Effectiveness of current interventions in obese New Zealand children and adolescents

Getting serious about protecting New Zealand children against unhealthy food marketing

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SUMMARIES

Childhood obesity in New Zealand
Steven Kelly, Boyd Swinburn
New Zealand has an unacceptably high rate of childhood obesity at 11 percent of children. The cause is due to an over consumption of food particularly in the form of junk food. To reverse this serious problem an all-of-society approach with leadership from the government is going to be required. The consequence of ignoring the problem will threaten the future viability of the health service.

Effectiveness of current interventions in obese New Zealand children and adolescents
Yvonne C Anderson, Tami L Cave, Vicki J Cunningham, Nicola M Pereira, Donna M Woolerton, Cameron C Grant, Wayne S Cutfield, José G B Derraik, Paul L Hofman
Services to address childhood obesity in this country are currently limited. This audit looked at the progression of weight over 2 years in 290 children and adolescents across four different regions in New Zealand. It showed that, irrespective of the type of intervention provided, there were improvements over time, suggesting that addressing the issue is better than doing nothing. Health professionals need to be proactive in identifying and managing child and adolescent obesity.

Socioeconomic factors correlating with community antimicrobial prescribing
Genevieve Walls, Alain C Vandal, Tanya du Plessis, Veronica Playle, David J Holland
Increasing resistance of bacteria to antibiotics is a serious concern worldwide and in New Zealand. Increased bacterial resistance is linked to high numbers of community antibiotic prescriptions. New Zealand has surprisingly high rates of community antibiotic prescribing, which need to be decreased. Within New Zealand, Counties Manukau District Health Board (DHB) has the highest rate of community antibiotic prescribing. We hypothesised that there might be socioeconomic factors that influence antibiotic prescribing in our DHB. This paper showed that a higher ratio of number of people in a house to bedrooms in the house (which might indicate crowding) was associated with higher rates of antibiotic prescriptions. There may be a number of reasons for this association and further research is needed in other DHBs and within Counties Manukau DHB.

An audit on the appropriate use of faecal calprotectin testing within the Taranaki DHB: a case for a more discerning approach
Sean Lance, Campbell White
This audit aimed to explore the current use of faecal calprotectin (a marker of bowel inflammation) in the Taranaki DHB area. It is a highly sensitive test, so correct use can be extremely useful in excluding inflammatory bowel disease. However, due to poor specificity, inappropriate use can lead to a number of unnecessary investigations. Local development of guidelines around its use will help to ensure the test is used appropriately and patients achieve the maximum benefit from it.
Inequities in provision of seizure care across the Wellington Region
Purwa Joshi, Eloise Watson, Ian Rosemergy, Sisira Jayathissa
All patients presenting with a first seizure and those with repeated seizures should ideally be reviewed by a neurologist. We wanted to determine whether adult patients presenting with a seizure to the emergency department of Wellington Hospital and Hutt Hospital in the Wellington region were equally likely to be referred to a neurologist. This study showed that patients presenting to Hutt Hospital were less likely to be referred to a neurologist than those presenting to Wellington Hospital.

Getting serious about protecting New Zealand children against unhealthy food marketing
Stefanie Vandevijvere, Boyd Swinburn
Reducing childhood obesity is now a high priority for Government and New Zealand society, and foremost in these efforts should be getting serious about protecting children from being targeted by sophisticated marketing for the very foods and beverages that are making them fat. The marketing of unhealthy food products to children is powerful, pervasive, and predatory. Previous studies in New Zealand found that food marketing targeted at children through various media is predominantly for unhealthy food products. Statutory comprehensive regulations providing full protections for children against unhealthy food marketing are recommended, but strengthening voluntary codes into a more quasi-regulatory system would allow food companies to clearly demonstrate their commitments to become part of the solution for New Zealand’s unacceptably high rate of childhood obesity.

Clinical governance and point-of-care testing at health provider level
Geoffrey Herd, Samarina Musaad
Point-of-care testing (POCT) is defined as medical laboratory testing which is carried out near to the patient, or at the patient bedside i.e. medical laboratory testing which is carried out at the point of patient care. Clinical governance is a quality framework which is designed to continuously improve and refine clinical services to ensure that they are safe and cost effective. The authors recommend that hospitals and health clinics implement clinical governance and quality assurance programmes for point-of-care testing devices in the interests of patient safety.

Standardised (plain) packaging: the time for implementation has come
Janet Hoek, Richard Edwards, Mike Daube
Although a growing number of countries have passed legislation to introduce standardised (or ‘plain’) packaging, New Zealand’s legislation is currently stalled. The research evidence supporting standardised packaging is strong. Furthermore, evaluations from Australia, the first country to introduce this measure, show standardised packaging is reducing the appeal of smoking. Tobacco consumption in Australia has also fallen since the introduction of standardised packaging. The government should reassert its commitment to New Zealand’s Smokefree 2025 goal by recognising the Australian evidence and passing and implementing standardised packaging as soon as possible.
Childhood obesity in New Zealand

Steven Kelly, Boyd Swinburn

New Zealand has the third largest percentage of overweight and obese children in the OECD after Greece and Italy. New Zealand has one third of children overweight or obese compared to Australia which has only one quarter of children in this category. Currently 11% of New Zealand children are obese.

There is an under appreciation of the problem, as obesity has become normalised in our society. A recent survey shows that over half of parents with obese children believed that their child was a normal weight. Nine out of ten parents of obese children aged 2 to 4 years believed that their children were a normal weight. The cause for the rapid rise in obesity over the last 30 years is due primarily to an over consumption of calories. The particular problem is that the calories have been in an energy dense and nutrient poor form in both food and sugary drinks. We are continually told that if we exercise more we will lose weight. This is a myth, you cannot eat your way out of a bad diet. Over the last 30 years of the obesity epidemic, physical activity has changed very little.

We are biologically designed to live in a land of lean. The problem now is that we live in a land of plenty. The current environment we live in, is the obesogenic environment. It consists of energy-dense, palatable, cheap and readily available food. There is pervasive and persuasive food marketing and reduced access to physical activity. All of these factors have caused the obesity epidemic. The New Zealand Medical Association has released a landmark document, “Tackling obesity” that sets the scope and solutions to New Zealand’s obesity epidemic. In this publication, it advises that a multipronged approach will be required to reverse the effect of the obesogenic environment. The solution will require a collective response from healthcare professionals, policy makers, food industry, parents, individuals, community groups and government.

There is no single solution to obesity. The government however must provide the leadership and be willing to act through legislation and regulatory control where needed. Community-based approaches, such as Healthy Families NZ, and other non-regulatory measures are essential, but are unlikely to be sufficient to reverse New Zealand’s unacceptably high prevalence of childhood obesity.

Children cannot be held responsible for their obesity and parents and society need to protect them from the obesogenic environment. Eighty percent of obese children will become obese adults. Therefore, childhood obesity predicts the future health and weight of the population. Despite multiple opportunities in the last 10 years for the government to act seriously on obesity, little has been achieved. The financial implications to New Zealand of not tackling the obesity epidemic will threaten the viability of the public health service due to the escalating costs of treating obesity related diseases, especially diabetes. Obesity and chronic diseases have become the single greatest health challenge of the 21st Century. For example, if New Zealand follows the obesity trends of the US, the risk of a child developing diabetes at some point in their life could be one in three.

It is important that obesity interventions introduced into the population are safe, effective and supported by the evidence. Education about how to navigate the obesogenic environment are important, but it is clear from cost-effectiveness studies that these are far weaker compared to
policies that actually change the underlying problem of the obesogenic environment.\textsuperscript{7} There is now a substantial evidence base of strategies that are cost saving or cost neutral to the government. Clearly the cost of action is going to be far less than the costs of inaction.

Several groups of New Zealand experts have recommended that the government introduce the following effective strategies to combat childhood obesity.\textsuperscript{4,8} They are all based on good scientific evidence.

1. Restrictions on junk food marketing to children
2. An excise tax on sugary drinks
3. Healthy food service policies implemented in all schools and early childhood centres

The food industry is concerned with its financial profit and not with the health of the population. This year, KFC have sponsored the ICC Cricket World Cup and Super 15 rugby and you will have seen billboards around town as well as many television advertisements. McDonalds sponsored X Factor. This sponsorship is sending a clear message to children that promotes consumption of energy-dense, nutrient-poor food. It implies that by consuming this food, children will be healthy like their idols. It assumes that if they eat junk food all they need is some exercise to prevent obesity and stay healthy. This is clearly wrong and exploits the vulnerable nature of children.

There is now considerable evidence of harm caused by sugar sweetened beverages. We know that sugar calories promote excessive calorie consumption, fat storage and also rotten teeth. Many countries have now introduced taxes on unhealthy foods including Hungary, France, Mexico and some states in the US. Results from modelling studies suggest that tax on unhealthy foods is the single most cost effective approach to tackling obesity.

The Minister of Health, Dr Jonathan Coleman, must be congratulated for making childhood obesity a priority issue. Through an all-of-society approach with assistance from the government we can now expect to see a reversal in childhood obesity. In essence, this will be producing a society where the healthy choice is the easy choice.

\textbf{Competing interests:} Nil

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\textbf{REFERENCES:}
7. www.who.int/bulletin/volumes/93/5/14-145540.pdf?ua=1
Effectiveness of current interventions in obese New Zealand children and adolescents

Yvonne C Anderson, Tami L Cave, Vicki J Cunningham, Nicola M Pereira, Donna M Woolerton, Cameron C Grant, Wayne S Cutfield, José G B Derraik, Paul L Hofman

ABSTRACT

AIMS: To determine the effectiveness of current interventions in New Zealand in obese children and adolescents accessing either a standard model of care (medical input alone or with the addition of dietitian and physical activity input), or one of the country’s long-standing multi-disciplinary intervention programmes.

METHODS: Data were recorded over approximately 2.1 years of intervention from 290 patients across four centres in New Zealand, who manage obese and overweight children and adolescents aged 3–16 years in paediatric clinics.

RESULTS: There was a small but significant annual reduction in BMI SDS irrespective of the nature of intervention (-0.15 overall). There was no significant difference in BMI SDS between interventions. The extent of BMI SDS reduction decreased with increasing age at first outpatient attendance (p=0.0006). BMI SDS reduction was unaffected by ethnicity or gender.

CONCLUSIONS: Mild reductions in BMI SDS are achievable in children being referred to and managed for obesity by a range of models. It is important that paediatricians are proactive in identifying and addressing obesity with families. Further research is required to evaluate multi-disciplinary intervention programmes, and how their effectiveness can be increased, given their recognised benefits in improving cardiovascular and metabolic profile, as well as BMI SDS.

Introduction

Childhood obesity leads to adult obesity, and its co-morbidities. Longitudinal studies from the 1970s show that approximately one third of obese preschool children become obese adults, and about half of obese school-age children remain obese as adults. This finding has not changed with time; a 1996 adolescent cohort in the US found 37% of obese male and 51% of obese female adolescents (body mass index (BMI)>95th percentile) were severely obese (BMI>40kg/m²) by 30 years of age, compared with <5% of normal-weight teenagers.

Growth during childhood is a non-linear process with increases in weight and adiposity not always occurring simultaneously. As a consequence BMI varies through infancy, childhood and puberty making it an unsatisfactory measure of adiposity when assessing children of varying ages. BMI standard deviation score (SDS), which corrects for age and gender, is a better measure for assessing change in adiposity over time. Despite its inherent inaccuracy, to date most longitudinal studies have focussed predominantly on change in BMI.

In New Zealand, there are limited data sets available that allow BMI progression during childhood to be examined. The available data show a marked difference between the growth trajectories of Māori and New Zealand European children. The most comprehensive longitudinal study to date is the Dunedin Multi-Disciplinary Health and Development Study, a cohort...
of children born in Dunedin in 1972–73, followed up at two yearly intervals from age 3–16 years, then at 18, 21, and 26 years. The cohort was under-representative of non-European ethnicities with approximately 3% of the cohort being of either Māori or Pacific ethnicity. BMI was tracked with age, and for all groups, BMI became more stable with increasing age. At 18 years of age, the value of the 98th centile was close to the World Health Organisation (WHO) criteria defining obesity in adults, and it was recommended that this cut-off could be used to describe obese children and adolescents in the New Zealand population.

With regard to tackling childhood and adolescent obesity, the 2009 New Zealand Ministry of Health Guidelines recommended a multi-disciplinary approach, working with family/whānau to address food habits, activity and behaviour. This approach is supported by recent meta-analyses, which show that lifestyle interventions compare favourably with other approaches to childhood obesity. However, it is unclear if this approach works in the New Zealand context, and adoption of multi-disciplinary models and intervention in general has been variable nationally. Presently, for most children and adolescents in New Zealand, the available services are limited, with few centres running multi-disciplinary services. Those children that do see a paediatrician are likely to be able to access medical assessments for their weight, dietitian advice, and, if in an area where it is offered, Green Prescription ‘Active Families’ (described below) through their local regional sports trust, or equivalent physical activity programme.

While it is clear that most obese children continue to gain weight, what remains unclear is what the natural progression is over time. With no relevant longitudinal cohort able to answer this question for the child and adolescent age group, an alternative approach was sought. This collaborative multi-centre audit aimed to describe what the progression of weight change is during follow-up for those obese children and adolescents accessing either a ‘standard’ model of care in New Zealand (either medical input alone or with the addition of dietitian and/or physical activity input), or one of the country’s long-standing multi-disciplinary intervention programmes.

**Methods**

Entry criteria were children and adolescents aged 3 to 16 years that were identified as having a BMI>98th centile (WHO definition of obese), or >91st centile (over-weight) with significant weight-related co-morbidities. Data were collected from four district health board (DHB) regions across New Zealand (Midcentral, Northland, Taranaki and Waikato) together serving a paediatric population of 168,786. Entry was defined as first contact in clinic. Approval from the National Ethics Advisory Committee to treat this study as an audit was obtained.

The data were anonymised: dates of birth were collected for age calculations, and data sheets were password protected. For each patient, ethnicity, gender, and height and weight recordings taken at medical assessments spanning an average of 2.1 years from baseline were collected. BMI, BMI percentile, and BMI SDS were calculated using UK Cole normative data on the uploadable KIGS auxology software (Pfizer Endocrine Care™).

Data were described by age, gender, and ethnicity. The types of intervention received by each patient were recorded. The nature of obesity intervention varied depending upon what was available at the different centres, and what patients and their families accepted in terms of referral. Some patients presented with weight as the primary concern; others were being seen for other medical conditions where obesity was subsequently identified.

Intervention included one of the following:

i) ‘standard’ models of care—medical follow-up by a paediatrician at regular intervals with no dietitian input (usually because input was declined); ii) medical follow-up by a paediatrician and dietitian input at regular intervals; iii) medical follow-up/dietitian input and Green Prescription (GRx) ‘Active Families’ input; or iv) a multi-disciplinary intervention programme, that was offered at one centre. For all centres apart from one, the follow-up was by a paediatrician with an interest in obesity; for the other centre, results
were collected across the whole paediatric department’s caseload. The GRX ‘Active Families’ programme is implemented by 14 DHBs across New Zealand and delivered by regional sports trusts. It is a family/whānau based programme that attempts to encourage healthy lifestyle change in children, adolescents and their families at a community level, addressing both physical activity and nutrition in weekly sessions for up to 12 months. Its goal is to achieve persistent healthy lifestyle change in the participant and their family/whānau. The multi-disciplinary intervention programme involved input from a paediatrician, healthy lifestyles co-ordinator, dietitian, psychologist, and ‘Active Families’ co-ordinator. The intervention involved 8 group sessions at weekly intervals after baseline assessment, with a goal of follow-up for 24 months.

**Statistical analyses**

Data were analysed in Minitab (v.16, Pennsylvania State University, State College, PA, USA) and SAS v.9.3 (SAS Institute, Cary, NC, USA). Demographic characteristics were compared using one-way ANOVA. Multiple variable linear regression models were constructed in SAS v.9.3. Age, duration of follow-up, and ethnicity were included as independent variables in all models. Regression models also adjusted for the baseline value (at entry) of the outcome response to gain statistical efficiency and power (ie, baseline data were included in the model as covariates). All statistical tests were two-tailed. Demographic data are presented as means ± standard deviations (SD), while other data are model-adjusted means (estimated marginal means adjusted for the confounding factors in the models), with associated 95% confidence intervals.

**Results**

**Demographics**

A total of 290 children and adolescents (50% boys) aged 10.0 ± 2.8 years (range 3.4–16.1 years), with a mean BMI percentile of 99.6% (range 92.6–100.0%), and mean BMI SDS of 3.16 ± 0.72 (range 1.45–5.79), were captured for inclusion. Dates of collection spanned from October 2003 to October 2012 across the centres. There were no exclusions. Duration of follow-up analysed was 2.1 ± 1.1 years (range 0.2–7.5 years).

