2011 Canterbury earthquakes and aftershocks in clients with anxiety disorders

Caroline Bell¹, Helen Colhoun², Ron Chambers², Sarah-Eve Harrow², Claire Gilbert², Jenny Jordan², Meredith Blampied², Terri Motraghi²

¹. Department of Psychological Medicine, University of Otago; Anxiety Disorders Service, Canterbury District Health Board
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Due to the unpredictability of natural disasters, relatively few studies have been able to report data on pre-disaster psychological functioning. However, limited research suggests that individuals who have a pre-existing anxiety disorder diagnosis may be more likely to experience heightened posttraumatic stress reactions following a natural disaster.

This cross-sectional study aimed to assess the impact of the 2010 and 2011 Canterbury earthquakes and aftershocks in an adult clinical population with a pre-existing anxiety disorder. Participants were assessed at a community service two years after the Canterbury earthquakes. The experiences of a cohort of individuals with a pre-existing anxiety disorder will be compared and results will be discussed in the
context of reactions to a natural disaster among individuals with a psychological disorder. Clinical and research implications will also be considered.

Caroline Bell is a Psychiatrist and Clinical Head of the Anxiety Disorders Service in Christchurch. This is the only publicly funded specialist service for treating patients with severe anxiety disorders in New Zealand. She is also a senior lecturer at the Department of Psychological Medicine at the Christchurch School of Medicine and Health Sciences, University of Otago. Her research interests include investigating the neurobiological mechanisms involved in anxiety disorders and the clinical effectiveness of different treatment modalities for these conditions. This recent work has focused on the use of a computerised cognitive behaviour therapy treatment for patients with social phobia, panic disorder and GAD (Generalised Anxiety Disorder).

The Anxiety Disorders Service is a community-based team of clinicians who specialise in the treatment of adults experiencing severe anxiety disorders. After being referred from within mental health services or from their general practitioner, clients are given a full psychiatric assessment and provided with a number of evidence-based treatment options. These may include individual or group therapy, medication reviews and trials, as well as support from both physiotherapist and dietician services. To assist with continued development of best practice treatment for anxiety disorders and to evaluate treatment efficacy, the Anxiety Disorders Service conducts research on their group therapy programmes, within both a clinical and academic framework.

Administration in the disaster zone – moving stories from Pathology

Linda Kerr
Department of Pathology, University of Otago, Christchurch

The Department of Pathology is one of the largest departments in the University of Otago, Christchurch. It was the department most disrupted by the main building closure – we are a laboratory department so have specialist staff, space, and instruments. The poster was prepared for the University of Otago General Staff Conference 2012 to support ‘Fragmented Campus: UOC General Staff Navigate the Roadmap to Earthquake Recovery’. The information was easy to collect because we were living and breathing it – the team had to pack up offices and set them up in new locations several times, including furniture, equipment, information technology, and so on. For the team to function, it was important to have administration support integrated with academic staff and that the administration team had to be flexible problem solvers.

‘How we survived the earthquakes’

Elizabeth Hughes
Canterbury Medical Library, University of Otago, Christchurch

The Canterbury Medical Library, University of Otago, Christchurch is the key provider of library and information services for University of Otago, Christchurch School of Medicine and Health Sciences and Canterbury District Health Board. Prior to the February 2011 earthquakes, the library resided on the 6th floor of the University of Otago Christchurch Building. After the earthquakes for almost 2½ years, we provided services from various temporary locations in Christchurch public hospital and eventually in a portacom on Cambridge Terrace.
We returned to our 6th floor location in June 2013. This poster chronicles our journey through some of this time documented by staff who have kept a record of the journey through disaster and repair via photos and staff experiences.

The poster was prepared in 2012 for the University of Otago General Staff Conference in Dunedin in support of the presentation ‘Fragmented Campus: How University of Otago Christchurch General Staff Navigated the Road map to earthquake recovery’ presented by Jane Mariner of Mihi, Robyn Maguigan and Dean Pester of the Deans Department, University of Otago Christchurch School of Medicine and Health Sciences.

