Marketing unhealthy commodities on social media

Volume, nature and potential impact of advertisements on Facebook and YouTube by food brands popular in New Zealand

Regulatory chills: tobacco industry legal threats and the politics of tobacco standardized packaging in New Zealand

Poisoning due to tutin in honey—a report of an outbreak in New Zealand

If only Teina Pora had a MedicAlert bracelet

The Otago Medical School Anatomy Museum Collection: Taonga for learning in the 21st Century
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Volume, nature and potential impact of advertisements on Facebook and YouTube by food brands popular in New Zealand

Stefanie Vandevijvere, Charlotte Aitken, Boyd Swinburn

Posts on Facebook pages of 45 popular packaged food, beverage and fast food company brands over two months and YouTube channels of 15 popular brands over two years were analysed for nutritional quality and use of activities, promotional strategies (eg, cartoons) and premium offers (eg, competitions). Social media is an important medium for food marketers in New Zealand and promotional strategies and premium offers are frequently used.

Regulatory chills: tobacco industry legal threats and the politics of tobacco standardized packaging in New Zealand

Eric Crosbie, George Thomson

Political delays slow the diffusion of best practices. In this case the delays due to tobacco industry legal threats delayed standardised packaging, slowing smoking cessation and the reduction of initiation. They also delayed the reduction of government health expenditures and tobacco industry profits. Other countries introducing or implementing similar policies should learn from these experiences and take steps to proactively avoid unnecessary political delays that have a profound impact on public health.

Pertussis vaccination uptake in pregnancy: lessons to be learned from an integrated healthcare approach

Emma J Deverall, Benjamin Gilmore, Sam Illing, Roshini Peiris-John

Pertussis (or Whooping cough) is a serious, but vaccine preventable disease. Infants are the most at risk of complication and death, and are best protected by giving a free vaccine to their mother during pregnancy. An audit in Lakes District Health Board found the immunisation rate was much higher in Taupo (76%) than in Rotorua (45%). This paper explores the differences in the two regions. Coordinated efforts between the Primary Care Organisation, Midwives and the District Health Board in Taupo helps to bring vaccination to women in their community and improve vaccination rates.

Diagnosis of abdominal tuberculosis in Christchurch New Zealand: a case series

James MM Bevin, Simon C Dalton, Chris J Wakeman, Will RG Perry

This is a series of the 20 most recent cases of abdominal tuberculosis in Christchurch. We investigated as to how these patients presented and what investigations were used to diagnose these patients with abdominal tuberculosis. We found that patients with abdominal tuberculosis have very non-specific symptoms and as such the method of investigation you use is crucial. The literature suggests laparoscopy followed by a positive microbiological result has the best diagnostic utility—we found this was the most common and effective method to diagnose abdominal tuberculosis in Christchurch as well.
Metronidazole stewardship initiative at Christchurch hospitals—achievable with immediate benefits
Sharon J Gardiner, Sarah CL Metcalf, Paul KL Chin, Matthew P Doogue, Simon C Dalton, Stephen T Chambers

Metronidazole is a commonly used antibiotic. In hospitals, it is traditionally dosed three times daily, and often intravenously (IV). In October 2015, a campaign was started in Christchurch public hospitals to change to less frequent dosing (twice daily), and to prioritise the oral route for dosing. The initiative was successful with a 43% decrease in metronidazole IV use and savings of around $100,000 annually. Benefits include avoidance of bloodstream infections associated with IV access, and increased nursing ‘time to care’.

Poisoning due to tutin in honey—a report of an outbreak in New Zealand
Michael Beasley, Dell Hood, Philippa Anderson, John Reeve, Robin J Slaughter

In autumn 2008, an outbreak of toxic honey poisoning was identified in Thames, Waikato, New Zealand. This study aimed to investigate these cases of honey poisoning and determine which toxin was involved and describe the effects of the. After testing the honey, the causative toxin was identified as tutin, which comes from the New Zealand native plant tutu. Twenty-two people were potentially poisoned with 11 of these cases being confirmed as ingesting toxic honey. There were eight cases of seizures in poisoned patients. Food safety standards have since been enhanced to minimise the risk of toxic honey.

The Otago Medical School Anatomy Museum Collection: Taonga for learning in the 21st Century
Louisa JM Baillie, Christopher L Smith

The WD Trotter Anatomy Museum has a large and diverse collection of teaching models and specimens. The Louis Auzoux paper mâché ear model has been in high demand for hands-on teaching since the 1880s. It features clastic parts, large scale (10:1) and clear, intricate anatomical details. Reproduction of this valuable model was urgently required as it was becoming worn and damaged from handling, and needed to be ‘retired’. A replica model has been successfully produced in the Anatomy Workshop using digital scanning, 3D printing and skilled modelling and hand painting effects.
The marketing of commodities on social media sites is increasing as these commercial platforms adapt to evolving mobile technologies. New Zealand marketing regulations are frequently ineffective in this environment, as they either do not apply to foreign-domiciled sites or are evaded as corporations make use of ‘under-the-radar’ techniques such as user-generated content, mimicry of online ‘friendship’ practices and networked sharing. Current ‘controls’ rely on industry self-regulation. This means that companies are not publicly accountable around their social media marketing activities, a business-world situation that parallels the political scandals involving social media currently occurring globally.