**Type of intervention**

Half of the participants (n=145) underwent multi-disciplinary intervention at one centre, while the other half (n=145) received more ‘standard’ models of care at the other three centres (described above, see Table 1). There were variations in the ethnicity of participants undergoing the different interventions (p=0.005), with a smaller proportion of New Zealand Europeans undergoing multi-disciplinary intervention or medical only interventions (Table 1). Participants in the multi-disciplinary intervention group were older, had greater BMI at entry, and were followed for a shorter period of time than those from other interventions (Table 1). Notably, the change in BMI SDS was similar irrespective of intervention type (p=0.64). There was a significant reduction in BMI SDS over time with both multi-disciplinary intervention and ‘standard’ models of care (-0.15 overall, see Table 2).

**Effects of age, sex, ethnicity, and intervention type**

The extent of BMI SDS reduction was significantly affected by participant’s age at entry (p=0.0006). Thus, the older the child was, the lower the observed reduction in BMI SDS over time. This effect did not vary with gender (p=0.66), with males and females having an overall reduction in BMI SDS of -0.16 and -0.14 per annum respectively (both p<0.0001, see Table 3). Of note, there was no age difference in presentation between boys and girls across the cohort (p=0.35), and duration of follow-up was similar (~2.1 years; p=0.76, see Table 3).

A reduction in BMI SDS was observed in all ethnic groups, with an overall reduction of BMI SDS of -0.17 observed in New Zealand Europeans (p<0.0001), -0.15 in Māori/Pacific (p=0.001), and -0.16 in all other ethnicities (p=0.075, Table 3). However, Māori/Pacific had a greater average BMI SDS on entry to the programme compared with Asian/other (p=0.007), and New Zealand Europeans (p<0.0001). Despite a similar age at presentation, New Zealand Europeans were followed up for longer than participants from other ethnicities (p<0.01, see Table 3).
### Table 1: Demographics of study cohort at the time of study entry according to type of intervention. Where appropriate, data are means ± standard deviations.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Medical</th>
<th>Medical &amp; Dietitian</th>
<th>Medical &amp; Dietitian &amp; Active Families</th>
<th>Multi-disciplinary</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N (% of total cohort)</strong></td>
<td>23 (8%)</td>
<td>75 (26%)</td>
<td>47 (16%)</td>
<td>145 (50%)</td>
<td></td>
</tr>
<tr>
<td><strong>Gender (n (% males)</strong></td>
<td>17 (74%)</td>
<td>37 (49%)</td>
<td>25 (53%)</td>
<td>66 (46%)</td>
<td>0.077</td>
</tr>
<tr>
<td><strong>Ethnicity (n (%))</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.005</td>
</tr>
<tr>
<td>New Zealand European</td>
<td>11 (48%)</td>
<td>47 (63%)</td>
<td>32 (68%)</td>
<td>63 (43%)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>10 (44%)</td>
<td>25 (33%)</td>
<td>7 (15%)</td>
<td>65 (45%)</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>1 (4%)</td>
<td>1 (1%)</td>
<td>1 (2%)</td>
<td>6 (4%)</td>
<td></td>
</tr>
<tr>
<td>Asian/Other</td>
<td>1 (4%)</td>
<td>2 (3%)</td>
<td>7 (15%)</td>
<td>11 (8%)</td>
<td></td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td>8.5 ± 2.8</td>
<td>9.3 ± 3.3</td>
<td>9.6 ± 3.0</td>
<td>10.7 ± 2.1</td>
<td>&lt;0.0001</td>
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<tr>
<td><strong>BMI SDS</strong></td>
<td>3.39 ± 0.9</td>
<td>3.14 ± 0.83</td>
<td>3.08 ± 0.83</td>
<td>3.16 ± 0.83</td>
<td>0.40</td>
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<td><strong>BMI (kg/m²)</strong></td>
<td>27.8 ± 5.8</td>
<td>27.5 ± 4.6</td>
<td>28.2 ± 6.1</td>
<td>30.7 ± 6.0</td>
<td>0.0004</td>
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<tr>
<td><strong>Duration of follow-up (years)</strong></td>
<td>2.5 ± 1.2</td>
<td>2.7 ± 1.1</td>
<td>2.3 ± 1.3</td>
<td>1.7 ± 0.7</td>
<td>&lt;0.0001</td>
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### Table 2: Changes in body mass index (BMI) and BMI standard deviation scores (SDS) according to type of intervention. Data are means and 95% confidence intervals adjusted for confounding factors (including patient’s age and duration of follow-up) in the multivariate models.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Medical</th>
<th>Medical &amp; Dietitian</th>
<th>Medical &amp; Dietitian &amp; Active Families</th>
<th>Multi-disciplinary</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Δ BMI SDS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>-0.17 (-0.33–-0.01)*</td>
<td>-0.14 (-0.23–-0.04)**</td>
<td>-0.22 (-0.33–-0.10)***</td>
<td>-0.13 (-0.20–-0.07)***</td>
<td>0.64</td>
</tr>
<tr>
<td>per year</td>
<td>-0.08 (-0.17–-0.01)</td>
<td>-0.08 (-0.13–-0.03)**</td>
<td>-0.14 (-0.20–-0.07)****</td>
<td>-0.07 (-0.11–-0.03)****</td>
<td>0.35</td>
</tr>
<tr>
<td>Δ BMI (kg/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.10 (0.94–3.25)***</td>
<td>1.89 (1.23–2.56)****</td>
<td>1.14 (0.33–1.94)**</td>
<td>2.01 (1.53–2.49)****</td>
<td>0.30</td>
</tr>
<tr>
<td>per year</td>
<td>0.96 (0.26–1.66)**</td>
<td>0.85 (0.45–1.25)****</td>
<td>0.36 (-0.12–0.85)</td>
<td>0.86 (0.57–1.15)****</td>
<td>0.31</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001, and ****p<0.0001 for a change from baseline.
This multi-centre audit showed that any form of obesity intervention appears to be beneficial, irrespective of ethnicity and gender. This is encouraging, given that, in a 2013 Australian on-line survey, only 20% of paediatricians felt they could make a difference to an obese child’s weight. It has been argued that a statistical improvement in BMI SDS is not the same as a clinically significant improvement in these individuals, as in most cases, they move from being obese to slightly less obese. However, the Cochrane Collaboration review of interventions for treating obesity in children concluded that combined behavioural lifestyle interventions compared to ‘standard’ care can produce significant and clinically meaningful reductions in overweight children and adolescents. In a recent meta-analysis, lifestyle interventions that achieved a BMI SDS reduction of -0.1 led to significant improvements in low-density lipoprotein cholesterol, triglycerides, fasting insulin and blood pressure up to 1 year from baseline, therefore improving cardiovascular and metabolic outcomes in these individuals. However, it is important to acknowledge that, depending on age and severity of obesity, the ultimate goal, if severely obese, is to lose weight.

We were surprised that type of intervention did not affect outcome. The fact that a multi-disciplinary intervention programme did not outperform medical follow-up may be explained by two factors. Firstly the multi-disciplinary cohort were older, and increasing age was found to lead to a smaller BMI SDS reduction overall. The BMI SDS was greater at entry, which may have also impacted on the degree of BMI SDS reduction. Almost half of the multi-disciplinary cohort was either Māori or Pacific peoples, which may have contributed to outcomes given the known differences in BMI between Māori and New Zealand European cohorts with increasing age.

There were also differences in participant duration of follow-up, but it is unclear if this affected results. It is important to note that the multi-disciplinary intervention programme included in this study was as successful as those seen in recent meta-analyses of intervention programmes.

### Table 3: Demographic characteristics and changes in body mass index (BMI) and BMI standard deviation scores (SDS) over time according to gender and ethnicity. Demographic data are means ± SD; other data are means and 95% confidence intervals adjusted for other confounding factors (including patient's age and duration of follow-up) in the multivariate models.

<table>
<thead>
<tr>
<th>Variable</th>
<th>GENDER</th>
<th>ETHNICITY</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>New Zealand European</td>
<td>Māori/Pacific</td>
<td>Asian/Other</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>145</td>
<td>145</td>
<td>153</td>
<td>116</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>BMI SDS</td>
<td>3.29 ± 0.77</td>
<td>3.03 ± 0.65</td>
<td>2.95 ± 0.65</td>
<td>3.46 ± 0.71</td>
<td>3.02 ± 0.80</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.2 ± 5.6</td>
<td>29.3 ± 6.1</td>
<td>27.9 ± 5.0</td>
<td>31.2 ± 6.3</td>
<td>28.7 ± 5.7</td>
<td></td>
</tr>
<tr>
<td>Age at baseline (years)</td>
<td>9.9 ± 2.7</td>
<td>10.1 ± 2.8</td>
<td>10.0 ± 2.7</td>
<td>9.8 ± 2.7</td>
<td>10.5 ± 3.0</td>
<td></td>
</tr>
<tr>
<td>Duration of follow-up (years)</td>
<td>2.1 ± 1.1</td>
<td>2.1 ± 1.0</td>
<td>2.3 ± 1.2</td>
<td>1.9 ± 0.9</td>
<td>1.6 ± 0.6</td>
<td></td>
</tr>
</tbody>
</table>

\(\Delta\) BMI SDS

<table>
<thead>
<tr>
<th>Overall</th>
<th>-0.16</th>
<th>-0.14</th>
<th>-0.17</th>
<th>-0.15</th>
<th>-0.16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per year</td>
<td>-0.10</td>
<td>-0.07</td>
<td>-0.10</td>
<td>-0.08</td>
<td>-0.08</td>
</tr>
</tbody>
</table>

\(\Delta\) BMI (kg/m²)

<table>
<thead>
<tr>
<th>Overall</th>
<th>1.86</th>
<th>1.83</th>
<th>1.68</th>
<th>1.94</th>
<th>1.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per year</td>
<td>(1.37–2.36)</td>
<td>(1.33–2.33)</td>
<td>(1.17–2.18)</td>
<td>(1.33–2.55)</td>
<td>(0.55–2.99)</td>
</tr>
</tbody>
</table>

\(\Delta\) BMI SDS

| Overall | (0.44–0.98) | (0.58–1.14) | (0.36–0.97) | (0.51–1.24) | (0.01–1.49) |

\(\Delta\) BMI (kg/m²)

### Discussion

This multi-centre audit showed that any form of obesity intervention appears to be beneficial, irrespective of ethnicity and gender. This is encouraging, given that, in a 2013 Australian on-line survey, only 20% of paediatricians felt they could make a difference to an obese child's weight. It has been argued that a statistical improvement in BMI SDS is not the same as a clinically significant improvement in these individuals, as in most cases, they move from being obese to slightly less obese. However, the Cochrane Collaboration review of interventions for treating obesity in children concluded that combined behavioural lifestyle interventions compared to 'standard' care can produce significant and clinically meaningful reductions in overweight children and adolescents. In a recent meta-analysis, lifestyle interventions that achieved a BMI SDS reduction of -0.1 led to significant improvements in low-density lipoprotein cholesterol, triglycerides, fasting insulin and blood pressure up to 1 year from baseline, therefore improving cardiovascular and metabolic outcomes in these individuals. However, it is important to acknowledge that, depending on age and severity of obesity, the ultimate goal, if severely obese, is to lose weight.

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There were also differences in participant duration of follow-up, but it is unclear if this affected results. It is important to note that the multi-disciplinary intervention programme included in this study was as successful as those seen in recent meta-analyses of intervention programmes.

Multi-disciplinary intervention programmes for child and adolescent obesity have been shown to lead to weight loss in the short to medium term.
in numerous systematic reviews. A recent meta-analysis including 12 studies reporting BMI and 7 studies reporting BMI SDS showed a pooled BMI reduction of 1.25 kg/m\(^2\) (95% CI 0.32–2.18) and a BMI SDS reduction of 0.10 (95% CI 0.02–0.18) compared with control groups. However, the studies were of varying quality, and often with minimal long-term follow-up. BMI has been included in this paper to demonstrate that whilst BMI SDS may fall, BMI often continues to climb over time with increasing age. Whilst multi-disciplinary intervention programmes are important for the management of child and adolescent obesity, they are labour-intensive for staff and participants, and costly. If participants continue to gain large amounts of weight, and do not improve cardiovascular outcome or long-term metabolic risk, then the benefit of the programme would have to be questioned. As custodians of the future healthcare system, there is a need to be mindful of cost-effectiveness, and models of cost-effectiveness analysis that can incorporate BMI SDS as well as other agreed outcomes are required.

The optimal outcome measure to assess multi-disciplinary intervention programmes remains unclear. However, most programmes that have been included in meta-analyses have either used BMI or BMI SDS as the primary outcome. Given the changes in BMI over childhood and adolescence, as is demonstrated in this study, BMI as an outcome in isolation can be misleading. It has been argued therefore that BMI SDS should be used when comparing interventions. Waist-height ratio (WHR) is significantly better in predicting metabolic syndrome when compared with BMI SDS, and WHR has been shown to be superior for assessing adiposity than BMI in puberty. It is therefore recommended that WHR is considered an additional measure to BMI SDS when assessing outcome of intervention programmes. Waist circumference data were not available for the children included in this audit.

There is concern that extreme percentiles for BMI-for-age have a level of inaccuracy, and therefore high BMI values should be expressed as a percentage of the 95th percentile for heavier children. There may be a shift in future towards reflecting outcome data using BMI as a percentage of the 95th percentile for age for interventions, for example the recent RESIST trial. However, there has not been a universal shift towards this method of reporting outcome to date.

This study confirms the importance of intervening with obesity early, as the change in BMI SDS in association with any intervention decreased with increasing age of presentation to clinic. This is consistent with previous findings in meta-analyses, where BMI SDS reductions in children receiving intervention programmes were greater than BMI SDS reductions in adolescents.

Limitations of this study were the heterogeneous sample and the potential variability in measurement technique at varying centres, given its retrospective nature. However, this was somewhat mitigated by the collection of individual measurements over time. We are not able to describe the natural weight trajectory in an untreated obese population over time or compare with a control group as this was not available, but New Zealand’s contemporary longitudinal cohort study ‘Growing Up in New Zealand’ (www.growingup.co.nz) will be able to achieve this in a more representative population of the country’s ethnic demographic. It was not possible to ascertain from our data whether input from a paediatrician or a dietitian with a special interest in obesity affected outcome. This is a question that would be useful to ask in future research.

In conclusion, this study has shown that, in a heterogeneous paediatric sample, even medical follow-up alone can make a beneficial difference to BMI SDS over time, irrespective of gender or ethnicity. Paediatricians need to be proactive with regard to identifying and addressing child and adolescent obesity. Further research evaluating multi-disciplinary intervention programmes for obesity in children and adolescents in New Zealand is required, especially regarding how to improve outcome of these programmes for ethnic and socioeconomic subgroups with the highest prevalence of obesity.
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Competing interests:
Dr. Anderson reports grants from the Health Research Council of New Zealand, grants from the Royal Australasian College of Physicians, and grants from the Taranaki Medical Foundation, during the conduct of the study.

Acknowledgments:
Diana O’Neill (Senior Advisor, Primary Health Care Implementation, Sector Capability & Innovation Directorate, Ministry of Health), Dr Pat Tuohy (Chief Advisor – Child & Youth Health, Ministry of Health), John Doran (Department of Paediatrics, Taranaki District Health Board), Health Research Council of New Zealand, Taranaki Medical Foundation, Royal Australasian College of Physicians and Sport Taranaki.

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REFERENCES:


Socioeconomic factors correlating with community antimicrobial prescribing

Genevieve Walls, Alain C Vandal, Tanya du Plessis, Veronica Playle, David J Holland

ABSTRACT

BACKGROUND: Increasing antimicrobial resistance is a serious concern in New Zealand and worldwide. Antimicrobial resistance is tied to increased community antimicrobial consumption. Investigation of the drivers of antimicrobial prescribing in different locales is needed so that targeted interventions can be devised. Counties Manukau District Health Board (CMDHB) serves a diverse, relatively socio-economically deprived population that has the highest rate of community antimicrobial prescribing in New Zealand. We hypothesise that socio-economic factors are important in determining much of the prescribing of antimicrobials in the CMDHB population.

METHODS: We collected data on the number of antibacterial prescriptions per person in each pre-defined geographical Area Unit in the CMDHB community in 2013, and compared these with demographic and socioeconomic parameters collected in the 2013 New Zealand census. Simple and multiple linear regression analyses were used to identify factors that correlated with antimicrobial prescribing.

RESULTS: Multiple regression analysis showed that antimicrobial prescribing was strongly associated with a higher ratio of number of people to bedrooms in a dwelling (an index of crowding), with some added association with Māori ethnicity. When these factors were accounted for, there was no significant added influence from a range of other factors such as income, smoking or educational qualifications.

CONCLUSIONS: Antimicrobial prescribing may be influenced by different factors within different communities. It is important to target the determinants of antimicrobial prescribing when addressing the issue of high community antimicrobial consumption. In the CMDHB community, crowding in homes is associated with higher rates of antimicrobial prescribing. This association may be because crowding directly increases infection rates, or that crowding serves as a proxy for other factors yet to be identified. Further investigation of the determinants of antimicrobial prescribing is needed.

Introduction

The World Health Organization has recently identified antimicrobial resistance as one of the greatest threats to human health. The use (and overuse) of antimicrobials is an important driver of antimicrobial resistance. It is therefore important that prescribers of antimicrobials make prudent decisions: in the first instance, deciding whether an antimicrobial is indicated at all; and secondly, about the class, dose and duration used.