Libraries and wellbeing in post-earthquake Christchurch

Sarah Gallagher¹, Andrew Adams², Anna Howard², Donna Robertson², Ryan Reynolds³, Coralie Winn³

1. University of Otago Health Sciences Library, Dunedin
2. Christchurch City Libraries, Christchurch City Council
3. Gap Filler Trust, Christchurch

The effects of the Christchurch earthquake sequence are wide-ranging and have been devastating to communities. The temporary loss of public facilities, such as libraries, has been felt strongly. Libraries fulfil an important place in society for a wide range of people. They provide a place for the community to meet, for ‘literacy, learning and leisure’¹.

Temporary libraries, mobile libraries, roving librarians and community book exchanges evolved to meet the needs of Christchurch’s communities. Evidence from reports, studies, comments in social media, and customer feedback demonstrate clearly that in post-earthquake Christchurch, access to libraries was, and continues to be, extremely important for the wellbeing of individuals. This is evident from increased usage of library websites when physical libraries were unavailable, delight, relief, and increased use when libraries re-opened, or when alternative options were made available.


Sarah Gallagher is an Academic Liaison Librarian at the University of Otago Health Sciences Library in Dunedin. She holds an MA in Classics from the University of Otago and an MLIS from Victoria University of Wellington. At the time of the earthquakes Sarah was working for Boffa Miskell in Christchurch. On hearing about the Gap Filler initiative she contacted Coralie Winn and with Ryan Reynolds with an idea for a book exchange. Together they developed the Think Differently Book Exchange on the corner of Kilmore and Barbadoes Streets. Sarah is interested in the role of libraries as places and in their role in supporting the wellbeing and mental health of communities. The poster and references available from http://hdl.handle.net/10523/4387. Contact: sarah.gallagher@otago.ac.nz
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The effect of maternal obesity of developmental gene expression in the fetal arcuate nucleus. H Twigg, C Jasoni. Centre for Neuroendocrinology and Department of Anatomy, Otago School of Medical Sciences, University of Otago, Dunedin.

It has been well established that changes in the uterine environment can affect fetal development. Additionally, it has been further shown that maternal obesity is associated with increased risk of the development of obesity in the offspring, however the mechanism of this relationship is not fully understood. We, and others, have observed that the offspring of obese mothers show altered development of axonal projections from cells in the hypothalamic arcuate nucleus (ARC), known to be one of the key brain areas for body weight regulation. Based on this, we hypothesised that the expression of genes that regulate axon growth and guidance would be altered in fetuses developing in obese mothers when compared with mothers of normal weight.

Quantitative-RT-PCR (qRT-PCR) was used to assess gene expression in the mouse ARC at gestational day 15.5 (GD15.5), representing mid-gestation, and early arcuate development. Specifically, we examined the Robo genes (Robo1, Robo2 and Robo3), and the Slit family (Slit1 and Slit2), which produce ligands for Robo receptors, and are involved in directing axon guidance.

Robo2 expression is significantly up-regulated (1.96-fold ± 0.37 (SEM) P < 0.05, Student’s t test) in offspring from mothers on a high fat diet (MHF) compared with controls. Robo3 expression is significantly down-regulated (0.53-fold ± 0.18 (SEM) P < 0.05) in MHF females compared to controls. Slit2 expression is up-regulated (1.38-fold ± 0.07 (SEM) P < 0.01, Student’s t test) in MHF males, and this change in expression is highly significant.

The results presented in this study indicate that changes in Robo and Slit expression could provide a molecular mechanism behind malformation of weight regulation circuitry in offspring from obese mothers. With the incidence of obesity in the developed and developing world reaching epidemic proportions, an understanding of the mechanisms that underpin elevated risk for obesity are critical in order to best confront this disease.

Increased sympathetic activity in obesity may protect against pulmonary hypertension. C Diong, E Gray, P Jones, D Schwenke. Department of Physiology, Otago School of Medical Sciences, University of Otago, Dunedin.

Evidence suggests that obesity is protective against pulmonary hypertension (PH) which is a disease characterised by an elevation of mean pulmonary arterial pressure (MPAP). It is well established that pulmonary sympathetic nerve activity (pSNA) is
an important modulator of MPAP due to β-adrenergic-mediated vasodilation of pulmonary vessels. This study aimed to establish whether pSNA is elevated in obesity and how this impacts vascular tone.