The business models of social media platforms are structured around exploiting the warehoused personal data of the masses from which algorithms can identify highly specific group and individual profiles, allowing micro-targeted advertising, often via sophisticated psychological profiling tools. These algorithms draw on users’ values and meanings, embedding brands within people’s everyday practices and identities, catering for specific national contexts and cultural settings. This type of highly targeted marketing encourages peer-to-peer transmission of messages and content, enabling electronic ‘word-of-mouth’ viral marketing. Such sharing of ‘information’ blurs the boundaries between commercial messages and private activity, making it difficult for users to identify marketing content that often morphs as it travels through the network.

The massive audience reach of online networks means these approaches are highly effective and cheap, in part because they work with the free ‘immaterial labour’ of their numerous users, creating vast profit-streams from selling such data to interested businesses. Facebook has over 2.1 billion users, over half of whom access the platform on their phones daily, where every one of their keystrokes is recorded as data that is owned by the corporation. Social media marketing is also effective because algorithms can identify and recruit new generations of consumers, effectively grooming children to become consumers as they gather disposable income or cross key age-barriers such as those around alcohol and tobacco. Given such platform affordances, it is not surprising that a recent review concluded that digital marketing has significant detrimental effects on “the intended use and actual consumption of unhealthy commodities.”

In this volume, Vandevijvere, Aitken and Swinburn provide much-needed insights into the marketing of common unhealthy (highly-processed, energy dense and nutrient poor) food and beverage products on Facebook and YouTube in New Zealand. Their study tracked Facebook activity over two months, and YouTube presence over two years, of snack food, beverage and fast food companies. It examined the nature and extent of promotional activities and their potential reach, estimating that 10% of adolescents in New Zealand could be exposed to these influences. Diverse marketing techniques were employed, with companies encouraging users to engage with posts and online content to ensure products were seen by users’ friends and online networks. In this way, online brands amplify the reach and relevance of marketing messages, appropriating users’ labour with little incentive or reward.

According to a recent OECD report, obesity rates in New Zealand are third worst in the world, with one in three...
adults and over 12% of children classified as obese. Overconsumption of unhealthy products is related to chronic non-communicable diseases and premature mortality. Evidence demonstrates that marketing such products is related to adverse health outcomes, and conversely, regulating food advertising to children is an effective strategy to tackle eating behaviours closely linked to obesity. Promoting unhealthy products on social media is an effective marketing strategy, but is ethically problematic, particularly when it is targeted at children and young people who are high users of social media platforms.

New Zealand children are over-exposed to unhealthy food marketing in everyday settings. A recent study of 11–13 year-olds using wearable cameras found that they were exposed to such marketing on average more than 27 times per day (twice the rate than for healthy foods) and that most products they saw were sugary drinks, fast food, confectionary and snack foods. The convergence with targeted, interactive marketing (often keyed to human neurological processes) within social media platforms means that children’s environments are potentially inundated with highly engaging promotions of a wide range of health-demoting products. The ubiquity of unhealthy food marketing within children’s environments, both offline and online, normalises brands and has detrimental health effects. Reducing children’s exposure to the marketing of unhealthy foods is essential and must include consideration of social media.

Public health recommendations to protect young people within social media environments have been largely ignored by governments and corporations. The policy implications of marketing unhealthy commodities online have been viewed as too difficult. For example, the report of the New Zealand Ministerial Forum on Alcohol Advertising and Sponsorship 2014 began: “As a forum we believe protecting the young from alcohol-related harm is paramount” (p1) but subsequently placed social media marketing outside the remit of the review. We need to grapple with marketing on social media if we want to safeguard our young people from the promotion of unhealthy products.

Extending existing regulatory codes to social media is not going to be effective as they do not take into account the particular characteristics of the social media environment, including its interactive, immersive and personal nature (aspects which appeal to children and young people particularly). Our exploratory research with young adults engaging with alcohol marketing on Facebook found that the alcohol industry embeds their marketing activities within online friendship activities. In this way the marketing became obscured, but also normalised, effectively hidden in plain sight as part of the routine flow of material on Facebook. We concluded that “social media marketing of alcohol is likely to encourage consumption through new forms of promotion (particularly through alcohol venues online), the exploitation of networked peer group friendship practices and [favourable] perceptions of the behaviour of others”. In this platform, algorithms target those users who are more likely to consume specific products such as alcohol or unhealthy foods; in other words, those who may be most vulnerable.

Social media platforms are now significant commercial institutions and as such should attend to the ethical responsibilities of constructive citizenship, including accountability for brand activity on their platforms. The vast databases that social media corporations have assembled could also be made available for public scrutiny and research for the public good, showing for instance the impact of marketing activities in terms of overconsumption of unhealthy foods and other commodities. The infrastructure itself—usurped as it is from the digital commons—could be defined and regulated, including making all use of personal data transparent so users can clearly see the flow of content, where their data goes, who receives it and how it is subsequently used.