Antimicrobial resistance has been correlated with the amount of antibiotic used in a community, both in New Zealand and overseas. Recently Thomas et al reported community antimicrobial use in New Zealand and compared it with other nations using daily defined doses (DDD). Although not a perfect measure, and sometimes difficult to calculate, DDD is a parameter adjusting for antimicrobial dose, duration, and age, which allows broad comparisons over time and between locales. It appears that New Zealand's human antimicrobial consumption is higher than previously thought, and that it has increased in recent years. Thomas et al also reported on regional variation in community prescribing of antimicrobials within New Zealand. Antimicrobial prescribing rates were highest in the community served by Counties Manukau District Health Board (CMDHB).

It is clear that New Zealand's rates of community antimicrobial prescribing are...
too high and must be reduced. To achieve this goal it is important to understand what determines antimicrobial prescribing in a particular setting. We reasoned that there may be socioeconomic factors (amongst others) that are important in determining antimicrobial prescribing within CMDHB, an area of relative socioeconomic deprivation. We investigated this by examining 2013 census data for defined geographic areas with concurrent data on antimicrobial prescriptions for the same areas.

Methods

Community antimicrobial prescribing data for 2013 for CMDHB were obtained from the Ministry of Health Pharmaceutical collection. The data were presented as the total number of scripts (each individual item was considered a script) for PHARMAC-subsidised, community-dispensed antimicrobials for people living in Area Units (AUs) within the CMDHB geographic area. Area Units are geographic areas of different sizes within New Zealand, used for the purposes of administration and statistical analysis. Area Units are relatively small geographic areas, and although numbers vary, they typically include several hundred to 10,000 residents. The antimicrobial data for 2013 were collected by the Ministry of Health but classified under the older geographic boundaries for Area Units used in the 2006 national census. For the purposes of this paper, the antimicrobial prescription data for 2013 were reallocated to the appropriate redrawn Area Units used in the 2013 census. In some situations aggregation of prescription data and Area Units into larger groupings was necessary to make sure that the correct antimicrobial dispensing data were allocated to the correct population. When Area Units needed combining, the census data for these areas was combined in a weighted fashion to represent the new area (see below). A few small Area Units of fewer than 150 people were excluded.

New Zealand underwent a national census in 2013. Census data for each Area Unit is being released progressively and is available on-line.\(^3\) Area Unit data were collected for: median personal income, median family income, self-reported ethnicity, median age of population, mean of usual number of residents in a dwelling, mean number of bedrooms in a dwelling (from which the people-bedroom ratio, PBR, was obtained for each Area Unit); and the percentages of Area Unit population who were unemployed, who had no educational qualification, who smoked tobacco, who were born overseas, who were aged <15 years, and the percentage of single parent families. The Area Unit overall New Zealand Deprivation Index (a composite index of proportions of people with no access to the internet; receiving a means-tested benefit; with a low household income; who are unemployed; who have no qualifications; who were not home owners; who lived in a single parent family; who lived in households below a bedroom occupancy threshold; and who had no access to a car) was also collected.\(^4\)

The census characteristics of the Area Units were analysed against the number of antimicrobial prescriptions dispensed in 2013, divided by the resident population in the Area Units, to give the number of per capita prescriptions. Characteristics (independent variables) were first analysed by weighted simple linear regression to identify variables that appeared to correlate with per capita prescriptions, using Area Units as weights. Variables yielding promising relationships with antimicrobial prescribing in weighted simple linear regression were selected for weighted multiple linear regression analysis. A stepwise forward and backward selection of variables (adding and removing variables to the multiple linear regression) was used. A combination of observed significance level and Akaike’s information criterion (AIC)\(^5\) was employed to select the model that used the fewest independent variables to best explain most of the behaviour of per capita antimicrobial prescriptions (the dependent variable). Due to high collinearity amongst the identified variables, inclusion and exclusion of pairs of variables was considered at times. Weighted linear regression analyses were performed using the statistical analysis software package R version 3.1.2.\(^6\) Two infectious diseases physicians (DH and GW) and a statistician (ACV) performed the analyses together. All derived quantities such as
ratios of predicted values were obtained from the estimated parameter values and covariance matrices of the fitted regression models, using the multivariate delta method. The coefficient of determination $R^2$, which denotes the proportion of the variance in the per capita antimicrobial prescriptions explained by the variables in a model, was used to compare models. The partial $R^2$, which denotes the proportion of variance explained uniquely by one variable in the presence of other variables in the model, was used to compare variables in some instances.

**Results**

Counties Manukau District Health Board (CMDHB) comprises a large area including urban South and East Auckland, and rural locales. There were 136 discrete Area Units within CMDHB after small Area Units of fewer than 150 people were excluded. It was necessary to combine 37 of the Area Units into 11 larger composite Area Units to account for redrawn boundaries between the 2006 census and the 2013 census, and to ensure antimicrobial dispensing data were allocated to the correct populations. This gave a total of 110 Area Units as data points for regression analysis.

The total ‘usually resident’ population in the CMDHB Area Units in the 2013 census was 465,351. The 11 composite areas accounted for 94,242 people. The median population for an Area Unit was 3,911 (interquartile range (IQR) = 2691). The number of antimicrobial scripts prescribed for an Area Unit varied from 0.52 to 2.71 scripts per person per year (median 1.11, IQR = 0.36).

**Weighted simple linear regression**

The Area Unit-specific covariates (independent variables) were strongly correlated amongst themselves, with absolute correlation coefficient $r$ values ranging from 0.42 to 0.96. The New Zealand Deprivation Index (NZDep) was positively correlated with per capita antimicrobial prescriptions. The most deprived decile population received roughly twice the number of antimicrobial scripts per capita as the least deprived decile (0.84 versus 1.76, estimated ratio 2.1, 95% confidence interval (CI)[1.1, 3.1]).

With the aim of exploring possible drivers of antimicrobial prescribing in the community, we examined several demographic and socioeconomic characteristics, including separate components of the NZDep, to assess their correlation with dispensed antimicrobial scripts.

Median personal income and median family income for each Area Unit were negatively correlated with numbers of antimicrobial scripts dispensed per capita. Percentage of the population unemployed and percentage with no educational qualification displayed positive correlation. The median age of population was negatively correlated, whereas the percentage of the population who were children (aged <15 years) or aged 65 or over positively correlated with number of scripts dispensed per capita. The percentage of the population born overseas was not correlated whereas identifying as being of Pacific Island or Māori ethnicity was positively correlated (the correlation was greater for those of Pacific Island descent). Percentages of the population who smoked tobacco, and who had no access to a vehicle or telecommunications, were both positively correlated.

An Area Unit characteristic with a strong correlation ($r=0.71$) with antimicrobial prescriptions was the ratio of usually resident household members to the number of bedrooms in the dwelling.

**Weighted multiple linear regression**

Because of the obvious potential for several census Area Unit characteristics to co-correlate, multiple linear regression was performed, selecting different variables to include in a predictive model.

A predictive model including just two variables – the ratio of usually resident household members to number of bedrooms in the dwelling (people-bedroom ratio, PBR), and percentage of Area Unit population identified as Māori – displayed the best AIC amongst the models surveyed and explained more than half of the variance in per capita antibacterial scripts across Area Units. The coefficient of determination ($R^2$ value) using just these two variables in the model was 0.55. By comparison, a model with all variables retained reached an $R^2$ of 0.60. Within the
Table 1: Medians and interquartile ranges for census characteristics of CMDHB Area Units, with the coefficient of determination ($R^2$ value) of the model regressing antimicrobial scripts dispensed per capita in 2013 on the census characteristic. All simple linear regressions were highly significant (p value $< 10^{-10}$), but census characteristics displayed strong collinearity. Last column shows partial $R^2$ values (proportions of extra variance explained) for each variable when already accounting for PBR and %Māori to explain antimicrobial prescribing patterns.

<table>
<thead>
<tr>
<th>Characteristics of census 2013 Area Units</th>
<th>Median (interquartile range)</th>
<th>Coefficient of determination ($R^2$)</th>
<th>Partial $R^2$ in a model accounting for %Māori and PBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBR (mean ratio of household members to bedrooms in dwelling)</td>
<td>0.97 (0.31)</td>
<td>0.50</td>
<td>40.6%*</td>
</tr>
<tr>
<td>% Māori</td>
<td>14.6 (11.4)</td>
<td>0.25</td>
<td>10.1% **</td>
</tr>
<tr>
<td>Median personal income ($)</td>
<td>26,400 (11,200)</td>
<td>0.45</td>
<td>0.0%</td>
</tr>
<tr>
<td>Median family income ($)</td>
<td>65,500 (33,800)</td>
<td>0.48</td>
<td>0.2%</td>
</tr>
<tr>
<td>% with no educational qualification</td>
<td>25.4 (13.5)</td>
<td>0.42</td>
<td>0.0%</td>
</tr>
<tr>
<td>% unemployed</td>
<td>5.9 (5.4)</td>
<td>0.51</td>
<td>0.0%</td>
</tr>
<tr>
<td>% smokers</td>
<td>16.8 (12.1)</td>
<td>0.41</td>
<td>2.3%</td>
</tr>
<tr>
<td>% under 15 years</td>
<td>22.8 (8.1)</td>
<td>0.37</td>
<td>3.7%</td>
</tr>
<tr>
<td>% Pacific Islander</td>
<td>14.4 (32.6)</td>
<td>0.43</td>
<td>1.1%</td>
</tr>
<tr>
<td>% one parent families</td>
<td>22.3 (16.6)</td>
<td>0.51</td>
<td>0.2%</td>
</tr>
<tr>
<td>% with no access to phone, fax, internet</td>
<td>1.8 (2.6)</td>
<td>0.43</td>
<td>0.3%</td>
</tr>
<tr>
<td>% with no access to vehicle</td>
<td>6.4 (7.1)</td>
<td>0.44</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

PBR, people-bedroom ratio; * Against a model with % Māori only; ** Against a model with PBR only

Figure 1: Antimicrobial scripts per capita versus people-bedroom ratio. The open circles vary in size to represent weighting.
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retained model, the people-bedroom ratio (PBR) accounted for most of the variance of antimicrobial prescriptions per capita (partial $R^2 = 0.41$) whereas the proportion of Māori in the Area Unit population accounted for only fractionally more ($R^2 = 0.1$). Adding other variables did not appreciably increase the proportion of variance explained (Table 1).

Discussion

Antimicrobial resistance is recognised as an immediate and serious concern worldwide, and New Zealand is not immune to the global increase in antimicrobial resistance rates. Increased antimicrobial resistance is tied to increased community antimicrobial consumption, amongst other factors. Thomas et al have demonstrated that community antibiotic use in New Zealand is high compared with many other countries and, perhaps surprisingly, is on a par with countries (such as Italy and France) whose use of antibiotics may be considered excessive. The importance of decreasing community antibiotic prescription, and hence consumption, in New Zealand is emphasised and several strategies to achieve this are strongly advocated.

Within New Zealand, community antimicrobial consumption varies by district health board, with CMDHB recording the highest community consumption of antibiotics among 20 DHBs studied in 2012. Antimicrobial prescription rates are probably influenced by many interacting factors, including the incidence of infectious disease within a community, and prescriber and patient factors such as access to healthcare, socioeconomic status, education, and personal and cultural beliefs (factors which may themselves be linked to rates of infection in a community). Many of these factors will be inextricably intertwined and may affect different communities in different ways.

In this paper, we investigated the hypothesis that socioeconomic factors are important in contributing to the higher rate of community antimicrobial prescribing in CMDHB.

CMDHB is situated in the north of New Zealand’s North Island and includes the territorial authorities of Auckland, Waikato District and Franklin District. The DHB serves a diverse population of around 500,000 people (11% of New Zealand’s population). The population is relatively young (24% of the population is under the age of 24 and 13% of New Zealand’s children live in the CMDHB catchment area) and has a relatively high proportion of people of Māori (15% of the CMDHB population, accounting for 12% of New Zealand’s Māori population), Pacific Island (22% of the CMDHB population, accounting for 40% of New Zealand’s Pacific Island population) and Asian (22% of CMDHB’s and New Zealand’s Asian population) ethnicity. The population is growing at a rate of about 1.5–2% per year, which translates to an additional 8,000 to 9,000 residents each year. According to the 2013 census, 36% of the CMDHB population lives in areas classed as the most socio-economically deprived (deciles 9 and 10 according to the NZDep).

This paper looked at antimicrobial prescriptions per head of population in a year, and analysed this against age, ethnicity and several socioeconomic variables. Antimicrobial prescriptions per capita was the measurement used in this paper, rather than DDDs, because data for the former were more readily available. The measurement of antimicrobial prescriptions per capita as a marker for community antimicrobial consumption has been validated in other studies of antibacterial prescribing and deprivation.

Initial analysis showed strong associations between antimicrobial prescription rates and most of the analysed socioeconomic variables. A problem with this kind of analysis is that there are strong associations between the independent variables themselves (eg, smoking was correlated with crowding and income level). Multiple regression analysis showed that the ratio of household members to bedrooms in a dwelling, which could be thought of as representing crowding, accounted for most of the variation in antimicrobial prescription rates. ‘Crowding’ may serve as a useful marker which summarises the effects of the other variables, such as income, access to telecommunications, education level and so forth; once adjustments for crowding were performed, the
other variables (apart from Māori ethnicity) did not contribute much extra association.

These results—that antibacterial prescriptions per head within the CMDHB community appear to be strongly influenced by the ratio of the number of people in a house to the number of bedrooms (or crowding) are not particularly surprising in themselves, but rather serve as a direction for further investigation. Is crowding more prevalent within CMDHB compared with other DHBs? Is crowding a proxy, representing other factors driving antimicrobial prescription? Do these factors correlate with a greater incidence of infectious disease in the CMDHB area compared with other DHBs? How much of the high CMDHB community antimicrobial prescribing is appropriate (for example, are antimicrobials often prescribed for upper respiratory tract infections in the CMDHB community)?

Poverty and deprivation are known to be associated with increased rates of infectious disease in New Zealand.\(^{10,11}\) In New Zealand, an association between crowding or other markers of socio-economic deprivation has been shown for infectious diseases such as tuberculosis,\(^{12}\) rheumatic fever,\(^{13}\) meningococcal disease,\(^{14}\) skin and soft tissue infections\(^{15}\) and serious *Staphylococcus aureus* disease.\(^{16}\)

New Zealand studies have also shown an increased risk of infectious disease in people of Māori and Pacific Island ethnicities.\(^{10,15,17}\) There is also some suggestion that geographic location within New Zealand may have an association with some infectious diseases; *S. aureus* sepsis and skin and soft tissue infections, for example, appear to be more prevalent in northern areas,\(^{16}\) although this may reflect the distribution of other risk factors predisposing to *S. aureus* infection.

An increased ratio of number of people to bedrooms in a dwelling (possibly reflecting crowding in some situations) may serve as a proxy for other as-yet unidentified factors driving antimicrobial prescription. Such factors may include the types of infectious diseases whose acquisition and spread is associated with crowding;\(^{11}\) the populations disproportionately affected by crowding and infectious disease (e.g. children);\(^{11}\) the prescribing practices of those working in communities where crowding and deprivation are common; and the presence of community-based interventions targeting infectious diseases.

This study is a preliminary exploration of the potential links between socio-economic factors and community antimicrobial prescribing. There are limitations that may influence the conclusions that can be drawn from this study. Similar analysis needs to be performed in other DHBs before we can conclude that CMDHB’s particular demographic and socio-economic composition influences the high antimicrobial prescribing rate. Describing the burden of infectious disease in the CMDHB population is also important when trying to explain high antimicrobial prescription rates and identify whether antimicrobial prescribing is appropriate in the CMDHB community. It is not known from this study who prescribes the majority of antimicrobials, and the indications for these prescriptions.

Further investigation into the determinants of the high rates of community antimicrobial prescription within CMDHB is needed, so that strategies to reduce community antimicrobial use can be developed and targeted. In particular, comparison of the incidence of infectious disease and crowding within the CMDHB community with other DHBs would be of interest. Qualitative and quantitative research relating to prescriber and patient behaviour could also identify areas to target.
ARTICLE

Competing interests: Nil

Acknowledgements:

We would like to thank Suzanne Holyoak, Information Analyst, Analytical Services, National Collections and Reporting, National Health Board, Ministry of Health for providing antibacterial prescribing data.

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REFERENCES:


An audit on the appropriate use of faecal calprotectin testing within the Taranaki DHB: a case for a more discerning approach

Sean Lance, Campbell White

ABSTRACT

AIMS: Faecal calprotectin (FC) is a recognised marker for excluding inflammatory bowel disease (IBD). However, it is often not used appropriately. This audit aimed to identify the rate of its use of in Taranaki, along with attempting to assess how appropriately it is used and overall utility.

METHODS: A list of FCs performed in Taranaki from July 2013 to December 2013 was obtained. Notes were examined, identifying the indication, its outcome, and a decision made whether or not the test added any benefit.

RESULTS: 206 patients were identified. A large number (n=75) were excluded due to inadequate clinical information. Of the remaining 131 patients, 37% (n=49) did not benefit. 22% (n=29) avoided further investigation with a negative result. 91% of patients with previously known IBD avoided invasive investigation with a negative result. There was a strong correlation between very high levels (>500mg/g) and a diagnosis of IBD (88%), as well as a strong correlation between lower levels (<200mg/g) and excluding IBD (86%).