Using *in vivo* electrophysiology, we directly recorded pSNA in anaesthetised Zucker rats and showed that pSNA in control obese rats (obese-C; 2.4 ± 0.4 µV.s; mean ± S.E.M; n = 8) was significantly elevated compared to their lean controls (lean-C; 0.5 ± 0.1 µV.s; n = 7; *P* < 0.001; unpaired *t*-test). PH led to a small 2.9-fold increase in pSNA in lean rats (lean-PH; 2.0 ± 2.5 µV.s; n = 4) but a large 13.2-fold increase in the obese rats (obese-PH; 7.1 ± 2.5 µV.s; *P* < 0.01; n = 4).

To determine the effect of differing pSNA on vessel diameter, we performed synchrotron radiation microangiography. We blocked the effect of pSNA by administrating the β-adrenergic antagonist propranolol (2 mg/kg) and then induced acute hypoxic pulmonary vasoconstriction using 8% O₂ for 5 minutes. The magnitude of constriction in lean-C and lean-PH rats was 12.6 ± 3.5% (n = 7) and 16.3 ± 3.4% (n = 7), respectively. However, compared to lean-C rats, pSNA blockade in obese-C (26.2 ± 3.7%; n = 7; *P* < 0.05) and obese-PH rats (27.6 ± 4.7%; n = 7; *P* < 0.05) resulted in a significantly greater magnitude of vasoconstriction.

Our results suggest that pSNA is significantly elevated in obesity and plays a larger role in vasodilation of the pulmonary vasculature. This may in part explain why obesity in PH results in an improved clinical outcome.

**Phenotypic and functional characterisation of human macrophages – a role in colorectal cancer. S Norton¹, E Dunn¹, F Munro², J McCall², R Kemp¹. ¹Department of Microbiology and Immunology, Otago School of Medical Sciences. ²Department of Surgical Sciences, Dunedin School of Medicine, University of Otago, Dunedin**

In contrast to other cancers, high infiltration of macrophages into the tumour of people with colorectal cancer has been associated with improved patient prognosis. This association may be due to limitations of markers used to identify macrophages *ex vivo*. Thus, the mechanisms involved in macrophage responses to cancer are poorly understood. Our goal was to establish macrophage subset identification methods and analyse whether these subsets infiltrate colorectal tumours.

Multicolour flow cytometry was used to identify macrophage populations derived from blood, and differences in function confirmed using ELISA, Greiss reaction and quantitative RT-PCR.

M1 macrophages were identified as CD11b+, CD64+, CD14-, CD206+/lo, CD163-; and highly expressed the nitric oxide synthase 2 gene, indicating pro-inflammatory function. M2 populations were CD11b+, CD64+, CD14hi, CD206+, CD163+, and produced high levels of interleukin-10 protein, indicating anti-inflammatory function. These combinations of surface markers represent a novel way to measure macrophage subsets *ex vivo*. These markers are often used to identify macrophages, but not in combination. CD206 was chosen as an M2 marker, but was highly expressed on M1 macrophages. The two populations were subsequently detected in tumour and associated non-transformed bowel tissue from three people with colorectal cancer.
There appears to be an increased frequency of M2 macrophages in tumour tissue. Analysis revealed a population of gut resident macrophages (9.58 ± 2.92 and 11.5 ± 4.179) with a unique phenotype (CD45+, CD11b-, CD64-, CD14-, CD206+ CD163-), present in both tumour and non-transformed bowel tissue.

This study highlights the complexity of macrophages and provides methods to examine them ex vivo from human tissue. Data gained from this work may help define macrophage type as either prognostic or therapeutic targets.

Secreted amyloid precursor protein-α attenuates cell death in organotypic hippocampal slices. M Elder1, J Blok1, B Mockett2, J Williams1. Brain Health Research Centre, 1Department of Anatomy, Otago School of Medical Sciences, 2Department of Psychology, University of Otago, Dunedin.

Alzheimer's disease (AD) is a neurodegenerative condition characterized by deposition of amyloid beta (Aβ) and apoptotic cell death, especially in the hippocampus. Curiously, neurotoxic Aβ is cleaved from amyloid precursor protein while alternate cleavage liberates the neuroprotective molecule, secreted amyloid precursor protein-α (sAPPα). This study aimed to investigate whether sAPPα application could prevent cell death in organotypic hippocampal slices following Aβ insult or the generic cell death-inducing oxygen glucose deprivation (OGD).