Counter-marketing can also expose the motives and tactics of companies, and highlight the ways in which users are manipulated by industry and social media companies themselves. Social movements may help to demonstrate the invisible (and at times underhanded) corporate strategies and forces that are involved in encouraging
consumption of products that lead to poorer population health outcomes. Globally, research suggests that companies vary their online marketing techniques by country, marketing healthier products in wealthier countries, while showcasing their philanthropic activities in less wealthy countries.21

The recent disclosures around Cambridge Analytica and the unauthorised use of Facebook users’ data to influence democratic processes has brought the use of social media data into the public spotlight.1 Much attention is being given to the political dimensions of what Steve Bannon (previous executive chairman of the “alt-right” news network Breitbart) has referred to as the cultural warfare necessary to drive particular political agendas. Whistleblowers have discussed how Facebook routinely harvested data for political purposes, data that were “private and personally identifiable”, belonging to ‘friends’ of users of tens of thousands of apps operative on the platform.22 In contrast, very little attention or critique is directed towards the entrenched marketing on Facebook (and other social media platforms) that use the same tactics to build individuated consumer cultures, while making huge profits for corporations.

Social media are built on commercial imperatives that have nothing to do with public health. The marketing of unhealthy foods, alcohol, tobacco, gambling and other products is rife on social media platforms and has been linked to poorer health and wellbeing outcomes for youth and adults. It is daunting but crucial to document what is occurring in this ephemeral and evolving persuasion space, to gather evidence that shows how marketing creates health-demoting perceptions, attitudes and behaviours, how they can be resisted and what public policy interventions are indicated.

**Competing interests:**
Nil.

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**REFERENCES:**


5. Gupta H, Lam T, Pettigrew S, Tait RJ. Alcohol


Tobacco targets—doomed to fail?

Mike Daube

There has been incontrovertible evidence that smoking is lethal for nearly seven decades, since publication in 1950 of authoritative papers by Doll and Hill in the British Medical Journal and Wynder and Graham in the Journal of the American Medical Association. Vast numbers of papers and reports since then have left no doubt that globally and nationally this is the largest preventable cause of death and disease. Each year according to the World Health Organization, more than seven million deaths around the world, and, according to the Ministry of Health, 5,000 deaths in New Zealand, are caused by smoking.

The word “preventable” is critical. We know the extent of the problem, but we have also known for several decades the key approaches needed to prevent the deaths and disease caused by smoking—no single magic bullet, but a comprehensive approach comprising regulation, public education, cessation supports and continuing advocacy.

There has been progress, and New Zealand has indeed at times been one of the leading countries in terms of implementing some of the actions needed, but it has been all too slow.

The New Zealand government’s 2011 goal of “a smokefree New Zealand by 2025” was laudable, albeit optimistic, but on the basis of current trends in terms of both prevalence and governmental action it is doomed to fail. In order to meet the smokefree goal by 2025, the government recognised that daily smoking rates would need to be at 10% by 2018. The national data from 2015 show daily smoking rates at about 15%. Smokefree by 2025 would require a massive decline, well beyond optimism.

As we have known the extent of the problem for decades, so we have known the vector—the international tobacco industry which, in the words of a recent UK High Court judgement, “facilitates and furthers, quite deliberately, a health epidemic. And moreover, a health epidemic which imposes vast negative health and other costs upon the state.” The tobacco industry, with a well-justified reputation for lies and deceit, has from the outset done everything in its power to oppose and delay any action that might reduce smoking, while continuing to promote its products wherever possible, often with a special focus on vulnerable and disadvantaged populations.

The introduction of standardised (or “plain”) packaging in Australia was achieved despite the most ferocious industry opposition this author has seen in 45 years working on tobacco—testament to the impacts feared by the tobacco companies from a measure that would reduce their last legitimate form of direct promotion. Few measures have so well illustrated the tobacco “Scream Test” that health advocates often cite—the louder the tobacco industry screams, the more effective a measure is likely to be. It was therefore not surprising that following implementation of standardised packaging the Imperial Tobacco company gloomily concluded that “Australia is the darkest market in the world.”

In an important paper that will be a valuable addition to the international literature on tobacco control processes, Crosbie and Thomson have shown not only that the companies had similar fears in New Zealand, but also that they learned from their defeat in Australia by focusing much of their lobbying effort on legal threats that successfully intimidated governments into delaying introduction of an evidence-based
measure recommended by health authorities as part of a comprehensive approach.

While standardised packaging is now being implemented in New Zealand (as it is elsewhere—by the end of 2018 it should be either in place or on the way in close to 20 countries), the process has been slow, and the Australian experience shows that tobacco companies will do everything they can and spend as much as it takes to undermine and counter its impacts. Meantime, the New Zealand Government has significantly reduced its already modest support for tobacco control advocacy, which means that further much-needed complementary action is far less likely to eventuate, and there will inevitably be less public exposure of the industry's lobbying and other promotional activities.