CONCLUSIONS: FC remains useful to exclude IBD, and can assist in patients with established disease. However, in a significant percentage, the test adds no value. The absolute level of FC may also assist diagnosis. More research is needed, and more education is recommended.

Inflammatory bowel disease (IBD) is the umbrella term used to describe Crohn’s disease (CD), ulcerative colitis (UC), and indeterminate colitis (IC). All of which have both significant similarities and differences in their aetiology, presentation, diagnosis and management.1

Faecal inflammatory markers are used to assist diagnosis and management of IBD. Of these, calprotectin is the most useful with a wide range of quoted sensitivities and specificities. One meta-analysis (13 studies, 1,041 patients) published in the British Medical Journal in 2010, estimated the sensitivity to be 93%, and specificity 96% for detecting inflammation.2 Von Roon et al found similar results of 95% and 91%, respectively, in their meta-analysis (30 studies, 5,983 patients) published in the American Journal of Gastroenterology in 2007.2 Specificity of faecal calprotectin for detecting IBD is much lower – due to the various other causes of an elevated level, eg infection, non-steroidal anti-inflammatory drugs, colorectal cancer.4 Despite this, due to its high sensitivity, faecal calprotectin testing presents itself as a highly useful investigation especially in the primary care setting.

Calprotectin is found in the cytosol of inflammatory cells and acts as a bacteriostatic cytokine-like substance.4,5 Only a small amount (5g minimum) of stool is required for the test and it is extremely stable at room temperature, so is able to be stored for up to 7 days without diminishing its accuracy.4,5 This enables a lag time between collection and processing–extremely useful in the primary care setting, and similarly
so in New Zealand, enabling samples to be processed at non-local labs eg, currently, Canterbury Health Laboratories in Christchurch contracts to Taranaki DHB. It is relatively expensive ($90 per assay) and so is not without some financial implications.

The question of the utility of faecal calprotectin has been raised ever since it started to be used more widely, along with the question surrounding the current accepted reference range and if this is appropriate or not. A number of audits, primarily based in the National Health System (NHS) in the UK, have attempted to assess this. A similar audit to this, performed by Allison et al at the Royal Gwent Hospital in Newport, UK, was published in *Gut* in 2013. The authors examined faecal calprotectin samples for 266 patients over a two-year period (Feb 2010–April 2012), who were previously not known to have IBD. Of these, 155 had a normal result; however, management was deemed unaltered in 126 (81%) of the patients, of whom 30 went on to have a (normal) colonoscopy. Of the 29 patients where the test was thought to alter management, only 17 were spared the need for endoscopic evaluation. For those 98 patients with an elevated result, 60 (61%) of the patients had unaltered management due to various reasons (eg, further investigation indicated anyway by way of symptoms/bloods), and 27 (28%) were falsely elevated, demonstrated by subsequent negative endoscopic evaluation. The same group did another audit looking at faecal calprotectin testing on patients with known IBD. Over the same time period, 98 patients were identified with 71% (n=70) having an elevated result. Of these, only nine (13%) had a change in their management.

In 2013, Seenan et al attempted to determine the diagnostic yield of further investigation in patients with lower GI symptoms and mildly elevated faecal calprotectin. 163 patients (most of who presented with diarrhoea or abdominal pain) were included, after having had a faecal calprotectin mildly positive (between 100–200mcg/g). Of these, 131 went on to have colonoscopy, and only 23 (18%) demonstrated abnormalities. Interestingly, IBD was the final diagnosis in only 1.8% (n=3) of the patients investigated, with almost half (48.5%) diagnosed with IBS. The negative predictive value of faecal calprotectin from 100–200mcg/g for excluding a significant GI pathology was high, at 98% (for IBD, adenoma, or colorectal carcinoma), casting doubt on the standard laboratory reference range (normal range <50mcg/g).

There have been no such audits done on the use of faecal calprotectin testing in the Taranaki DHB. The aim of this audit was to determine the current rate of request of faecal calprotectin testing within the Taranaki DHB, to determine the clinical indications for requesting this test, and the outcomes for the patients involved. It will provide a baseline set of data with provision of recommendations to improve the service, and a plan to re-audit after recommendations are put in place.

**Method**

Patients were identified as having had a faecal calprotectin test between 1 July 2013 and 31 December 2013 from records kept by Taranaki Medlab, based in New Plymouth (the receiving centre for all Taranaki DHB faecal calprotectin tests). A search of their electronic clinical records was performed to identify the reason for which they received the test. This was achieved by examining a number of potential resources, such as electronic discharge summaries, clinic letters, scanned clinical notes, and indications stated on investigation reports, such as CT abdomens and endoscopies. Information was also extracted on other investigations done at the time of the test, such as stool samples and imaging. Follow-up documentation from the same resources was also examined. Further information was sought from general practitioners, who were approached and requested to provide the relevant clinical documentation as to the events surrounding and precipitating the request of faecal calprotectin testing.

**Results**

A total of 206 patients over the age of 16 had a faecal calprotectin test during the 6 month period between 1 July 2013 and 31 December 2013. Table 1 and Figure 1 show the basic demographic features and ordering clinician.
The range of the level of faecal calprotectin was from 1 to >500mcg/g, with the mean faecal calprotectin 68mcg/g, and median 29mcg/g.

The majority of patients had negative results (0–50mcg/g, n=125), or only mildly elevated results (51–100mcg/g, n=23; 0–100mcg/g, n=148). Of those over 100mcg/g, 30 were 100–200mcg/g, and 12 were strongly positive (>500mcg/g) (see Figure 2).

A total of 11 patients (5%) tested, had a previous known history of inflammatory bowel disease. Five had a history of bowel cancer.

Of the 206 patients tested, 78 (38%) went on to have further investigation, 76 with either upper GI endoscopy (11), colonoscopy (44), sigmoidoscopy (3), or both upper GI endoscopy and colonoscopy (18). Two patients had CT colonographies. Of the 11 patients with a known history of IBD, only one went on to have a colonoscopy (91% avoided invasive investigation), compared to three of the five with a history of bowel cancer progressing for colonoscopy. Six of the patients with known IBD had levels less than 100mcg/g, four had levels from 100–200mcg/g, and one had a level of >500mcg/g—this was the sole patient who went on to have a colonoscopy.

56 (74%) of the scopes were negative, with 10 identifying diverticulosis, six showing ulcerative colitis, two showing indeterminate colitis, one with Crohn’s disease, and one diagnosing colorectal cancer after histological examination. Of those scopes showing IBD, all were new diagnoses apart from one, giving an incidence rate of approximately 8% per year—significantly higher than the background incidence rate of IBD in the general population (approximately 0.02% per year), but clearly a much more highly selected for patient group.

The results were then compared to the original indication given for requesting faecal calprotectin. This was done in an attempt to identify the number of patients where the test was useful, and helped to avoid further unnecessary investigation or intervention, along with those patients where it did not offer any clear clinical benefit due to a number of factors (such as significant symptoms/clinical factors) that would necessitate further investigation irrespective of the result of the faecal calprotectin test. See Figure 4 for a visual representation of this.

<table>
<thead>
<tr>
<th>Table 1: gender and age demographics</th>
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<tbody>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Age range</td>
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<tr>
<td>- Mean age</td>
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<tr>
<td>- Median age</td>
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<td>- Mode age</td>
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<th>Figure 1: ordering clinician</th>
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<tbody>
<tr>
<td>Primary Care</td>
</tr>
<tr>
<td>Physicians</td>
</tr>
<tr>
<td>Surgeons</td>
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<table>
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<tr>
<th>Figure 2: levels of faecal calprotectin</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–50mcg/g</td>
</tr>
<tr>
<td>51–100mcg/g</td>
</tr>
<tr>
<td>100–200mcg/g</td>
</tr>
<tr>
<td>201–500mcg/g</td>
</tr>
<tr>
<td>&gt;500mcg/g</td>
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</tbody>
</table>

The results were then compared to the original indication given for requesting faecal calprotectin. This was done in an attempt to identify the number of patients where the test was useful, and helped to avoid further unnecessary investigation or intervention, along with those patients where it did not offer any clear clinical benefit due to a number of factors (such as significant symptoms/clinical factors) that would necessitate further investigation irrespective of the result of the faecal calprotectin test. See Figure 4 for a visual representation of this.
From the 206 patients, 75 were excluded due to lack of information. This left 131 eligible patients. 29 (22%) had faecal calprotectin measured as a method to rule out IBD, successfully avoiding further unnecessary investigation or intervention. For 39 of the patients (30%), the elevated faecal calprotectin prompted onwards referral—whether it be surgical or gastroenterology outpatients, or directly to endoscopy. A total of 38 patients (29%) had faecal calprotectin measured without it clearly adding any value to their ongoing management, as the diagnosis was clear (eg, infectious diarrhoea), or their clinical presentation dictated further investigation irrespective of the faecal calprotectin result (most commonly, these patients had both faecal calprotectin and endoscopy/colonoscopy requests made at the same visit). The remaining 19 patients (15%) had endoscopic evaluation following their faecal calprotectin test, but it was unable to clearly define whether or not the test had provided clinical benefit in their case, but all of the endoscopies/colonoscopies were normal in these patients. 11 of these patients had faecal calprotectin levels less than 100mcg/g, and so the assumption may be made that their management was not affected by their essentially normal faecal calprotectin level.

**Discussion**

Faecal calprotectin has been an extremely useful diagnostic and surveillance tool for inflammatory bowel disease for some time now. As with many investigations, it has a number of disadvantages and should always be interpreted within the appropriate clinical situations.

The major findings of this audit include a large proportion of patients (29%) not clearly benefitting from the measurement of faecal calprotectin. In a further 11 patients, this was also likely to be the case, making a total of 37% of the examined population—a total potential cost of approximately $4,410. This is likely to be an underestimation due to the significant paucity of data that exists. Estimation of the number of patients who underwent subsequent invasive investigation by way of endoscopic bowel evaluation unnecessarily is somewhat more difficult, because when faced with concerning symptoms and...
an abnormal faecal calprotectin test, the clinician is somewhat obliged to investigate further.

This audit does highlight the utility of faecal calprotectin testing when done in the appropriate clinical setting, with a similar proportion (22%) having IBD excluded with a negative test and avoiding more invasive investigation. The audit also demonstrates the potential role for monitoring in patients with known IBD to minimise repeat invasive investigation (91% avoided investigation).

The level of faecal calprotectin also appears to have a significant effect on further investigation, along with the rate of diagnosis. This audit demonstrates higher rates of endoscopic evaluation for patients with higher levels or faecal calprotectin, correlating with a higher rate of identification of IBD, especially in those patients with extremely high levels where 88% of the patients were later identified endoscopically to have IBD after an initial faecal calprotectin of >500mcg/g. A very large proportion (86%, n=178) of the patients had levels less than 200. There was a lower rate of investigation in these patients (33%), but also no cases of IBD identified. This supports the observation that a higher level suggests a higher chance of IBD, and also supports the suggestion that a higher cut-off (than the current normal range of 0–50mcg/g) would not compromise the sensitivity and negative predictive value of the test. It most definitely highlights the need for clinical correlation and clinical judgement when interpreting the test.

Of note, eight new cases of IBD were identified over the study period of 6 months (an incidence rate of approximately 8% per year). This is likely to be an overestimate of the background incidence rate in Taranaki, due to the highly selected for population included in this audit.

There are a number of limitations involved with this study. The study design, being retrospective and observational, means that a number of biasing and confounding features are not accounted for. The information that was able to be gained was done so by examination of patient clinical notes and online results, and so the information extracted from this is under the influence of investigator bias as to the interpretation of various aspects. Along with this, information sets for all patients involved may not be complete. Doing a similar audit, but prospectively, would enable more complete and more efficient information gathering, and would likely reveal more insight into the underlying reasons behind ordering the test. Adding to this, a major limiting factor has been the large percentage (36%, n=75 patients) of patients for whom there was insufficient clinical data available to adequately assess the initial indication, and the subsequent investigations/outcomes for the patient. Unfortunately, this was due to a poor uptake/response rate from practitioners involved. This was despite approval from the local ethics advisor and formal approval from the Health and Disability Ethical Committee. Reasons cited were mainly surrounding patient confidentiality and consent—something not usually an issue with clinical audits. Despite this, the data obtained do identify a significant portion of unnecessary tests, and likely provide a true representation of the test's use in current medical practice.

**Conclusion and recommendations**

Faecal calprotectin testing is becoming more common in the assessment of a wide range of gastrointestinal symptoms, and is a very sensitive test when used in the appropriate clinical setting. It also provides a very useful and non-invasive method of monitoring patients with known IBD and, for both of these reasons, can lead to the reduction in the number of potentially avoidable and dangerous invasive investigations.

However, it is not specific for IBD and so interpretation of the results must be made within the clinical presentation and alongside other clinical features and investigations as appropriate. More education is needed for those clinicians using the test most frequently—particularly in primary care where it will likely prove to have the most benefit.

In addition to further education, it would be beneficial to engage primary care providers and work together to
develop a locally agreed-upon policy framework for requesting faecal calprotectin—with clear recommendations on indications and instances when the test would be beneficial, along with clear recommendations on further intervention and management following either a normal or abnormal test. Once established, this could be easily implemented in Taranaki due to the single receiving centre (as mentioned above, Taranaki Medlab). Repeat audit following this is recommended to assess whether requests for faecal calprotectin are becoming more appropriate.

Competing interests: Nil

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Inequities in provision of seizure care across the Wellington Region

Purwa Joshi, Eloise Watson, Ian Rosemergy, Sisira Jayathissa

ABSTRACT

AIM: We wanted to determine whether adult patients presenting with a seizure to the emergency department (ED) of Wellington Hospital and Hutt Hospital, in the Wellington region, were equally likely to be referred for neurology input.

METHODS: A retrospective review was conducted of 250 consecutive patients presenting with a seizure to the ED of each hospital. Patient electronic records were examined to determine the proportion of patients discussed with the inpatient neurology team and referred to neurology outpatient clinic.

RESULTS: Fifty-two per cent of the patients presenting to Wellington Hospital ED with a seizure were referred to neurology, compared to 13.4% of those presenting to Hutt Hospital ED. The proportion of 'first seizure' patients referred to neurology was 63.1% for Wellington Hospital and 9.8% for Hutt Hospital. The difference in referral rates was primarily attributable to the difference in inpatient referrals. Māori were over-represented in the patients presenting to ED with a seizure, compared to their population composition.

CONCLUSIONS: This study demonstrated unequal referral practices and therefore provision of neurology care for adult seizure patients across the Wellington region, for patients with established epilepsy and those with a first seizure. There were a disproportionately high number of Māori accessing acute seizure care.

Introduction

The healthcare services in the Wellington region of New Zealand are provided by three district health boards (DHBs), Capital & Coast DHB (CCDHB), Hutt Valley DHB (HVDHB), and Wairarapa DHB. Each DHB has one acute hospital with emergency medical services. However, only CCDHB has a tertiary-level neurology department. This department is responsible for provision of neurology care to the entire region, with a total population of around 490,000.1 The department operates from Wellington Hospital (CCDHB), with two outreach outpatient clinics provided at Hutt Hospital (HVDHB). There are no outpatient clinics provided at Wairarapa DHB.

In the preceding year, there were five sudden unexpected deaths in epilepsy (SUDEP) cases amongst young adult epilepsy patients in the HVDHB area. A review of these deaths prompted us to evaluate the provision of epilepsy care in the Wellington region. In particular, we wanted to determine whether adult patients presenting to CCDHB and HVDHB emergency departments with epilepsy were managed in a similar way.

The National Institute of Clinical Excellence (NICE) guidelines recommends that all patients presenting with a first seizure, and those presenting with repeated seizures, should be reviewed by an epilepsy specialist.2 This is to ensure that patients receive an early and accurate diagnosis as well as initiation of treatment as appropriate.

Methods

We conducted a retrospective review of 250 consecutive adult patients presenting to emergency departments (ED) of Wellington Hospital and Hutt Hospital with a seizure before 31 December 2013.

Discharge coding was used to search for patients aged 16 years or higher, presenting to the Wellington Hospital ED and Hutt Hospital ED with the primary diagnosis of a seizure (ICD-10 codes G40.x, R56.1, R56.9)
starting from 31 December 2013 and going back until 250 consecutive patients were included. Repeat presenters were only included once.

A review of the emergency department electronic notes and the discharge summary for each patient was undertaken. From these sources, we collected demographic information as well as whether this event was the patient’s first seizure, whether the patient’s management was discussed with a Neurologist and whether the patient was referred to the neurology outpatient clinic. Data was entered into a secure epilepsy database, EpiNet. The t-test was used to compare the difference between proportions.

Demographic data was compared to the Ministry of Health census data for each DHB separately.

This study was done as a quality improvement activity, and according to National Health and Disability Ethics Committee guidelines, did not require ethics approval.