Hippocampal slices (400 μm) from P7-10 Sprague-Dawley rat pups were plated on membranes and maintained at 34-37°C for 10 days. Slices were treated with either 1 nM sAPPα or phosphate buffered saline prior to insult (either 20 minutes of exposure to an anoxic and glucose-free environment (OGD, n = 6) or Aβ 25-35; 2.5 μM, 48 hours (n = 4). Activated caspase-3 levels were used as a measure of apoptosis and assessed by western blot analysis and LIVE cell staining. Cell death was measured by incubation with propidium iodide (PI) (7.5 μM, 24 hours) and visualized by fluorescence microscopy.

While OGD produced robust cell death in hippocampal areas CA1 and CA3, preincubation with sAPPα showed no neuroprotective effect as assessed by PI (P ≤ 0.05, one-way ANOVA). However, western blot analysis revealed significantly decreased activated caspase-3 levels following sAPPα application compared to untreated OGD slices (P < 0.05, one-sample t-tests). LIVE cell imaging corroborated the presence of apoptosis following OGD. Furthermore, pretreatment with sAPPα significantly attenuated cell death in the dentate gyrus following Aβ insult (P < 0.05, one-way ANOVA with Tukey's post hoc).

In conclusion, sAPPα pre-treatment was insufficient to prevent death following OGD however reduced apoptosis was observed following OGD and Aβ insult. Together these findings may assist in the pursuit of a treatment to prevent the loss of hippocampal neurons in AD.
Prefrontal cortex stroke affects learning and memory. L Zhou¹, A Clarkson¹².¹Department of Anatomy, Otago School of Medical Sciences, ²Department of Psychology, University of Otago, Dunedin.

Stroke is a leading cause of long-term disability and can affect motor, sensory, language, vision and cognition (memory, attention and executive function). Research into motor impairments is well established, however little is known about the effects on cognitive deficits after stroke. Therefore we aimed to establish a stroke model that would allow us to assess components of learning and memory. We have chosen to target the prefrontal cortex (PFC), as epidemiological evidence has shown that small strokes to PFC areas are linked to cognitive impairment.

Strokes were induced in 3-month old C57Bl/6J male mice using either the photothermotic (PT) model of stroke with 18, 20 or 22-minutes light exposure (n = 2, 4, 5 respectively) or an injection of N5-(1-iminoethyl)-L-ornithine, dihydrochloride (n = 2). Using the 22-minute PT model of stroke, mice received either sham (n=9) or stroke (n = 10) surgeries and assessed on novel object (NO) and the object-location recognition (OLR) tasks. Open field and elevated plus maze (EPM) tests were used to monitor motor and anxiety levels in mice.

Cresyl-violet staining and ImageJ software were used to quantify the area of infarction. These infarct quantifications show that 22-minute PT stroke was the most consistent size and reliable. For both the open field and EPM, no significant differences were found between sham and stroke mice at 1 and 4-weeks post stroke (P ≥ 0.05). Assessment on the NO task also showed no differences at 1 and 4-weeks between sham and stroke mice (P≥0.05). Assessment however on the OLR task stroke mice were found to have no impairment at 1-week, but significant impairment at 4-weeks post-stroke compared to sham mice (P ≤ 0.05).

This is the first experimental evidence that strokes to the PFC result in a delayed onset impairment in the OLR task, similar to human studies. We suggest that this model may therefore be a useful tool in assessing potential rehabilitative/cognitive therapies after stroke.

Inhibitory role of Langerhans cells (LCs) during cutaneous wound healing. J Ann, L Wise, N Real, G Stuart, M Hibma. Department of Microbiology and Immunology, Otago School of Medical Sciences, University of Otago, Dunedin.

Langerhans cells (LCs) are epidermal dendritic cells (DCs) that play a pivotal role in skin immunity as well as maintaining tolerance. Previous research has suggested LCs may also be involved in the wound healing response, as changes in LC number have been observed following cutaneous injury and in injury-associated skin diseases. The aim of this study was to determine if LCs play a regulatory role during skin repair.