New Zealand is a signatory to the WHO Framework Convention on Tobacco Control, which came into force in 2005 and is legally binding in 180 countries. The Convention and its Guidelines are clear and explicit that “There is a fundamental and irreconcilable conflict between the tobacco industry’s interests and public health policy interests”, and Article 5.3 of the Convention requires that “In setting and implementing their public health policies with respect to tobacco control, Parties shall act to protect these policies from commercial and other vested interests of the tobacco industry...”. Governments have a responsibility to ensure that all their agencies (not only health departments) are aware of and committed to Article 5.3.

This is especially important at a time when the tobacco industry is more aggressive than ever in seeking to prevent any actions by governments that might reduce smoking. The industry has always devoted substantial resources to lobbying and public relations activities; in recent years these efforts have been stepped up, whether through the companies themselves or through associated organisations, “think tanks” and front groups. Legal action and threats against government, of the nature outlined by Crosbie and Thomson (and even, as in the UK and Australia, against organisations such as universities and cancer charities), provide yet further evidence that tobacco companies will do whatever it takes to further their interests and cause more preventable deaths. As in Australia, these companies have no interest in the health or wellbeing of New Zealanders: they are based in London and New York, and their only interest is the financial health and wellbeing of their shareholders.

Future generations will wonder why, nearly 70 years after incontrovertible evidence about its harms, smoking was still the largest preventable cause of death and disease, and tobacco companies were still allowed to flourish. The answer lies partly in the sheer power of the tobacco industry, and partly in the inability of health groups to match its resources and ruthlessness. But even more than this, responsibility rests with governments that have failed to act despite clear evidence about the action needed and absolute certainty that their inaction would result in tens of thousands of unnecessary deaths.

“Smokefree New Zealand by 2025” may have seemed a laudable aspiration in 2011, but the loss of momentum, further tobacco industry lobbying, promotional and distraction activities, a focus on approaches that will not offend tobacco interests and reduced support for public health advocacy mean that it now looks completely unrealistic. That is a triumph for Big Tobacco, an indictment of the government’s failure to take prevention seriously, and a public health tragedy.
REFERENCES:


Volume, nature and potential impact of advertisements on Facebook and YouTube by food brands popular in New Zealand

Stefanie Vandevijvere, Charlotte Aitken, Boyd Swinburn

ABSTRACT

AIM: To analyse extent, nature and potential impact of marketing by food and beverage brands popular in New Zealand on Facebook and YouTube.

METHOD: Popular food and beverage brands in New Zealand were selected from Socialbakers. Posts on Facebook pages of 45 packaged food, beverage and fast food companies over two months and YouTube channels of 15 companies over two years were analysed for nutritional quality and use of activities, promotional strategies (eg, cartoons) and premium offers (eg, competitions).

RESULTS: The 45 brands selected made 762 Facebook posts during October–November 2016. About 28% of posts were videos and 2/3 (63%) contained at least one occasional (ie, unhealthy) food. Promotional strategies were used in 41% of posts, with a famous sportsperson/team being the most frequently used. Premium offers were used in 34% of posts, with competitions being the most frequently used. It was estimated some posts could potentially reach 10% of New Zealand adolescents. The 15 food brands selected posted about 300 videos on their YouTube channels during 2015–2016. About 84% of videos contained food marketing and 77% of products marketed were occasional. Promotional strategies and premium offers were used in 61% and 24% of videos respectively, and the most common marketing techniques were the same as on Facebook.

CONCLUSION: Social media is an important medium for food marketers in New Zealand and promotional strategies and premium offers are frequently used. Methodology needs to be developed to monitor actual exposure to such advertisements.

RESULTS from the recent New Zealand Health Survey revealed that one in three New Zealand children are either overweight or obese,¹ and one of the factors known to influence the unhealthy food and beverage choices related to childhood obesity is food and beverage marketing.²⁻⁴ Nowadays there are countless platforms that companies can use to target children and adolescents and consumers more broadly, with social media sites like Facebook and YouTube being very popular.² In 2012, 93% of New Zealanders aged 15–24 years used the Internet, with this number likely to have grown since. In addition, 88% of Internet users engage in social media, with Facebook and YouTube being the most popular sites.⁵

A review undertaken of New Zealand studies to date indicates that advertisements through a wide range of media platforms are predominantly for unhealthy foods.⁶ Previous research on the extent and nature of unhealthy food and beverage advertising in New Zealand, however, has mainly focused on traditional media platforms like television and magazines.⁷⁻¹⁰ Traditional media is still important for marketers as a recent study on television advertising in New Zealand showed that the average rate of unhealthy food advertising was 9.1±5.2 per hour and about 88% of unhealthy food advertisements were shown during children's peak viewing times.¹¹ However, new media, such as online and social media