**Table 1: Baseline characteristics of seizure patients**

<table>
<thead>
<tr>
<th></th>
<th>Wellington ED</th>
<th>Hutt ED</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
<td><strong>Mean age in years</strong></td>
<td>45.7</td>
<td>45.1</td>
<td></td>
</tr>
<tr>
<td><strong>Male gender</strong></td>
<td>137 (54.8%)</td>
<td>132 (52.8%)</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European &amp; other</td>
<td>196 (78.5%)</td>
<td>174 (69.3%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Māori</td>
<td>41 (16.3%)</td>
<td>55 (21.9%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Pacific</td>
<td>13 (5.3%)</td>
<td>21 (8.5%)</td>
<td>0.16</td>
</tr>
</tbody>
</table>

**Table 2: Ethnic distribution of seizure patients compared to the regional population**

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Wellington ED Seizure patients (%) (N=250)</th>
<th>% Capital &amp; Coast DHB population (N = 302,645)</th>
<th>p-value</th>
<th>Hutt ED Seizure patients (%) (N=250)</th>
<th>% Hutt Valley DHB population (N = 145,835)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori</td>
<td>41 (16.3%)</td>
<td>11.1%</td>
<td>0.008</td>
<td>55 (21.9%)</td>
<td>17.8%</td>
<td>0.08</td>
</tr>
<tr>
<td>Pacific</td>
<td>13 (5.2%)</td>
<td>7.3%</td>
<td>0.20</td>
<td>21 (8.5%)</td>
<td>8.5%</td>
<td>0.95</td>
</tr>
<tr>
<td>European &amp; other</td>
<td>196 (78.5%)</td>
<td>81.6%</td>
<td>0.19</td>
<td>174 (69.6%)</td>
<td>73.7%</td>
<td>0.14</td>
</tr>
</tbody>
</table>

**Results**

Two hundred and fifty unique patients presented to Wellington Hospital between 11 February 2013 and 30 December 2013. For the Hutt hospital, the same number presented between 20 October 2012 and 31 December 2013. The baseline characteristics of these patients are given in Table 1.

There were more European patients presenting to Wellington ED, representing the ethnic mix of two DHBs. Māori were over-represented in the patients presenting with a seizure to both hospitals, as shown in Table 2. Sixteen percent of the seizure patients presenting to Wellington Hospital were Māori, compared to the population composition of 11.1%. Twenty-two percent of the seizure patients presenting to Hutt Hospital were Māori, compared to the population composition of 17.8%.

**Rate of neurology referral for all patients**

A significantly higher proportion of patients presenting with a seizure to Wellington ED (52%) were referred to
neurology services compared to those presenting to Hutt ED (13.6%). This difference was statistically significant. The proportion of seizure patients that were discussed with the inpatient neurology team while the patient was in ED, and the proportion that were referred to the neurology outpatient clinic are shown in Table 3. Patients presenting to Wellington ED were more likely to be discussed with neurology whilst in the emergency department, compared to those presenting to Hutt ED. First seizure patients presenting to Hutt ED were more likely to be referred to another medical specialist or discharged without a specialist referral. See Table 4.

**Discussion**

The National Institute of Clinical Excellence (NICE) recommends that all epileptic patients presenting with recurrent seizures should be referred to an epilepsy specialist. Furthermore, NICE recommends that all patients presenting with a first seizure should be referred to an epilepsy specialist—and seen, ideally, within 2 weeks. These recommendations were developed after an audit of SUDEP cases in the UK in 1999 found that 35% of the patients received inadequate access to specialist care. Our study shows that the provision of epilepsy specialist care in the Wellington region falls well short of these recommendations, and that the level of provision of seizure care varies between adjacent DHBs.

Patients presenting to Hutt ED were more likely to be referred to another medical specialist or be discharged without any specialist referral. The majority of ‘other specialist’ referrals were to general medicine and the remaining to either neurosurgery or oncology. Almost a third of the seizure patients presenting to Wellington ED and a half of those presenting to Hutt ED were discharged without referral to any specialist.

**First seizure patients**

Seventy-six of the 250 (30.4%) seizure patients presenting to Wellington ED and 61 of the 250 (24.4%) seizure patients presenting to Hutt ED were presenting with their first seizure. Patients presenting with first seizure to Wellington ED were more likely to be discussed with neurology whilst

<table>
<thead>
<tr>
<th><strong>Type of referral</strong></th>
<th><strong>Wellington ED N = 250</strong></th>
<th><strong>Hutt ED N = 250</strong></th>
<th><strong>p-value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurology In ED*</td>
<td>130 (52%)</td>
<td>34 (13.6%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Outpatient</td>
<td>96 (38.4%)</td>
<td>9 (3.6%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td></td>
<td>34 (13.6%)</td>
<td>25 (10%)</td>
<td>0.21</td>
</tr>
<tr>
<td>Other specialist</td>
<td>42 (16.8%)</td>
<td>90 (36%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>No specialist</td>
<td>78 (31.2%)</td>
<td>126 (50.4%)</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

* In ED = case discussed with neurology team while the patient was in ED.

<table>
<thead>
<tr>
<th><strong>Type of Referral</strong></th>
<th><strong>Wellington ED N = 76</strong></th>
<th><strong>Hutt ED N = 61</strong></th>
<th><strong>p-value</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurology In ED</td>
<td>48 (63.2%)</td>
<td>6 (9.8%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Outpatient</td>
<td>37 (48.7%)</td>
<td>1 (1.6%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td></td>
<td>11 (14.5%)</td>
<td>5 (8.2%)</td>
<td>0.25</td>
</tr>
<tr>
<td>Other specialist</td>
<td>20 (26.3%)</td>
<td>31 (50.8%)</td>
<td>0.003</td>
</tr>
<tr>
<td>No specialist</td>
<td>8 (10.5%)</td>
<td>24 (39.3%)</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
approximately 1,000 persons with epilepsy in the area. This means that the incidence of SUDEP cases in the HVDHB catchment in the last year was significantly higher than expected. This could be due to clustering of cases and we have no historical data to calculate rates or examine a trend.

Our study showed that patients presenting with any seizure to Hutt ED were less likely to be referred for neurology review than those presenting to Wellington ED. Patients presenting with first seizure to Hutt ED were also less likely to be referred for further evaluation. This could result in diagnostic or management omissions. It is not possible to say whether this contributed to the SUDEP episodes in the HVDHB catchment area but a contribution could not be completely ruled out.

A higher proportion of patients with first seizure were discharged directly from the Hutt ED with no specialist referral when compared to Wellington ED. A correct diagnosis of epilepsy requires the clinician to distinguish between seizures and other causes of transient neurological disturbance, which can be difficult. Misdiagnosis occurs in approximately 25% of the cases, especially when the diagnosis is made by a non-specialist. The misdiagnosis of epilepsy can result in serious health consequences for the patient as well as significant costs to the healthcare system.

Furthermore, the practice of discharging patients with a first seizure with no formal follow up plan possibly reflects an assumption amongst doctors that patients, having had a first seizure, will not require treatment. This is an assumption that is often incorrect and there are a number of instances where antiepileptic drug treatment may be considered after a first seizure. A history of focal onset to a seizure, the presence of any focal abnormality on neurological examination or the presence of epileptiform abnormalities on EEG all independently predict an increased risk of seizure recurrence. It is probable that some of the patients discharged with no formal follow-up may, in fact, have subtle findings that would only have been identified in subsequent neurological assessments. While patients may be subsequently referred for specialist assessment, this relies on the patient being seen again by their general practitioner and that referral being made. This has a financial cost to the patient, creates a time delay and is an inefficient use of health care resources.

As for many patients with complicated chronic disease, epilepsy patients require a cohesive interaction between primary care and hospital services. Some general practitioners acknowledge a lack of confidence regarding their own knowledge about epilepsy, as well as a lack of familiarity with new antiepileptic drugs. These issues have been identified as possible barriers to providing epilepsy care. The New Zealand chapter of the International League Against Epilepsy (NZLAE) has acknowledged these issues and is working to promote education about epilepsy amongst health care professionals.

It is probable that if the neurology service is physically located at the same hospital, this may facilitate direct communication between clinicians and thereby increase the likelihood of cases being discussed. This is consistent with the finding that the most significant difference between the two hospitals was the inpatient referral rate. It is likely that referring patients to a remote department is perceived as being more difficult. It is not possible to replicate multiple subspecialist services across a region; however it is apparent that in order for patients to receive a consistent standard of care, close liaison needs to exist between the various acute care services.

The proportion of Māori patients presenting to the emergency department with a seizure was significantly higher across the region. This difference in attendance numbers was made up by patients presenting with established epilepsy, rather than with a first seizure. We feel that the discrepancy is due to suboptimal seizure control and inadequate access to routine epilepsy care, rather than a higher incidence of epilepsy in Māori. This study did not examine the details of this discrepancy; however this difference is unlikely to represent access to hospital care alone.

It is probable that this trend reflects a wider issue regarding seizure care in the community, in primary care as well as in hospital outpatient clinics. Similar findings have been reported in Indigenous Australians and in the US, where those in low
socioeconomic groups present more frequently to ED for seizure care and hospitalization, and there are lower rates of specialist care. Our numbers were too small to allow comparison between Māori and non-Māori for rates of neurology referral. However, we expect these rates to be similar.

The main limitation of our study is that it was a retrospective review and relied on complete and accurate documentation by the ED clinicians as to whether a specialist referral was made. As a result it is possible that the calculated figures underestimate the true referral rate. However, we expect that this should not affect the comparison between the two DHBs. Additionally, our study did not specifically look at the referral pattern for patients with repeated seizures, who represent the highest risk group and have the greatest need for specialist input. This is an important quality measure and warrants inclusion in future studies.

These results highlight the lack of equity of access for epilepsy and seizure patients across the Wellington sub-region. These results have important implications for the provision of epilepsy care by the regional neurology service and the various DHBs that make up the region. Future planning and delivery of services needs to be based on equity of access for sub-regional populations, so health resources could be distributed equitably.

**Conclusion**

This study has demonstrated that the provision of epilepsy care across the Wellington region was unequal and in many cases did not comply with the NICE guidelines. Patients with acute seizure presentations in the HVDHB area were much less likely to receive neurology input than those in the CCDHB area, primarily because of different referral patterns across the two DHBs. Māori patients were also more likely to access acute medical services for seizure care. This information is directly applicable to the Wellington region, but is also applicable to other regions and other services which share this model of subspecialist provision of care, and should therefore inform health care planners on the resourcing and provision of regional services.

**Competing interests:**

Dr. Rosemergy reports they are the national secretary of the New Zealand chapter of ILAE (International League Against Epilepsy).

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VIEWPOINT

Getting serious about protecting New Zealand children against unhealthy food marketing
Stefanie Vandevijvere, Boyd Swinburn

ABSTRACT
Reducing childhood obesity is now a high priority for Government and New Zealand society, and foremost in these efforts should be getting serious about protecting children from being targeted by sophisticated marketing for the very foods and beverages that are making them fat. The marketing of unhealthy food products to children is powerful, pervasive and predatory. Previous studies in New Zealand found that food marketing targeted at children through various media is predominantly for unhealthy food products. Statutory comprehensive regulations providing full protections for children against unhealthy food marketing are recommended, but strengthening voluntary codes into a more quasi-regulatory system would allow food companies to clearly demonstrate their commitments to becoming part of the solution for New Zealand’s unacceptably high rate of childhood obesity.

The marketing of unhealthy food products to children is powerful, pervasive and predatory. It is powerful because it influences children’s food preferences, purchase requests, and consumption.\textsuperscript{1-3} It is pervasive because modern, integrated marketing ensures that brands engage with children across multiple media platforms. It is predatory because it exploits the credulity of children for commercial gain. It is timely to evaluate the degree of exposure of New Zealand children to unhealthy food marketing so that policy options can be better formulated and monitored.

Previous studies in New Zealand found that food marketing targeted at children through television,\textsuperscript{4-6} internet (paper under review), magazines,\textsuperscript{7} sports,\textsuperscript{8-10} around schools,\textsuperscript{11} in schools\textsuperscript{12} and on front-of-pack of food products\textsuperscript{13} is predominantly for unhealthy food products high in salt, sugar and saturated fat (Table 1). New Zealand children and adolescents who watch the most TV are significantly more likely to be higher consumers of foods most commonly advertised on TV: sugar-sweetened beverages, sweets, snacks and fast food.\textsuperscript{14} In addition, beverages that children commonly associate with sports overwhelmingly have characteristics which do not support them in adhering to existing nutrition guidelines.\textsuperscript{15}

International, national and public support for restriction of junk food marketing to children
There is strong international support for the restriction of unhealthy food marketing to children. Five years ago, at the 63\textsuperscript{rd} World Health Assembly, New Zealand and other member states endorsed Resolution WHA63.14 to reduce the marketing of unhealthy foods and non-alcoholic beverages associated with obesity in children and adolescents. In 2013, at the 65\textsuperscript{th} Health Assembly, member states also endorsed the World Health Organization (WHO) Global Action Plan and Monitoring Framework to Prevent and Control Non-Communicable Diseases (NCDs), including the restriction of unhealthy food and beverage marketing to children as one of 25 indicators to reduce NCDs by 25\% by 2025.\textsuperscript{16,17} The WHO Commission on Ending Childhood Obesity, chaired by the Chief Science Advisor to the New Zealand Prime Minister, also highlighted the imperative to reduce children’s exposure to unhealthy food and beverage marketing.\textsuperscript{18} There is
strong agreement of experts within the public health and medical communities in New Zealand about the restriction of unhealthy food marketing as one of the top priorities to tackle childhood obesity.\textsuperscript{19,20} The New Zealand Medical Association’s report on \textit{Tackling Obesity}\textsuperscript{19} included it as one of the 10 priorities, and the 56 public health experts participating in the healthy Food Environment Policy Index,\textsuperscript{21} identified the reduction of food marketing through broadcast and non-broadcast media and in settings where children gather as two of the seven top priorities.\textsuperscript{22} A New Zealand public opinion poll recently showed that the level of public support for not allowing advertisements of products that contain a lot of sugar and salt to be shown on television before 9pm was 3.7 on a scale from 1 to 5. In addition, the level of public support for not allowing fast food and soft drink companies to sponsor children’s sport was similar.\textsuperscript{23}

**Mandatory approaches—regulation as the gold standard**

The strongest policy option to protect children from being targeted by the marketing of unhealthy food products would be comprehensive restrictions of unhealthy food marketing to children through statutory regulations which cover all media, with a focus on television, sport sponsorship and marketing in settings where children gather. The Nutrient Profiling Scoring Criterion (NPSC)\textsuperscript{24} or the Health Star Rating system for the healthiness of foods developed by Food Standards Australia New Zealand could be used to define unhealthy food products not to be marketed to children, and children should be defined as up to at least 16 years old.

**Voluntary approaches—moving beyond failed self-regulation**

Studies have consistently demonstrated the failure of industry self-regulations to reduce the exposure of unhealthy food marketing to children and adolescents,\textsuperscript{25-27} because the sector has too many vested interests in perpetuating the status quo. The voluntary controls on marketing unhealthy foods to children currently in place by the Advertising Standards Authority\textsuperscript{28} are narrow, weak and ineffectual, and their continuation in their current form, is not a credible option for protecting children. There is, however, the potential for strengthening voluntary commitments by food companies and marketers by taking what is being called a quasi-regulatory approach. This would involve the Government setting clear policy goals and performance targets for the food industry to meet, monitoring them closely and providing the credible expectation that, if measureable improvements in voluntary performance are not achieved, more direct forms of regulation will be introduced.\textsuperscript{29} Quasi-regulatory approaches have worked in the UK for sodium reduction in processed food products\textsuperscript{30} and in Australia for implementing the voluntary Health Star Rating front-of-pack labelling. Expectations should include clear timelines for outcomes, common definitions,\textsuperscript{2} transparency and reporting requirements. Regular monitoring of the extent and nature of unhealthy food marketing through various media by an independent body is important to significantly strengthen and improve food industry initiatives.