Mice expressing the diphtheria toxin (DT) receptor from the langerin/CD207 promoter were treated with DT (two intraperitoneal injections of 1 µg/kg) so as to selectively deplete LCs. Mice then received full thickness, cutaneous, punch (4 mm) wounds above each hind-limb. Six days post-wounding, mice were euthanised and wounds were fixed in zinc-salts solution, paraffin-embedded then (4 µm) sections...
were stained with Martius Scarlet Blue (MSB) or by immunofluorescent-histochemistry.

Staining for langerin/CD207 confirmed that LCs were depleted in DT-treated mice. Depletion of langerin/CD207+ cells resulted in an immediate 30% reduction in wound size compared to controls (day 1-2 post-wounding, n = 8, P < 0.05, ANOVA/Bonferroni’s post hoc test). MSB-stained sections revealed increases in the area of neo-epidermis (30%, n = 8, P < 0.05, unpaired t-test) and granulation tissue (70%, n = 8, P < 0.05) in LC-depleted wounds compared to controls. Fluorescent-stained sections revealed a 2.5-fold reduction in MHC class II+ dermal DCs (n = 8, P < 0.05) and increases in F4/80+ macrophages and CD8+ T cells (n = 2) adjacent to the granulation tissue of LC-depleted wounds compared to control wounds.

In conclusion, LCs may inhibit the inflammatory and proliferative phases of cutaneous wound healing by modulating trafficking of dermal DCs, macrophages and CD8+ T cells. Understanding the complex dynamics of the immune system during skin repair may lead to improved therapies for skin wounds and their associated diseases.

The effect of riboceine on glutathione and plasma cholesterol levels in Lp(a) mice.
T Kader1, C Porteous1, S Geiseg2, S. McCormick1. 1Department of Biochemistry, Otago School of Medical Sciences, University of Otago, Dunedin, 2School of Biological Sciences, University of Canterbury, Christchurch.

Elevated concentrations of lipoprotein(a) [Lp(a)] are an independent risk factor for developing atherosclerosis. Lp(a) accumulates oxidised phospholipids (OxPL) and promotes lipid deposition and inflammation in the artery. To date, there is no effective therapy available to reduce these atherogenic properties of Lp(a). Riboceine is a cysteine analogue designed to increase anti-oxidant glutathione (GSH) synthesis. As GSH is an essential cofactor for the reduction of OxPL, we hypothesized that increased GSH levels may reduce the OxPL content of Lp(a) and thereby reduce its atherogenicity. As the pathways of cholesterol synthesis or efflux are regulated by OxPL, we hypothesized riboceine may alter total plasma cholesterol levels.

Lp(a) mice were supplemented with riboceine (4 mg per day) in their drinking water for 8 weeks. High Performance Liquid Chromatography (HPLC) was used to measure GSH quantitatively in the plasma and liver tissue of the Lp(a) mice and total cholesterol levels were measured by enzymatic assay.

There was a trend towards increased GSH levels in the plasma of riboceine-treated mice compared to controls (2.13 ± 0.54 nmol/mL (mean ± SEM) versus 1.31 ± 0.17 nmol/mL, respectively) but not to statistical significance (P = 0.1914, n = 4, two-tailed unpaired student t-test). There was also a trend for increased GSH in the livers of treated animals (0.92 ± 0.08 µmol/g versus 0.72 ± 0.06 µmol/g, respectively; P = 0.0821, n = 4, two-tailed unpaired student t-test). Total cholesterol levels were 79.49 ± 6.47 mg/dL and 57.45 ± 5.91 mg/dL before and after the treatment, respectively, although this difference was not significant (P = 0.1050, n = 4, two-tailed paired student t-test).
These results suggest that riboceine may increase GSH levels which could alter Lp(a) atherogenicity as well as reduce cholesterol levels. However, more animals need to be treated to establish if these trends become significant.