ARTICLE
allows marketers to engage more deeply with their audiences and even magnify effects of traditional media. A previous New Zealand study identified a wide range of marketing techniques and features on food brand websites, including advertisement (87%), viral marketing (64%), cookies (54%), free downloadable items (43%), promotional characters (39%), designated children's sections (19%) and advergaming (13%). Most techniques appeared more frequently on websites specifically targeting children and adolescents, than on other websites targeting the general public. Food marketing on social media has not yet been analysed in New Zealand and there are very few studies internationally. A recent Australian study analysing content of Facebook pages of the most popular food brands found that competitions based on user-generated content, interactive games and apps were the most common techniques used to engage with consumers, adolescents in particular. In addition, the study found that adolescents and young adults appeared to be the users engaging the most with the marketing content. Another Australian study also found that the majority of promotional activities that selected food brands are using to promote unhealthy food and beverages are targeted at adolescents. In general, adolescents are considered an important target group for food and beverage marketers. Currently in New Zealand, advertising is self-regulated by the industry-led Advertising Standards Authority (ASA). The ASA recently reviewed its advertising codes. The Children's and Young People's Advertising Code (the new Code) went into full effect beginning October 2017. It strengthens previous restrictions on advertising of occasional (i.e., unhealthy) food and beverages, specifically for children younger than 14 years. For adolescents 14–18 years, these same restrictions do not apply. In addition, the new Code includes definitions about targeting children. As for social media in particular, the new Code implies that brands and companies cannot target any occasional food advertisements to children and young people aged less than 14 years old. However, research has consistently shown that self-regulation does not significantly reduce children's exposure to unhealthy food and beverage marketing and a critical review of the new Code by 77 health professors indicates that the impact of the new Code on reducing exposure of children and adolescents to unhealthy food marketing is uncertain.

The aim of this study is to determine the extent, nature and potential impact of internet-based food and beverage marketing by analysis of the marketing of popular food brands in New Zealand on Facebook and YouTube.

Methods

Selection of food and beverage brands

Using Socialbakers, a global social media analytics company, the most popular food and beverage brands on Facebook and YouTube in New Zealand were identified. Numbers of page ‘likes’ by New Zealanders on Facebook and numbers of New Zealand channel subscribers on YouTube (including all age groups) were used as a measure of popularity.

We selected the 15 most popular Facebook pages and the five most popular YouTube channels for each of the packaged food, fast food and beverage categories, giving us 45 Facebook pages and 15 YouTube channels to analyse. Brands tended to post less frequently on YouTube than Facebook, so two years of YouTube videos (2015–2016) and two months of Facebook posts (October–November 2016) were analysed for each brand selected.

Data collection

Screenshots of each post on a popular brand's Facebook page were captured with Evernote and the following information was entered into a database: the type of post (video, image or text alone), the number of likes, shares, comments and views (if post was a video), the presence of a food or beverage product, the nutritional quality of the product if one was advertised, the use of activities, premium offers and/or promotional strategies. Similar information was collected for each YouTube video, including the number of video views, the presence of a food or beverage product, the nutritional quality of the food or beverage product if one was advertised, and the use of activities, premium offers and/or promotional strategies.
strategies. For three food brand Facebook pages and three Youtube Channels (one of each food industry sector), two researchers coded the advertisements independently and compared results. Since there were no discrepancies, one researcher then continued coding the remaining pages and channels.

To assess the nutritional quality of advertised food and beverage products, the Ministry of Health Food and Beverage Classification System (updated in 2016 and now under the auspices of the Heart Foundation and called “Fuelled For Life”) was used, which classifies products as ‘everyday’, ‘sometimes’ or ‘occasional’. This is the classification system used by the new Code. Everyday foods and drinks are the healthiest choices and are from the four food groups (vegetables and fruit, breads and cereals, milk and milk products, meat and alternatives). Sometimes foods and drinks are mostly processed foods with some added fat, salt or sugar. Occasional foods and drinks are high in saturated fat, salt or sugar and should not be provided or sold to children (eg, confectionery, sugar-sweetened beverages).

Activities for consumers included games, recipe ideas, voting, commenting, tagging friends, liking and sharing posts, following the brand on other media forms (eg, Snapchat, Instagram, Twitter), arts and crafts, registering for an event or downloading apps.

Promotional strategies included the use of cartoons/company owned characters, licensed characters, amateur sportspersons, famous sportspersons/teams, sports events, non-sports celebrities, movie tie-ins, non-sporting events/festivals, claims of awards won, a child consuming a product and advercation (where information about the company or its foods is presented as educational material). Premium offers included the use of competitions, buy one get one free (or similar), 20% extra product (or similar), limited time only/limited edition, donation to charity, free item with purchase and limited time product discounts.

Reach

On Facebook (not possible through Socialbakers) we estimated the potential reach of posts made by each food brand among 13–18 year-olds using the “Create ad” feature, which defines a target Facebook audience for potential advertisers. When logged in to Facebook as a Page Administrator, Create Adverts could be selected from the dropdown menu. In Create a Custom Audience, we specified ‘New Zealand’ and ‘13–18 years’. The Interests filter then listed the size of specific audiences by looking at their interests, activities, the pages they have liked and closely related topics, ie, Facebook assesses a potential audience who have ‘liked’ or engaged with named pages or similar ones. We entered the food and drink brands that were most popular by the general New Zealand population as derived from Socialbakers as interests and identified which of these food and drink brands Facebook defined as generating the greatest potential reach among 13–18 year-olds in New Zealand. However, we were unable to obtain similar estimates for YouTube.