**Conclusion**

Reducing childhood obesity is now a high priority for both the New Zealand Government and society, and foremost in these efforts should be getting serious about protecting children from being targeted by sophisticated marketing for the very foods and beverages that are making them fat. Statutory comprehensive regulations providing full protections for children against unhealthy food marketing are recommended, but strengthening voluntary codes into a more quasi-regulatory system would allow food companies to clearly demonstrate their commitments to becoming part of the solution for New Zealand’s unacceptably high rate of childhood obesity.
Table 1: Evidence on the extent of unhealthy food marketing to children through diverse media in New Zealand

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Medium</th>
<th>Sample size</th>
<th>Extent of unhealthy food marketing to children</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jenkin, 2009</td>
<td>Television</td>
<td>Four weeks of weekday TV, 3.30–6.30pm, 60 h of TV time, TV2, mid-winter</td>
<td>483 advertisements for food products or retailers with 66% for ‘unhealthy’ foods</td>
<td>Only one channel, limited hours of the day</td>
</tr>
<tr>
<td>Wilson, 2006</td>
<td>Television</td>
<td>155 h of TV time, 6.30–8.30 am and 3.30–6.30 pm on weekdays and 6.30–11.30 am on weekends, TV3 and TV2</td>
<td>588 food advertisements with 80% of ads on TV3 and 69% of ads on TV2 for ‘unhealthy’ foods</td>
<td>Only two channels, limited hours of the day</td>
</tr>
<tr>
<td>Wilson, 1999</td>
<td>Television</td>
<td>42 h of TV time, 3.30–6.30pm on weekdays and 8–11 am on weekends, TV2</td>
<td>269 food advertisements with 63% for ‘unhealthy’ foods</td>
<td>Only one channel, limited hours of the day</td>
</tr>
<tr>
<td>Carter, 2013</td>
<td>Sports settings</td>
<td>308 websites of national (n=58) and regional (n=250) New Zealand sporting organisations</td>
<td>24% of websites featured food company sponsorship. 186 logos on the websites included bars and restaurants (34%), unhealthy brands or companies (28%) and healthy brands/companies (20%).</td>
<td>Websites may not show all sponsorships</td>
</tr>
<tr>
<td>Maher, 2006</td>
<td>Sports settings</td>
<td>107 websites of national and regional New Zealand sporting organisations and local sport clubs</td>
<td>640 sponsors listed on 107 websites. Sponsorships with ‘unhealthy’ products (33%) over twice as common as those associated with ‘healthy’ products (16%).</td>
<td>Actual sponsorship practices of clubs not assessed, study included gambling and alcohol as well</td>
</tr>
<tr>
<td>Vandevijvere, 2015 (under review)</td>
<td>Internet</td>
<td>Websites (n=70) of the food brands most frequently marketed to children through television, sport sponsorship, magazines and Facebook plus the most popular websites (n=110) among New Zealand children 6–17 years</td>
<td>Marketing techniques on food brand websites, included ‘advercation’ (branded education) (87%), viral marketing (64%), use of cookies (54%), free downloadable items (43%), promotional characters (39%), designated children’s sections (19%) and ‘advergaming’ (branded games) (13%). Techniques more frequent on websites specifically targeting children. Food marketing on popular non-food websites was low.</td>
<td>Social media not assessed</td>
</tr>
<tr>
<td>No, 2014</td>
<td>Magazines</td>
<td>3 magazines which target 10–17 year olds plus 3 other popular (women’s) magazines with this age group</td>
<td>Branded food references (30% of total) were more frequent for unhealthy (43%) compared to healthy (25%) foods. Magazines specifically targeted to children and adolescents contained a significantly higher proportion of unhealthy branded food references (72%) compared to the women’s magazines (42%).</td>
<td>Only one food group assessed</td>
</tr>
<tr>
<td>Devi, 2014</td>
<td>Product packaging</td>
<td>Front-of-pack for all breakfast cereals (n = 247) at two major supermarkets in Auckland in 2013</td>
<td>Of the 52 products displaying promotional characters, 48% were for ‘cereals for kids’, and of those, 72% featured on ‘less healthy’ cereals.</td>
<td>Only one food group assessed</td>
</tr>
<tr>
<td>Maher, 2005</td>
<td>Outdoors around schools (1 km radius)</td>
<td>10 schools randomly selected from Wellington and Wairarapa area</td>
<td>Out of the 1,408 advertisements, 62 were for food with 70% of them for ‘unhealthy’ foods.</td>
<td>Limited number of schools included, pilot study</td>
</tr>
<tr>
<td>Richards, 2005</td>
<td>In schools</td>
<td>77/114 primary/intermediate schools and 79/147 secondary schools in six geographical regions of New Zealand (Auckland, Waikato, Wellington, Nelson/ Marlborough, Canterbury and Southland)</td>
<td>Most schools were involved in at least one form of sponsorship. Almost all schools reported selling products, and 58% of products sold by primary/intermediate and 61% by secondary schools were for ‘unhealthy’ foods.</td>
<td>Poor details on sponsorship practices</td>
</tr>
</tbody>
</table>
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Clinical governance and point-of-care testing at health provider level
Geoffrey Herd, Samarina Musaad

ABSTRACT
Clinical governance provides a quality assurance and safety framework. A large proportion of point-of-care testing (POCT) activities in New Zealand are not subject to the same levels of regulation and accreditation that must be met by conventional medical laboratory testing. Providers who use POCT for diagnosis, monitoring and treatment need to develop programmes that are subject to effective clinical governance to ensure that POCT devices are suitable and safe for the clinical setting in which they are being used, and test results are consistently accurate and precise, ie reliable, at all times. POCT needs to be integrated with clinical management protocols and test results need to be accessible to healthcare personnel.

Effective clinical governance of POCT by providers requires recognition by top management that the scale and scope of testing within New Zealand is large and expanding, and that there are associated risks and costs. Systematic input from laboratory, clinical and managerial stakeholders, and compliance with guidelines and standards is required to ensure that POCT is safe, clinically justified and cost effective.

Introduction
Point-of-care testing (POCT) is defined as, “testing that is performed near or at the site of a patient with the result leading to possible change in the care of the patient and is performed in a variety of clinical settings.” POCT in hospitals is used to obtain test results more quickly than by conventional laboratory testing in order to improve clinical decision making.

POCT devices are classified as in vitro diagnostic devices (IVDD). In many situations, non-laboratory trained personnel carry out the actual testing. Examples include blood gas analysis and thromboelastography in operating theatres; pregnancy tests, urinalysis, and cardiac troponins in emergency departments, and HbA1c in outpatient diabetes clinics. Patients can self-monitor glucose levels at home and adjust medication accordingly. In general practice, infectious diseases can be screened for using POCT devices.

Point-of-care technologies can help to improve access to healthcare. For example, the community pharmacist-led anticoagulant monitoring service (CPAMS) for patients on warfarin in New Zealand, which is consistent with the concept of ‘better, sooner, more convenient’ healthcare.

Implementation of POCT in hospitals and clinics can also shorten the ‘therapeutic turn-around time’ when compared with conventional laboratory testing. However, POCT devices must be ‘fit for purpose’ in the clinical setting in which they will be used and because many tests are carried out by staff who are not professionally trained in medical diagnostic testing, appropriate onsite certification and quality control is required to ensure ongoing clinical safety.

POCT can improve patient outcomes, but presents significant challenges. This type of testing needs to be governed and regulated at a national level, but also needs to be supported by adequate clinical governance and quality management systems at provider level. Standards and guidelines are needed in the interests of patient safety because currently there are no requirements for POCT to be performed.
A point-of-care test is appropriate in the management expertise to determine if and logistics presenting the clinical specialties, pathology, solved by conventional laboratory tests. by point-of-care testing which cannot be clinical problem which needs to be solved Therefore, from a governance perspective, establishing standard of care and assists setting; (iii) the POCT technology meets the and logistical requirements for the clinical (ii) the test or service meets the analytical appropriate for use at the point of care; (iii) the test or service meets the analytical and logistical requirements for the clinical setting; (iii) the POCT technology meets the established standard of care and assists with achieving best health outcomes. Therefore, from a governance perspective, the most important step is to define the clinical problem which needs to be solved by point-of-care testing which cannot be solved by conventional laboratory tests.

A POCT governance group representing the clinical specialties, pathology, nursing, finance, information services and logistics will have the clinical and management expertise to determine if a point-of-care test is appropriate in the intended clinical setting, identify risks, and ensure that it is integrated with patient care pathways.

The New Zealand Point-of-Care Testing Advisory Group (NZPOCTAG) has developed a set of Best Practice Guidelines for POCT which reflect the current literature and experience from ISO 22870:2006 accredited New Zealand medical testing laboratories. The guidelines provide a framework for establishing a sustainable POCT quality management system which encompasses the clinical and financial risks and the operational impact of the new POCT service in terms of clinical staff and laboratory scientists time, health and safety, infection control, location of equipment, services, data transmission, storage and dispatch of consumables, documentation, collection of samples, education and training of staff. Adverse event or incident reporting systems and clinical audits should be implemented to ensure ongoing quality, safety and corrective or preventive action taken as required. It is also important to determine how the POCT results correlate with those obtained by conventional laboratory instruments in terms of sensitivity, specificity, accuracy, bias and uncertainty of measurement.

The strategy outlined above should be supported by an organisational POCT policy and the appointment of a POCT Coordinator or Manager to manage the clinical and financial risks and operational impact associated with POCT. This approach attempts to address the constraining problem of ‘silo budgeting’, meets the challenges and mitigates the disadvantages of POCT and also rests on evidence for its potential to improve health outcomes. Some of the organisational perspectives and challenges associated with implementation of quality management systems for POCT are listed in Box 1. A governance group will have the authority and expertise to address these challenges.

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**Box 1: Challenges for POCT—Organisational Perspectives in New Zealand**

- laboratory staff perspectives — perceived high cost, inferior results, erosion of work place, deskilling
- medical/nursing/midwifery/management perspectives
- attitudes to quality control testing: “it’s only glucose…”
- attitudes to certification: “where is your evidence?”
- attitudes to accreditation: “why do we need it?”
- prevalence of “silo mentality and budgeting”
- prevalence of high perceived cost of POCT by management
- lack of appreciation that modern medicine is impossible without POCT
- lack of appreciation in terms of improved patient outcomes
- lack of appreciation that POCT can improve both access to healthcare and the patient experience
- lack of appreciation of the need for pathologist and medical laboratory scientist advice and oversight

This viewpoint article discusses governance for POCT programmes and the implications for executive teams and providers, with examples of successfully implemented programmes in New Zealand.

Clinical governance for POCT at healthcare provider level

Evidence-based laboratory medicine (EBLM) provides a platform for the selection of diagnostic technologies and is crucial for effective clinical governance of POCT. EBLM can help to assure that: (i) a particular test or technology is clinically appropriate for use at the point of care; (ii) the test or service meets the analytical and logistical requirements for the clinical setting; (iii) the POCT technology meets the established standard of care and assists with achieving best health outcomes.

Therefore, from a governance perspective, the most important step is to define the clinical problem which needs to be solved by point-of-care testing which cannot be solved by conventional laboratory tests.

A POCT governance group representing the clinical specialties, pathology, nursing, finance, information services and logistics will have the clinical and management expertise to determine if a point-of-care test is appropriate in the intended clinical setting, identify risks, and ensure that it is integrated with patient care pathways.

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Evaluation and validation of POCT devices

In the UK, the Medical Devices and Health Products Regulatory Agency (MHRA) has published evaluation information on POCT devices. In New Zealand, there are no minimum standards manufacturers must meet for quality and analytical performance (with the exception of glucose meters). Information on the performance of some POCT devices is limited, and it is strongly recommended that devices are validated before use.

At the time of writing, the NZPOCTAG is in the process of developing a national database of POCT devices, but a Reference Laboratory Device Evaluation Service is needed for independent evaluations of POCT devices. This service would need to use internationally accepted evaluation protocols, such as those published by the Clinical Laboratory Standards Institute. This concept is similar to the Scandinavian Evaluation of Laboratory Equipment for Primary Health Care (SKUP) service.

So how do stakeholders decide which technology or device should be used for a POC test? In the absence of a centralised repository of information, reliance on literature, knowledge and evaluation expertise from pathologists and medical laboratory scientists is recommended by the NZPOCTAG, the Australasian Association of Clinical Biochemistry (AACB) and the Royal College of Pathologists of Australasia (RCPA). The lack of a central repository of information also means that devices must be evaluated and validated in the intended clinical setting by pathology and clinical staff locally. Validation tests may require ethical approval and is also time consuming and costly both for providers and suppliers.

Patient safety, quality and POCT

The principal reason for any clinical quality management system is to reduce error and improve patient outcomes. The main sources of error related to POCT are: operator incompetence or non-adherence to procedures; the use of uncontrolled reagents and equipment; and technical issues at the time of performing POCT. The impact of these errors can be amplified by incoherent regulation and rapid result availability which in turn may lead to misinformed therapeutic intervention.

Basic information on sources of error is available from device manufacturers but pathologists and medical laboratory scientists from accredited laboratories can provide leadership and objective advice on the implementation of robust quality assurance systems to ensure the ongoing quality of the test results.

Where possible, test results should be incorporated into the patient's electronic medical record, and technologies which are compatible with connectivity standard POCT1-A2 should be used. Connectivity-based systems improve compliance with test procedures and quality control to prevent analytical errors, ensure traceability of test results between operators and the patient's record, reduce test gaps, transcription errors, and the risk of patient harm. Connectivity helps to integrate the patient's POCT results with other health information.

Portable devices, such as glucose meters and lactate analysers, which are used between patients can be a source of healthcare acquired infections and therefore, appropriate infection prevention strategies and decontamination procedures should be implemented.

Standards and guidelines for POCT in New Zealand

International Accreditation New Zealand (IANZ) is responsible for accreditation of medical testing and POCT against the ISO 15189:2012 and the ISO22870:2006 standards. In addition to the two medical testing standards, and the connectivity standard POCT1-A2, the AACB, the NZPOCTAG and RCPA have developed guidelines and position statements for the implementation of POCT systems.

Copies of the NZPOCTAG Best Practice Guidelines for POCT have been distributed to a wide range of New Zealand health agencies and are also available from the authors (the New Zealand Institute of Medical Laboratory Science (Inc)) website, www.nzimls.org.nz, and the Institute of Clinical Excellence website, www.nzice.co.nz.

Regulation and accreditation for POCT in New Zealand

The majority of POCT devices are not regulated in New Zealand. Pregnancy test kits are IVDD, which are not medicines but undergo the same the regulatory process as...
medicines under the Medicines Act 1981. Medical devices are required to be listed on the Web Assisted Notification Database (WAND) but IVDDs are exempt from inclusion on this database and suppliers are not required to comply with pre-analytical standards. PHARMAC is due to assume responsibility for management of medical devices from 2015, and this may provide an opportunity for a formal approval process for POCT devices with information on their analytical performance and enhancement of the New Zealand database.

Assessment of POCT testing is not specified as part of hospital accreditation and certification, although hospital and community medical laboratories are accredited by IANZ to ISO 15189:2012. In addition, District Health Board (DHB) contracts for community-based medical laboratory testing require accreditation to ISO 15189:2012, but accreditation for POCT to ISO 22870:2006 in hospitals is not mandatory.

At the time of writing, in New Zealand there are 63 conventional medical testing laboratories, both in hospitals and in the community, which are accredited for medical testing by IANZ to ISO15189:2012. Eighteen of these laboratories have accreditation to ISO 22870:2006 for POCT. The latter group which have POCT accreditation only include DHB-based public hospital laboratories. Examples of the scope and scale of POCT accreditation in New Zealand vary from one device in one location, up to 42 different devices across many locations and may involve certification of less than ten operators, to hundreds of operators. The IANZ website lists DHB medical laboratories and the scope of testing encompassed by accreditation for POCT in their respective hospital settings.

Examples of successful implementation of non-DHB POCT services

Despite its challenges, POCT programmes have been successfully implemented in non-accredited settings. Rawene Hospital in the Hokianga, an area of high deprivation, does not have an on-site laboratory service. The use of POCT improved patient disposition and diagnostic certainty and resulted in fewer transfers to Whangarei Hospital. The total annualised treatment costs to Hokianga Health Enterprise Trust were $90,222, but the net saving to the Northland DHB was $362,360.

A review of the CPAMS initiative showed that the mean Time in Therapeutic Range (TTR) for the 671 patients whose results were evaluated was 78.6%, rising to 79.4% and 80.2% for patients who had been in the CPAMS for 16 weeks or 26 weeks respectively. All pharmacy sites achieved a mean TTR in excess of 70% (range 71.4% to 84.1%), well above the recommended target of 60%.

These programmes are supported by quality management systems based on ISO 22870:2006 and the NZPOCTAG Best Practice Guidelines for Point-of-Care Testing.

Conclusion

Clinical governance and quality assurance systems among health providers who use POCT are not universal in New Zealand. POCT can improve access to healthcare but presents some unique organisational challenges. Providers need to ensure that if a POCT service is to be implemented, it needs to be clinically appropriate for the intended setting, that POCT is a suitable alternative to conventional laboratory based testing and that the clinical and financial risks are considered by a clinical governance group.
There is a diverse and rapidly expanding range of POCT technologies available which are used by large numbers of clinical staff who are not specifically trained in medical laboratory testing. Therefore, the selection of devices needs to be integrated with clinical pathways and their implementation needs careful management in the interests of patient safety. The authors recommend that a national reference laboratory service be established to evaluate and provide objective advice on POCT devices. Where possible, connectivity-based systems should be selected so that the results of POC tests can be integrated with the patient’s electronic medical record.

The New Zealand Point-of-Care Testing Advisory Group has developed Best Practice Guidelines for Point-of-Care Testing. Clinical and executive teams are encouraged to use this document to guide decision making and to seek advice from accredited medical testing laboratories with regard to device selection and the design of quality management systems for POCT. Accreditation for POCT should also be considered where practicable.

Competing interests:
Geoffery Herd reports other from Roche Diagnostics New Zealand, other from Radiometer Pacific New Zealand, other from Siemens Ltd New Zealand Healthcare Sector, outside the submitted work; he is a member of the New Zealand Point-of-Care Testing Advisory Group. This group is comprised of medical laboratory scientists and pathologists from District Health Board and Community Pathology Laboratories who are actively involved in point-of-care testing in New Zealand. The group provides advice on point-of-care issues and best practice to a wide variety of health groups and agencies.