**Regulation of voltage-gated calcium channels in PC12 cells by Leucine Rich Repeat Kinase 2. C Bedford, S Condliffe. Department of Physiology, Otago School of Medical Sciences, University of Otago, Dunedin.**

Leucine rich repeat kinase two (LRRK2) is a widely expressed protein belonging to the Roco family of proteins, mutations in which have recently been discovered as a cause of familial Parkinson’s disease (PD). Despite an array of interacting proteins having been identified across multiple cellular systems, LRRK2’s functional role remains to be determined. Manipulation of LRRK2 expression disrupts many Ca\(^{2+}\)-dependent cellular processes. It therefore may act as an upstream regulator of initial Ca\(^{2+}\) signaling events which could explain LRRK2’s widespread effects.

The central aim of this study was to determine whether LRRK2 alters endogenous voltage-gated Ca\(^{2+}\) (Ca\(_V\)) channel function in PC12 cells using whole cell patch clamp electrophysiology. Additionally, transiently transfected PC12 cells underwent epifluorescence imaging to identify morphological changes and identify any effects of L-type Ca\(^{2+}\) blockers on neurite morphology.

Peak Ca\(_V\) channel currents in LRRK2 transfected cells showed a significantly (\(P = 0.0025, n \geq 7, \text{one way ANOVA with Tukeys post-hoc test}\)) higher current density across a number of holding voltages relative to untransfected and EGFP-transfected controls. This results indicates that LRRK2 up regulates endogenous Ca\(_V\) channel function. Morphological assessment showed no significant effect of LRRK2 transfection on total neurite length relative to EGFP transfected and non-transfected controls (\(P>0.05, N \geq 63, \text{Kruskal-Wallis test}\)). Furthermore, addition of a L-type Ca\(^{2+}\) channel blocker Nifedipine (1 µg/mL) had no significant effect on total neurite length relative to untransfected controls (\(P > 0.05, n \geq 43, \text{Kruskal-Wallis test}\)). These results suggest that LRRK2 dependent modulation of Ca\(_V\) channel function does not affect neurite differentiation.

Overall, this study has identified a novel effect of LRRK2 on Ca\(_V\) channels which may explain how LRRK2 has such widespread cellular effects, and advances our understanding of LRRK2s functional role. If the effect of LRRK2 on Ca\(_v\) channels is responsible for pathology, Ca\(_v\) channel blockers currently being investigated for Parkinson’s therapy, may be important for Parkinson’s patients harbouring LRRK2 mutations.
A link between air pollution and heart failure

Air pollution is a well-recognised risk factor for cardiovascular health, and it has been shown to be an important trigger of acute myocardial infarction. This systematic study reviews the relationship of air pollution to acute heart failure, including hospitalisation and heart failure mortality.

Thirty-five studies were included in the review and an association between acute heart failure and daily increases in gaseous (carbon monoxide, sulphur dioxide, nitrogen dioxide, ozone) and particulate air pollutants was sought. All of these pollutants, except ozone, were found to be clearly associated with heart failure hospitalisation and mortality.

An editorial commentator applauds the study and notes that the European Respiratory Society observes that “citizens are entitled to clean air, just like clean water and safe food.”


Diverse sources of C. difficile infection

It has been thought that *Clostridium difficile* infection is transmitted predominantly within health care settings. Prevention efforts have focused on scrupulous hygiene and isolation of known cases. Judicious use of antimicrobials is also recommended. Other sources are possible—asymptomatic colonised patients, water, food and animals.

This report evaluates the sources of *C. difficile* in one region, Oxfordshire, UK, over a 3-year period. 1223 *C. difficile* isolates were evaluated on whole-genome sequencing and 45% of them were genetically distinct from all previous isolates. The researchers observe that most of these organisms “were acquired from asymptomatic persons or some other environmental reservoir.”


Combined oral contraceptives and the risk of venous thrombosis

Many women use combined oral contraceptives, despite such use being associated with an increased risk of venous thrombosis. This meta-analysis reviews the risk of venous thrombosis in 10 frequently prescribed oral contraceptives. All combinations included ethinylestradiol (EE) in a dose ranging from 20–50 mg together with levonorgestrel or gestodene.

All were found to increase the risk of venous thrombosis twofold with the highest risk observed for 50 µg EE with levonorgestrel; the lowest risk was observed for 20 µg or 30 µg EE with levonorgestrel and for 20 µg EE with gestodene.

A clear message.

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