Results

Facebook

The most popular Facebook page among packaged food brands was Whittaker's Chocolate Lovers, however, the page with the highest potential reach among 13–18 year-olds was Chupa Chups. Among popular fast food companies, the most popular page and the page with the highest potential reach among 13–18 year-olds was McDonald's. For popular beverage brands, Coca Cola was the most popular Facebook page and had the highest potential reach among 13–18 year-olds (Table 1).

Overall, 762 Facebook posts were made by the 45 brands during October and November 2016, and 28% of these posts were videos (Table 2). The number of posts made over the two-month period varied largely between brands, ranging from zero posts (zero posts per day) by Skittles to 62 posts (one post per day) by Lewis Road Creamery (Table 1), giving an overall average of 17 posts (0.3 posts per day) (Table 2).

Of the Facebook posts, 64% contained a food or beverage product and the remainder posts were marketing the brand or company without depicting a specific food or beverage product. About 99% of food and beverage products marketed were classified as being for occasional consumption only. Of the 45 pages...
Table 1: Extent of advertising by food brands popular in New Zealand on their Facebook pages (October–November 2016).

<table>
<thead>
<tr>
<th>Popularity rank</th>
<th>Food brand</th>
<th>Number of page likes</th>
<th>Potential likes of page among 13–18 year olds</th>
<th>Number of posts on page during two-month period</th>
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<td>1</td>
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<td>394,359</td>
<td>14,000</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Griffin's</td>
<td>242,072</td>
<td>12,000</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>Cadbury Dairy Milk</td>
<td>234,456</td>
<td>21,000</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Tip Top Ice Cream</td>
<td>191,569</td>
<td>12,000</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>Skittles</td>
<td>170,602</td>
<td>8,200</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Chupa Chups</td>
<td>161,619</td>
<td>56,000</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Lewis Road Creamery</td>
<td>158,798</td>
<td>5,300</td>
<td>62</td>
</tr>
<tr>
<td>8</td>
<td>Nutri-Grain NZ</td>
<td>113,953</td>
<td>11,000</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Kiwi Bacon</td>
<td>106,834</td>
<td>4,100</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>Pringles</td>
<td>106,231</td>
<td>35,000</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Tasti NZ</td>
<td>98,997</td>
<td>N.A3</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>Puhoi Valley</td>
<td>85,604</td>
<td>N.A3</td>
<td>45</td>
</tr>
<tr>
<td>13</td>
<td>Ferrero Rocher</td>
<td>84,033</td>
<td>7,100</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>KitKat</td>
<td>81,181</td>
<td>14,000</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>Marmite NZ</td>
<td>79,538</td>
<td>2,900</td>
<td>11</td>
</tr>
<tr>
<td><strong>FAST FOOD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>McDonald's</td>
<td>423,818</td>
<td>100,000</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>KFC</td>
<td>372,312</td>
<td>81,000</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>Domino's NZ</td>
<td>234,054</td>
<td>23,000</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>Pizza Hut</td>
<td>212,390</td>
<td>41,000</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>Subway NZ</td>
<td>212,390</td>
<td>35,000</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>Burger King NZ</td>
<td>185,295</td>
<td>27,000</td>
<td>53</td>
</tr>
<tr>
<td>7</td>
<td>Carl's Jr. NZ</td>
<td>171,591</td>
<td>34,000</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>Pita Pit NZ</td>
<td>129,097</td>
<td>29,000</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>BurgerFuel</td>
<td>100,023</td>
<td>29,000</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Starbucks</td>
<td>80,149</td>
<td>42,000</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Hell Pizza</td>
<td>79,043</td>
<td>6,600</td>
<td>26</td>
</tr>
<tr>
<td>12</td>
<td>Subway</td>
<td>68,478</td>
<td>35,000</td>
<td>23</td>
</tr>
<tr>
<td>13</td>
<td>Nando's NZ</td>
<td>68,014</td>
<td>8,100</td>
<td>18</td>
</tr>
<tr>
<td>14</td>
<td>Mexico NZ</td>
<td>56,969</td>
<td>N.A3</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>Wendy's NZ</td>
<td>55,612</td>
<td>9,200</td>
<td>35</td>
</tr>
</tbody>
</table>
Table 1: Extent of advertising by food brands popular in New Zealand on their Facebook pages (October–November 2016) (continued).