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A systematic review of international evidence suggests standardised ('plain') packaging will decrease the appeal of smoking, increase the salience of on-pack warnings, and reduce misperceptions about the harms of smoking. Standardised packaging thus represents a vital measure governments should implement as part of a comprehensive approach, if they wish to end the smoking epidemic.

The World Health Organization (WHO) has endorsed standardised packaging as “a legitimate and effective tobacco control measure”, which “is fully in line with the spirit and intent of the outcome of the UN High-level Meeting, and ... in accordance with international legal obligations under the WHO FCTC”.

The UK and Ireland have already passed legislation introducing standardised packaging, and other nations, including France and Norway, have announced plans to proceed with standardised packaging. Yet, despite this international momentum, and repeated statements from the previous Minister of Health that standardised packaging is “inevitable”, progress in implementing this measure here has not kept pace with other countries.

Given New Zealand was the first country to adopt a smokefree goal, it might also be expected to be at the vanguard of new tobacco control measures. However, although the Smoke-free Environments (Tobacco Plain Packaging) Amendment Bill, which passed its first reading on 11 February 2014 (118 votes to 1), was returned from the Health Select Committee on 5 August 2014, it still has no second reading date. Instead of moving quickly to pass this evidence-based legislation, which has strong and growing public support in New Zealand, the Government has stated its intention to await outcomes from two international legal cases against the Australian government. Unfortunately, this position effectively enables the tobacco industry to create further delays by attenuating resolution of these disputes.

While a cautious stance may initially have seemed prudent, the growing evidence base, increasing international adoption of standardised packaging and promising research findings from Australia, all suggest it is timely for the Government to revisit its initial position and accelerate the progress of this important legislation. If tobacco companies dictate the pace of New Zealand's legislative agenda, we will see continuation of a marketing strategy that tempts young people into experimenting with smoking and sees 13 New Zealanders die every day from illnesses caused directly by smoking.

We call on the Government to recognise the encouraging evidence from Australia and growing adoption of standardised packaging by other countries, and re-assess their stance. There are now even more reasons to pass and implement standardised packaging legislation without delay.

The Australian government introduced standardised packaging primarily to protect young people from the devastating illnesses that reduce the length and quality of smokers' lives. The legislation was designed to achieve this goal by reducing the attractiveness and appeal of tobacco products, increasing the salience and impact of health warnings, and reducing the ability of tobacco product packaging to mislead consumers about the harms of smoking. Then Health Minister Nicola Roxon stated, “of course we’re targeting people who have not yet started, and that’s the key to this plain packaging announcement—to make
sure we make it less attractive for people to experiment with tobacco in the first place”.

Data from Australia, which implemented standardised packaging from 1 December 2012, support predictions from experimental and exploratory studies and show standardised packaging is achieving the legislation’s objectives, consistent with researchers’ and public health groups’ expectations.

Evidence of detailed trends among young people will inevitably take time to emerge, but it is encouraging that the recent National Drug Strategy Household Survey (NDSHS) found, “Younger people are delaying the take up of smoking” and “the age at which 14–24-year-olds smoked their first full cigarette increased from 15.4 in 2010 to 15.9 in 2013”.

While age of initiation had been increasing for some time, the NDSHS evidence is consistent with predictions that standardised packaging would reduce the appeal of smoking. Studies conducted pre- and post-standardised packaging found smokers had significantly stronger cognitive, affective and aversive responses to on-pack warnings following standardised packaging’s implementation, while their perceptions of pack attractiveness and appeal all declined significantly.

Their propensity to display packages in public settings, particularly those where children are present, also declined. Analyses of smokers’ thoughts of quitting as standardised packaging was implemented found these increased.

Again, the mounting evidence from Australia corroborates predictions made using survey, qualitative and experimental data, and strengthens the case for urgent action to pass and implement standardised packaging legislation.

It is also encouraging that adult smoking prevalence post-standardised packaging has fallen to the lowest level yet recorded. The 2013 NDSHS reported 12.8% of Australians aged 14 years and over were daily smokers, a decline of 2.3% percentage points from 2010; furthermore, smokers have reduced the average number of cigarettes they smoke per week from 111 cigarettes in 2010 to 96 in 2013. These figures are also consistent with researchers’ predictions and are further supported by other government data. For example, the Australian Bureau of Statistics showed total consumption of tobacco and cigarettes, as measured by estimated expenditure on tobacco, fell from $3.508 billion in the last quarter of 2012 to $3.405 billion in the first quarter of 2014, the lowest expenditure ever recorded.

Commonwealth Treasury data showed similar results as tobacco clearances fell by 3.4% in 2013 relative to 2012.

The accumulating evidence contradicts dire predictions made by the tobacco industry and its allies that standardised packaging would result in adverse consequences, such as increased smuggling and illicit marketing of counterfeit cigarettes, or increased transaction times in stores. Industry claims have been comprehensively refuted by government agencies and peer-reviewed research.

Ahead of the legislation, the Australian tobacco industry and its allies claimed through lobbying, media, and even advertising, that they would be entitled to billions of dollars in compensation. When this claim was tested in the High Court, the industry not only lost comprehensively, but was required to pay the government’s costs. Furthermore, far from alienating smokers, support for standardised packaging among smokers almost doubled following the policy’s introduction.

Discrepancies between tobacco companies’ predictions and the actual effects we are now seeing should not be surprising, given the tobacco industry’s long-standing reliance on spurious arguments and questionable practices to oppose proportionate policy measures. Robust analyses from the UK recently exposed how the tobacco industry has misrepresented standardised packaging and suggest the government should treat any ‘evidence’ adduced by the industry with considerable scepticism.

Increasing adoption of standardised packaging by other countries suggests deferring progress on New Zealand legislation until international court cases have concluded is no longer a logical position for the government to hold. Deferring action risks leaving policy making captive to an industry that now has every incentive to delay these international legal proceedings for as long as possible.
We have known for decades how the tobacco industry has used packaging to position smoking as glamorous, sophisticated and rebellious, particularly following restrictions on traditional mass media advertising.\textsuperscript{21,39,40} The industry's arguments that standardised packaging would have no effect are as hollow as its legal actions are desperate, and the time has surely come for the Government to acknowledge the strong research evidence, display the same initiative shown by some of its strongest allies, and take firm, decisive action that sees standardised packaging implemented as soon as possible.

In summary, the Government has no need to fear standing alone or acting precipitously—it neither is nor would be. However, it should be mindful of the risk New Zealand now faces: being left behind as other countries respond to the research evidence and show resolute leadership in the face of corporate bullies. We urge the Government to act on the real-world data that is rapidly amassing, take a principled and evidence-based stand, and pass and implement the standardised packaging legislation as quickly as possible. Doing so will reassert New Zealand as a leader in tobacco control, demonstrate a commitment to ending the smoking epidemic, and foster realisation of New Zealand's world-leading goal of becoming smokefree by 2025.

**Competing interests:**

Janet Hoek reports she has received funding for tobacco control research from the Health Research Council, Royal Society Marsden Fund, ASH NZ, NZ Ministry of Health, and the NZ Heart Foundation. Some of the studies funded examined plain packaging, but the findings reported in this viewpoint were not directly funded by any external grant. She is a member of the Australian Government's Expert Advisory group on plain packaging and have given expert advice on this topic to the NZ Ministry of Health and Health Promotion Agency. Professor Daube reports he was Deputy Chair of the Australian Government’s National Preventative Health Taskforce and chaired the Tobacco Expert Committee that recommended plain packaging as part of a comprehensive approach.

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Reversible diabetes insipidus in a patient with multiple myeloma

James AD Shand, Nicole McGrath

ABSTRACT

We present a case of reversible diabetes insipidus in a 64-year-old man with multiple myeloma. Central diabetes insipidus developed in association with a myelomatous lesion of the clivus, but without evidence of macroscopic pituitary compression. Resolution of this patient’s diabetes insipidus was observed following treatment of his myeloma.

A 64-year-old man presented with bone pain and weight loss. Blood tests revealed serum IgA 12.8 g/L (normal range 0.8–4.0), serum free lambda light chains 857 mg/L (6–26), beta-2 microglobulin 7.5 mg/L (0.0–3.2), corrected calcium 3.41 mmol/L (2.10–2.55), albumin 41 g/L (38–52) and creatinine 134 umol/L (60–105). X-rays demonstrated multiple long bone lytic lesions. A diagnosis of advanced IgA lambda multiple myeloma (MM) was made and the patient commenced chemotherapy with cyclophosphamide, dexamethasone and bortezomib.

On the day of his third weekly dose of the first cycle of chemotherapy, he required hospital admission with profound dehydration and hypotension. He reported that he had been passing six litres of urine per day and drinking copious fluids. In retrospect, he had noticed increased thirst and urine output for six months, but had not mentioned it previously. His regular medications at this time were aciclovir, trimethoprim/sulfamethoxazole, ezetimibe, allopurinol, aspirin, cilazapril and dexamethasone. Admitting blood tests showed a creatinine of 152 umol/L (60–105), corrected calcium of 2.22 mmol/L (2.10–2.55) and a sodium of 137 mmol/L (135–145). His anti-hypertensive agent (cilazapril) was discontinued and he was rehydrated with IV fluids.

An overnight water deprivation test was suggestive of diabetes insipidus (DI), with a urine osmolality of 288 mOsm/kg (normal >750) and a matched serum osmolality of 293 mOsm/kg (normal urine/serum osmolality >2.4).

He then underwent a formal 7-hour water deprivation test, as per the local protocol. Despite being nil by mouth he continued to produce 75–200mL urine per hour. At the end of the test his urine osmolality was inappropriately low at 270 mOsm/kg with a serum anti-diuretic hormone (ADH) of only 0.8 pmol/L (normal >1.0). Following administration of 2mcg of IV desmopressin his urine osmolality increased to 359 mOsm/kg and urine volume reduced to 30mL/hour (Table 1).

A diagnosis of central DI was made and nasal desmopressin prescribed. The patient reported resolution of his nocturia and return to a normal fluid intake. There was no evidence of anterior pituitary dysfunction and he had a morning serum cortisol of 430 nmol/litre (200–700). He had a normal plasma glucose and none of his medications were known to cause central DI.

An MRI pituitary was arranged (Figure 1). The pituitary gland was normal, apart from absence of the posterior pituitary bright spot. There were mottled changes of the skull base, in particular the clivus, confirmed as lytic lesions on a subsequent CT head scan (Figure 2). The bone lesions were consistent with myeloma. On the MRI scan there was also anomalous cerebral vasculature with a primitive trigeminal artery that caused distortion of the pituitary gland.
**Table 1:** Results of a formal 7-hour water deprivation test.

<table>
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<th>Urine Volume (mL)</th>
<th>Urine Osmolality (mOsm/kg)</th>
<th>Plasma Osmolality (mOsm/kg)</th>
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<td>6</td>
<td>110</td>
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<tr>
<td>Desmopressin given</td>
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<tr>
<td>7</td>
<td>30</td>
<td>359</td>
<td>298</td>
</tr>
</tbody>
</table>

**Figure 1:** MRI pituitary demonstrating persistent primitive trigeminal artery (solid lines) and mottled changes of the clivus (broken line)

**Figure 2:** CT head demonstrating lytic lesions of the clivus (arrow)
Chemotherapy was continued with good effect associated with a rapid fall in serum free light chains after three cycles of four doses each. With this improvement the polydipsia and polyuria also decreased and the patient stopped his desmopressin nasal spray after 6 weeks without a recurrence of symptoms.

Discussion

This case demonstrates reversible central DI caused by MM with involvement of the skull base. The lytic lesions in the clivus presumably compromised posterior pituitary function. The mechanism is unclear; microscopic impingement seems most likely. With chemotherapy, our patient experienced a reduction in tumour burden and resolution of his DI symptoms. This patient also has a persistent primitive trigeminal artery that has been previously reported to cause compression of the pituitary gland and stalk. His symptoms only developed around the time of his MM presentation so anomalous cerebral circulation alone is unlikely to be the cause of his DI, but may have contributed to its development. We did not test anti-vasopressin cell antibody but there was no personal or family history of auto-immune disease and his DI initially worsened with dexamethasone treatment. Cyclophosphamide has previously been linked to nephrogenic DI but not central DI and is therefore unlikely to have been the cause of our patient’s presentation.

Neurological sequelae of myeloma are well documented with diverse aetiology, including metabolic derangement, spinal cord compression, secondary amyloidosis and medication side effects. However, direct central nervous system (CNS) involvement is rare and is generally associated with widespread intracranial disease. Pituitary dysfunction has been described in the context of sella plasmacytomas but we could only find one case report in the English literature of a patient with MM complicated by central DI. This patient had a sella plasmacytoma and panhypopituitarism which did not improve with treatment of his myeloma.

This case documents an unusual manifestation of multiple myeloma and contributes to our growing knowledge of the varied systemic effects of this disease.

Competing interests: Nil
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REFERENCES:
Oculosympathetic paresis
Ji Young Moon, Yeon-Hee Lee, Hyo Jin Lee

Clinical presentation
A 67-year-old recurrent uterine cervical cancer patient with left supraclavicular lymph node metastasis presented with one week history of left eyelid drooping. On history taking and examination there was a 3mm ptosis of the left upper eyelid, a smaller left pupil, and left facial hypohydrosis (Figure 1A). Administration of one drop of 0.5% apraclonidine in both eyes resulted in reversal of anisocoria and resolution of ptosis (Figure 1B).

Answer and discussion
Oculosympathetic paresis, also known as Horner’s syndrome, is a characteristic triad of features which consists mainly of miosis, partial upper eyelid ptosis and facial anhidrosis on the ipsilateral side. It occurs as a result of disease affecting the ipsilateral sympathetic pathway along its course from the hypothalamus to the orbit, and it may also be congenital or iatrogenic.\(^1,2\) It should prompt clinicians to investigate vigorously any lesion of the oculosympathetic tract as it may be the manifestation of an important underlying condition such as malignant tumor. Neoplasia is the most common cause and accounts for 35-60% of all cases.\(^3\)

Figure 1A: Ptosis of the left upper eyelid and a smaller left pupil.
Figure 1B: Reversal of anisocoria and resolution of ptosis after administration of one drop of 0.5% apraclonidine in both eyes.

Competing interests: Nil

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REFERENCES:
Re: Physician-assisted dying—a survey of Waikato general practitioners

David Richmond

Opinion polls of public and doctors have been a feature of the debate over legalising euthanasia and assisted suicide since the early 1950s. The ‘winners’ of course place great stock on the outcomes. However, research by professional pollsters shows clearly that the way a question is worded influences the answer. Gallup for example, has run regular public polls on this issue for many years and has found that public support for euthanasia for a person living with incurable severe pain drops from about 70% when the doctor’s intervention is euphemistically described as “ending the patient’s life by some painless measure” to 50% when it is described as “assistance to commit suicide”. Others have found even more drastic falls (to about 10%) when the question is personalised rather than hypothetical.

This ‘euphemistic factor’ impacts on Dr Havill's poll because it asks about a medical practitioner giving “assistance to die on request”. What does this mean? Isn’t that what every general practitioner is frequently called upon to do? Does “assistance to die” include, in Havill’s mind, killing the patient? If it does, why isn’t Havill prepared to say so for the sake of clarity, rather than resort to euphemisms?

A second difficulty with this poll is that question 1 is prefaced by the statement: “Given adequate safeguards against abuse, do you support...” The problem there is that nowhere in the world where euthanasia or assisted suicide are legal has it been possible to set in place legal safeguards against abuse. Thus, for example, in Belgium—which has legislation similar to the End of Life Choice Bill of Maryan Street—about one third of assisted suicides are carried out without any request from the patient. A proportion of those patients were judged to have been capable of making a request had they chosen to do so. In Oregon ‘doctor shopping’ aided by Compassion and Choices as a way of circumventing the legislation is common. Anyone responding to this question as worded would do so under a false sense of security. It would be much more realistic to preface any further polling with: “Given that adequate safeguards against abuse cannot be guaranteed,” or words to that effect.

Finally, I wonder why in the tabular presentation of results Dr Havill combined the two end categories of his five-point scale. We could possibly have learned something very important about the numbers that fully support his propositions on the one hand and that totally opposed them on the other had he reported the results without this modification.

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Electronic cigarettes appealing quit aids for young adult smokers

Marewa Glover, Hayden McRobbie

Guiney et al’s paper on the ‘Barriers to successful cessation among young late-onset smokers’ walked right past the elephant bellowing amidst their results. The small study surveyed 111 current smokers who were mostly non-Māori, non-Pacific. Mean age was 22.5 among the sample who had become established smokers after they turned 18 years old. A high proportion reported quitting behaviour in the previous 12 months, with nearly half intending to attempt quitting again in their imminent future. Electronic cigarettes were the second intended quit aid (50%) after quitting ‘without any support’ (73%). The internet (46%) and nicotine replacement therapy (45%) were similarly favoured.

The authors lamented the young people’s preferences as unfortunate because “using no support is the least effective quitting method”, and “there is no consistent evidence” that the young people’s preferred quit aid, e-cigarettes and/or the internet, “are effective at improving quit success”. The authors recommended the need to increase young people’s use of cessation aids (excluding electronic cigarettes or internet). They said there needs to be targeted services that appeal to, and are effective for, this group. However, because their sample had mostly low dependency levels and they concluded from the literature that nicotine replacement therapy (NRT) is not very effective for people with low dependency, they recommended that targeted services should focus on “non-chemical (ie, social and behavioural) reinforcers of smoking.” For example, “providing young adults with practical strategies to deal with social pressure to smoke in certain contexts.”