<table>
<thead>
<tr>
<th>BEVERAGES</th>
<th>Number of New Zealanders who like the Facebook page</th>
<th>Estimated using the ‘Create Ads’ feature on Facebook for the particular food brand</th>
<th>Not applicable. There was no information on potential likes by adolescents for these company pages.</th>
<th>Six posts were excluded because they contained alcohol.</th>
<th>One post was excluded because it contained alcohol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Coca Cola NZ</td>
<td>213,369</td>
<td>42,000</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Red Bull</td>
<td>190,654</td>
<td>41,000</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Lemon &amp; Paeroa</td>
<td>189,313</td>
<td>17,000</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 V Energy NZ</td>
<td>144,141</td>
<td>7,800</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Monster Energy</td>
<td>115,654</td>
<td>9,500</td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Mountain Dew – NZ</td>
<td>76,787</td>
<td>17,000</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Powerade NZ</td>
<td>69,491</td>
<td>8,800</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 V Energy Drink Australia</td>
<td>66,846</td>
<td>2,100</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Pepsi NZ</td>
<td>60,274</td>
<td>12,000</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Charlie’s Drinks</td>
<td>52,014</td>
<td>&lt;1,000</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Dr Pepper</td>
<td>27,253</td>
<td>1,800</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Lipton Ice Tea</td>
<td>20,714</td>
<td>2,300</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Phoenix Drinks</td>
<td>19,309</td>
<td>N.A³</td>
<td>10⁵</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Gatorade NZ</td>
<td>18,817</td>
<td>6,700</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Sprite Australia and NZ</td>
<td>18,286</td>
<td>N.A³</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Number of New Zealanders who like the Facebook page. Data obtained from the Social bakers website in mid-November 2016.
2. Estimated using the ‘Create Ads’ feature on Facebook for the particular food brand.
3. Not applicable. There was no information on potential likes by adolescents for these company pages.
4. Six posts were excluded because they contained alcohol.
5. One post was excluded because it contained alcohol.

Table 2: Comparison between popular packaged food, beverage and fast food brands of extent, nature and nutritional quality of posts made on their Facebook pages (October–November 2016).

<table>
<thead>
<tr>
<th>Volume and type of posts</th>
<th>Packaged food brands (n=15 brands)</th>
<th>Fast food brands¹ (n=15 brands)</th>
<th>Beverage brands¹ (n=15 brands)</th>
<th>Total (n=45 brands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of posts on all pages (n)</td>
<td>225</td>
<td>345</td>
<td>192</td>
<td>762</td>
</tr>
<tr>
<td>Average number of posts per page (n)</td>
<td>15</td>
<td>23</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td>Average number of posts per day per page (n)</td>
<td>0.2</td>
<td>0.4</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Posts that were videos (n (%))</td>
<td>45 (20)</td>
<td>76 (22)</td>
<td>94 (49)</td>
<td>215 (28)</td>
</tr>
</tbody>
</table>

Level of consumer interaction with posts¹

| Likes per post (mean ± SD) | 830 ± 1,408 | 1,916 ± 9,503 | 8,526 ± 26,791 | 3,261 ± 15,228 |
| Shares per post (mean ± SD) | 71 ± 222 | 481 ± 3,463 | 989 ± 2,729 | 488 ± 2,727 |
| Comments per post (mean ± SD) | 294 ± 680 | 268 ± 796 | 294 ± 832 | 282 ± 773 |
| Views per video (mean ± SD) | 79,021 ± 75,152 | 437,088 ± 988,319 | 782,817 ± 2,053,039 | 514,908 ± 1,509,284 |
Table 2: Comparison between popular packaged food, beverage and fast food brands of extent, nature and nutritional quality of posts made on their Facebook pages (October–November 2016) (continued).

<table>
<thead>
<tr>
<th>Nutritional quality of food and/or beverage products in posts</th>
<th>Posts containing a food and/or beverage product (n (%))</th>
<th>187 (83)</th>
<th>231 (67)</th>
<th>71 (37)</th>
<th>489 (64)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and/or beverage products classified as occasional2 (n (%))</td>
<td>205 (91)</td>
<td>208 (90)</td>
<td>71 (100)</td>
<td>484 (99)</td>
<td></td>
</tr>
<tr>
<td>Facebook pages with 100% of products classified as occasional (n (%))</td>
<td>11 (73)</td>
<td>8 (53)</td>
<td>13 (87)</td>
<td>32 (71)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use of marketing techniques in posts</th>
<th>Posts with an activity for consumers (n (%))</th>
<th>128 (57)</th>
<th>105 (30)</th>
<th>44 (23)</th>
<th>276 (36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posts with a promotional strategy (n (%))</td>
<td>52 (23)</td>
<td>121 (35)</td>
<td>136 (71)</td>
<td>309 (41)</td>
<td></td>
</tr>
<tr>
<td>Posts with a premium offer (n (%))</td>
<td>81 (36)</td>
<td>145 (42)</td>
<td>35 (18)</td>
<td>261 (34)</td>
<td></td>
</tr>
</tbody>
</table>

1. The number of likes, comments, shares and views on each post may include non-New Zealanders who have also liked the brands Facebook page.
2. Classified according to the Ministry of Health food and beverage classification system.
3. Six Posts by fast food brands and one post by a beverage brand were excluded because they included an alcohol product.

Table 3: Extent of advertising by food brands popular in New Zealand on their Youtube channels (2015–2016).