Quitting without support is not unusual for young adults. Use of cessation support is related to the perceived level of addiction and ability to quit, as well as negative views towards stop-smoking medicines. This group had high confidence in their ability to quit and so perhaps it is not surprising that they believed that they could do it on their own.

Electronic cigarettes, internet-based cessation support and possibly additionally NRT (as survey participants could select multiple intended cessation aids) appealed to at least half of the sample. There is growing evidence that both electronic cigarettes and internet programmes can help people to stop smoking. The internet could also have scored as highly as e-cigarettes because, in New Zealand, nicotine for use in electronic cigarettes is only legally available via the internet from overseas suppliers (or purchased in person overseas).

Polosa et al tested the provision of personalised advice to cut down and quit delivered by vape shop staff and found high and stable success rates. If young New Zealand adults, or any smokers, want to use electronic cigarettes in their next quit attempt, we should be ready with good information about how to vape instead of smoking, and we should be providing them with easier local access to nicotine to maximise their chance of sustained smoking cessation. This advice is being given by some stop smoking services in the UK, where an exodus of smokers to vaping has occurred: 400,000 in the previous year, taking the total number of vapers to 2.6 million.

We acknowledge that the international debate on vaping is highly conflicted, making it difficult for researchers, academics, doctors, healthcare workers and the general public to know whether to recommend new cessation technologies and products or ignore them. Young adults
LETTERS

are not ignoring what’s new and perhaps they have calculated the risk: 6 million deaths a year globally caused by smoking tobacco versus likely harm from vaping, estimated to be 95% safer. Whilst the Ministry of Health’s website advice on the use of e-cigarettes currently says that health professionals should promote approved cessation medication for assisting people who want to quit, they should not dismiss the use of e-cigarettes by people who want to use them to support their efforts to become smokefree. The evidence base for these alternative, yet popular, approaches to stopping smoking is changing quickly. We need to catch up on the latest evidence, the products and social media strategies so that we can better meet the cessation needs of all people who smoke.

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We would like to report significant seasonal variation in patients hospitalised for sepsis over a 10-year period (1 July 2004 to 30 June 2014). Sepsis is the systemic inflammatory response syndrome due to an infection.1

We evaluated seasonal variation in sepsis admissions to all public and private hospitals in Victoria. Admission rates were computed from the Victorian Admitted Episodes Dataset frequency counts divided by the Australian Bureau of Statistics’ Estimated Resident Population for the given period and presented as average seasonal (3-month) rates normalised to the year 2011 Australian census. Seasons of the year were defined according to admission dates in four month periods: summer (December, January and February), autumn (March, April and May), winter (June, July and August), and spring (September, October and November).

There were 44,222 sepsis admissions over the period. There was a statistically significant (p < 0.01) increase in the rates of sepsis admissions across seasons. The average seasonal rate of sepsis with co-morbidities and complications increased 18.1% from a low 14.4 (95% CI, 12.7-15.8) per 100,000 population in the summer to a high 17.0 (95% CI, 15.2-18.6) per 100,000 population in winter (Figure 1). Similarly, the rates for sepsis without comorbidities and complications were lowest in summer and highest in winter at 8.4 (95% CI, 6.3-9.1) and 10.1 (95% CI, 8.6-11.2) cases per 100,000 population, respectfully. The autocorrelation for a seasonal lag in sepsis admissions was 0.79, but this fell to -0.20 when adjusted for the seasonal and longitudinal changes, using autoregressive integrated moving average method. This suggests no additional trends outside the seasonal and longitudinal changes.

The average length of stay of the sepsis admissions was 8.3 days, approximately three times that of all hospitalised cases (2.9 days). The admission rates were highest in the adult age groups, in both men (54% of the cases) and women. One in seven of the sepsis admissions resulted in death in hospital; the seasonal variation observed for these deaths is consistent with Figure 1.

The results are similar to a prior study2 that examined seasonal variation in sepsis hospitalisations in acute non-federal United States hospitals between 1979 and 2003. It found sepsis admission rates to be seasonal and consistently highest during the winter.

Explanations for the increased rates of sepsis hospitalisations in winter may include the effect of viral infection, as influenza epidemics tend to occur in the winter months and respiratory syncytial virus epidemics often overlap the influenza season,3,4 and photo-periodicity influence on leukocyte function.5

Sepsis is a common reason for hospitalisation with significant healthcare costs.6 Patients with a diagnosis of sepsis are often hospitalised in intensive care units.7 While seasonal variations have been established for common conditions like asthma and chronic obstructive pulmonary disease,8 cardiac arrests8 and stroke mortality,10 there has been limited analysis of the seasonality of sepsis. Studies of seasonal trends in sepsis are useful for improving the accuracy of forecasting hospital demand beds and services and for optimising patient care.
Figure 1: Seasonal Rates of Sepsis Hospitalisations Per 100,000 Population, 2004–05 to 2013–14

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Trends in medical student research and publishing

Yassar Alamri

I read with interest the findings of Al-Busaidi and Al-Shaqsi on the contribution of medical students to the NZMJ. It is sobering to see such encouraging trend of high-quality medical student-led research in New Zealand. From as far back as the mid-1600s, medical students have significantly contributed to scientific and medical research. The NZMJ is a respected journal that has evidently fostered a healthy and supportive publishing environment for medical students, not only in New Zealand, but also internationally.

However, the trend worldwide, unfortunately, has not been as encouraging. Examining the published literature reveals two alarming trends. First, there is a gradual decrease in the number of physician-scientists (a term that refers to medical students intercalating a research-based degree, such as a PhD or, less often, MPH or BMedSci). Building a solid research foundation early in the student’s career allows for a continued path in that trajectory as a young physician. Thankfully, in New Zealand the number of intercalating students (ie, mainly MBChB/BMedSc(Hons)) has been on the rise over the past 15 years.

The second trend is that even though the number of student-authored articles has slightly increased, the ratio of student authors per publication to the total number of authors has, in fact, decreased. That is, more ‘senior’ authors were being added to published articles while the number of medical student authors remained static. Whether this is due to more collaborative research or, more worryingly, to senior authors being included as ‘honorary authors’ remains to be elucidated. With this in mind, it would be interesting to re-examine this study’s data to explore our student-author to senior-author ratio.

One final point deserves to be mentioned. The observed seasonal variation in publishing student research is intriguing, but not unheard of. Such ‘temporal bias’ has been studied in other journals, and while some journals exhibit such variation, others do not. For Northern Hemisphere journals that have shown month-to-month variation, summer months (especially July) seemed to have a higher acceptance rate. As Al-Busaidi et al have alluded to in the article, seasonal variation may be due to the nature of academic schedules, the effect of which extends to both authors (ie, submission rates) and NZMJ editors (ie, acceptance rates).

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The incidence of acute rheumatic fever in New Zealand, 2010–2013

Jason Gurney, Diana Sarfati, James Stanley, Nigel Wilson, Rachel Webb

Rheumatic fever is a major health priority for the current Government, and remains perhaps the most extreme example of an avoidable health disparity in this country. There is now substantial research underway to identify the causes of rheumatic fever in New Zealand, and to assess approaches to reduce the incidence and impact of this disease. Much of this research has been funded by a collaborative partnership between the Human Rights Commission (HRC), the Heart Foundation, CureKidz, Te Puni Kokiri and the Ministry of Health as part of the Rheumatic Fever Research Partnership programme.

As part of this effort, we have updated and built-on previous work in this area by estimating the burden of acute rheumatic fever (ARF) across multiple demographic and geographic strata between 2010–2013. To identify cases, we requested National Minimum Dataset (NMDS) hospitalisation data from the Ministry of Health pertaining to all hospitalisations in which a primary diagnosis of ARF was made (ICD-10-AM codes: I00–I02). Secondly, we requested public health notification data (EpiSurv) from the Institute of Environmental Science and Research for all new cases of reported ARF. We then merged these datasets together, and excluded those who a) had a recorded history of ARF (prior to 2010) or chronic rheumatic heart disease (RHD) (any time prior to the ARF diagnosis date), or b) were recorded as being a non-New Zealand resident at the time of their ARF. Following exclusions, a final set of n=733 remained for further analysis.

Ethnicity, geographic location (Census Area Unit) and date of birth/age were determined from both the hospitalisation and notification datasets, with hospitalisation data preferred to notification data when a case was recorded in both datasets. Ethnicity was determined using a modified version of the total ethnicity approach.5 Patient age was determined from date of birth (NMDS) or age at diagnosis (EpiSurv) data. The geographic location of each patient was attributed based on the Census Area Unit where they lived at the time of ARF incidence. Deprivation was determined using the NZDep index.7 Rurality was set using a simplified version of the Urban/Rural Profile Classification.8

We quantified the incidence of ARF separately by ethnicity, age group, deprivation, rurality and geographic location (DHB and Census Area Unit). In addition to descriptive analyses, we calculated crude and age-standardised incidence rates (per 100,000) using relevant Census population data as the denominator.

Our observations based on this updated data were, to a great extent, neither new nor unique; rather, they confirm the profound continuing inequity between population sub-groups. While ARF is uncommon in the general population, it differentially affects some population sub-groups over others: more than 9 out of every 10 cases occur among Māori or Pacific New Zealanders, with Māori nearly 30 times more likely to be diagnosed with ARF than the European/Other population (age-standardised relative risk [RR]: Māori 28.8, 95% CI 21.3–38.9)—and Pacific more than 40 times as likely (RR: 43.3, 95% CI 31.9–58.7). We also noted that those residing in the most deprived areas were more than 30 times as likely to be diagnosed with ARF compared to those residing in the least deprived areas (RR: 33.3, 95% CI 19.1–58.1). Rurality appeared to have a somewhat protective effect—with those living in...
rural areas nearly half as likely to sustain ARF compared to those living in urban areas (RR: 0.58 95% CI 0.44–0.75). Females also appeared to have slightly less risk of ARF compared to males (RR: 0.80, 95% CI 0.70–0.93).

Since Māori and Pacific New Zealanders are more likely to reside in areas of high deprivation compared to other ethnic groups, it is intuitive to assume that differences in ARF incidence by ethnicity are conflated with level of deprivation, particularly given the likely role of poverty-related exposures in the aetiology of this disease. However, when stratifying disease incidence by deprivation level, we found that Māori and Pacific New Zealanders remain substantially more likely to be affected by this disease regardless of NZDep decile (Figure 1)—suggesting that while deprivation is certainly an exposure of great importance, it is unlikely to be the sole explanatory factor for this ethnic inequity.

These observations were made for the period 2010 to 2013. We note that the Ministry of Health has reported a reduction in the number of ARF cases between 2014 and 2015. Whether this apparent reduction in disease burden is a real phenomenon—catalysed by interventions such as the national throat-swabbing programme—or a transient phenomenon remains to be seen, and will only be confirmed in retrospect.

The observations reported here are part of a wider study that is exploring the significance of RHD detected by echocardiography in high risk populations without a prior recognised episode of ARF. These data will be used in the development of a risk prediction model, which will allow us to simultaneously combine the effects of our predictors (eg, ethnicity, deprivation) and then identify (and quantify) those groups who are most at risk of developing ARF.

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**Figure 1:** Age-standardised incidence of acute rheumatic fever (2010-2013), by deprivation quintile and ethnic group.
LETTERS


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URL:
Glibenclamide, metformin, and insulin for the treatment of gestational diabetes

This report concerns a meta-analysis of the short term relative risks and benefits of insulin, glibenclamide, and metformin for treating women with gestational diabetes requiring drug treatment.

The review analysed 15 articles involving 2,509 subjects. The incidence of unfavourable maternal and foetal outcomes for the various medication combinations were collated. Glibenclamide was noted to be associated with unfavourable foetal outcomes.

The authors conclude that glibenclamide is clearly inferior to both insulin and metformin and should not be used for treating gestational diabetes if insulin or metformin is available.

BMJ 2015;350:h102

Adjunct prednisone therapy for patients with community-acquired pneumonia

In community-acquired pneumonia, an excessive release of circulating inflammatory cytokines can be harmful and cause pulmonary dysfunction. Theoretically, systemic corticosteroids could attenuate this inflammatory process and improve outcomes in the treatment of pneumonia.

This multicentre randomised trial in Switzerland tests this hypothesis. 785 patients, aged 18 years or older, were randomised to receive either prednisone 50mg daily or placebo for 7 days with their antibiotics.

Median time to clinical stability was shorter in the prednisone group — 3 days versus 4.4 days in the placebo group, facilitating earlier discharge from hospital. Pneumonia complications did not differ between the two groups. Hyperglycaemia needing insulin treatment was seen in 19% of the prednisone group and in 11% of the placebo group. The conclusions were that prednisone treatment for 7 days in patients with community-acquired pneumonia admitted to hospital shortens time to clinical stability without an increase in complications.

Lancet 2015; 385:1511-18

Aerosolised vaccine against measles?

A safe and effective injectable measles vaccine has been widely available since 1963. Subsequently, there has been a substantial decrease in measles-related deaths. However, major outbreaks still continue in poorer countries. Aerosolised vaccines might improve the situation as they can be administered by people without clinical training and do not cause injection-associated infections.

Data on the immunogenicity of aerosolised vaccine against measles in children are inconsistent. This randomised trial conducted in India aimed to clarify the issue. 1,001 children received the aerosolised vaccine and 1,003 the subcutaneous vaccine. At 91 days, seropositivity was achieved in 85.4% of the aerosol group and 94.7% in the subcutaneous group. Unfortunately, although more convenient, the aerosol vaccine was less effective.


URL:
It is common knowledge that milk is sometimes diluted with water and sold as fresh milk, or merely as milk. It is equally true that a great deal of ink is shed over milk, and much of the comment on the subject in the lay press is beside the question, and a waste of ink. Milk is not an antiseptic, and to point out that occasionally in the pantry it is sour and odorous is merely to state that the objectionable fluid is milk and not corrosive sublimate solution. Even in a perfect dairy in the country milk is a good culture medium, and the most conscientious dairymaid occasionally has sour milk in hot weather. It is important to know why milk becomes prematurely tainted. It may be the Government that is to blame, or the weather, or the city council, the health department, the farmer, the milkman, the landlord, or the cook, or the cow. It is of the utmost importance that milk should be as clean and fresh as possible.

In Wellington at the present time there is a great controversy over milk and many people have various plans for making perfect milk and perfect milkmen. The Wellington Hospital Board proposes to buy a milk farm at a cost of £9,000. The cost of maintenance is unknown, and we should like to know if the farm is expected to produce all the milk required for the hospital. If the Hospital Board controls the farm we feel certain that it will be dear milk and we shall defer judgment as to whether the quality of the milk depends solely upon the ownership of the farm. The responsibility of buying this farm at the price, and at the present time, has been thrown by the Minister upon the contributing local bodies. It is very difficult in a democracy to fix any responsibility upon an individual. A large number of critics say that the health department ought to control the purity of the milk supply, and an equally large number of reformers hold that the city council should establish a receiving station for milk.

We have taken pains to acquire authoritative information on the subject, and will venture to suggest some remedies. In the first place, Wellington has as good a milk supply as Christchurch or Wanganui. We suffer from the usual amount of
misgovernment. The Government will not allow milk to be carried on what are called mail trains. Milk, being a perishable commodity, is carried on slow trains, or, to be more accurate, very slow trains. The dairy farmer is compelled to cool his milk to 60 degrees, but as a matter of fact the milk is usually cooled to 55 degrees. The temperature as regards milk is all important. When the Government railways take charge of the milk the trouble begins. The temperature of the railway vans is commonly 70 degrees, and sometimes 80 degrees. A temperature of 80 degrees is easily attainable by allowing a van to stand on a siding throughout a summer day. The door of the van is kept shut while it is waiting to receive the farmers’ evening supply. In some more enlightened countries cool railway storage for milk is provided. Very few farmers indeed adulterate milk, so that a receiving station in the city for testing is not very necessary, but probably a step in the right direction. Dairy herds should be frequently and strictly inspected. There are not a few milkmen, however, who tamper with the milk. They are usually fined £2, and this is no deterrent. We propose fine of £25 and costs for the first offence, and cancellation of the licence for a second and last offence. This is done with the publican, and we assume that milk is a more important liquid than beer. The Health Department inspects the milk in the possession of milkmen. If the Department has no more power given it by legislation than it has in relation to quack medicines, we do not blame the Department.

Milk should be sold in bottles, but unless this is made compulsory, bottle milk will never successfully compete against the can system on the ground of increased expense. As regards milkmen being clad in white, as a symbol of purity, we do not stress the point; black is more in keeping with the seriousness of their vocation, red would warn the public of danger, and green suggest caution. Here are a few reforms to make a beginning. We trust that we have shown that the milk problem is largely a result of misgovernment “Of the people, for the people, and by the people.” Our Parliament is no better than a big city council and ought to be able to set up a cow committee to settle the milk question.

NZMJ April 1915; 102–104