<table>
<thead>
<tr>
<th>Popularity ranking</th>
<th>Brand YouTube Channel</th>
<th>Number of channel subscribers¹</th>
<th>Number of videos during two-year period (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACKAGED FOOD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>KitKat Australia &amp; New Zealand</td>
<td>2,786</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Tic Tac ANZ</td>
<td>2,419</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Whittaker’s Chocolate</td>
<td>872</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>Weetbix NZ</td>
<td>637</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>Anchor NZ</td>
<td>348</td>
<td>62</td>
</tr>
<tr>
<td>FAST FOOD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Hell Pizza NZ</td>
<td>35,577</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Maccas NZ</td>
<td>2,620</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>KFC NZ</td>
<td>905</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>Carl’s Jr. NZ</td>
<td>549</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>Domino’s NZ</td>
<td>433</td>
<td>29</td>
</tr>
<tr>
<td>BEVERAGES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>V Energy NZ</td>
<td>2,893</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Coke Happiness NZ</td>
<td>841</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Nescafe Australia &amp; NZ</td>
<td>810</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>Sprite Australia &amp; NZ</td>
<td>684</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>Mountain Dew NZ</td>
<td>394</td>
<td>25</td>
</tr>
</tbody>
</table>

1. Data obtained from the Socialbakers website in mid-November 2016.
Table 4: Comparison between popular packaged food, beverage and fast food brands of extent, nature and nutritional quality of posts made on their Youtube channel (2015–2016).

<table>
<thead>
<tr>
<th></th>
<th>Packaged foods (n=5 brands)</th>
<th>Fast food outlets (n=5 brands)</th>
<th>Beverages (n=5 brands)</th>
<th>Total (n=15 brands)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity and views of videos</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of videos by all channels (n)</td>
<td>120</td>
<td>97</td>
<td>83</td>
<td>300</td>
</tr>
<tr>
<td>Average number of videos per channel (n)</td>
<td>24</td>
<td>19</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Average number of videos per channel each month (n)</td>
<td>1.0</td>
<td>0.8</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Average number of views per video (mean ± sd)</td>
<td>87,879 ± 279,754</td>
<td>27,576 ± 62,654</td>
<td>124,395 ± 247,355</td>
<td>78,408 ± 225,732</td>
</tr>
<tr>
<td><strong>Nutritional quality of foods and/or beverages in videos</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Videos containing a food and/or beverage product (n (%))</td>
<td>94 (78)</td>
<td>82 (85)</td>
<td>76 (90)</td>
<td>252 (84)</td>
</tr>
<tr>
<td>Food and/or beverage products that were classified as occasional1 (n (%))</td>
<td>36 (38)</td>
<td>82 (100)</td>
<td>76 (100)</td>
<td>194 (77)</td>
</tr>
<tr>
<td>YouTube channels with 100% of products classified as occasional (n (%))</td>
<td>3 (60)</td>
<td>5 (100)</td>
<td>5 (100)</td>
<td>13 (87)</td>
</tr>
<tr>
<td><strong>Use of marketing techniques</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Videos containing an activity for consumers (n (%))</td>
<td>42 (35)</td>
<td>29 (30)</td>
<td>29 (35)</td>
<td>100 (33)</td>
</tr>
<tr>
<td>Videos containing a promotional strategy (n (%))</td>
<td>104 (87)</td>
<td>38 (39)</td>
<td>40 (48)</td>
<td>182 (61)</td>
</tr>
<tr>
<td>Videos containing a premium offer (n (%))</td>
<td>13 (11)</td>
<td>35 (39)</td>
<td>25 (30)</td>
<td>73 (24)</td>
</tr>
</tbody>
</table>

1. Classified according to the Ministry of Health food and beverage classification system.

Figure 1: Examples of activities, premium offers and promotional strategies on food brands’ Facebook pages.

**Example 1:** Example of an activity.

![Example 1](image1)

This Pizza Hut Facebook post includes an activity by getting people to comment and guess the new stuffed crust.

**Example 2:** Example of a promotional strategy.

![Example 2](image2)

This Gatorade New Zealand Facebook post includes a promotional strategy by having All Blacks consuming their drink.

**Example 3:** Example of a premium offer.

![Example 3](image3)

This Whitaker’s Chocolate Lovers Facebook post includes a premium offer by including a competition for consumers to enter.
analysed, 32 had 100% of their advertised products classified as occasional (Table 2). The pages with the largest potential reach among 13–18 year-olds in each of the three categories (Coca Cola, McDonald’s and Chupa Chups) all had 100% of their advertised food or beverage products classified as occasional.

Activities for consumers were used in 36% of Facebook posts, with asking consumers to like, comment, tag and share posts being the most commonly used activity. Promotional strategies were used in 41% of posts, and the most frequently used strategy was having a famous sportsperson/team in the post. Premium offers were used in 34% of posts, with competitions being the most common offer used (Table 2 and Figure 1).

It was estimated some posts for the most popular brands could potentially reach 10% of New Zealand adolescents (Table 1).

**YouTube**

The most popular YouTube channels in the packaged foods, fast food outlet and beverage categories were KitKat, Hell Pizza and V Energy NZ respectively (Table 3). Overall, 300 YouTube videos were made by the 15 YouTube channels during 2015–2016 (Table 4). The volume of videos made over the two-year period varied largely between brands, ranging from one video (0.0 videos per month) by Hell Pizza to 62 videos (2.6 videos per month) by Anchor (Table 3), giving an overall average of 20 videos over the two-year period (0.8 videos per month) (Table 4).

Of the YouTube videos, 84% contained a food or beverage product and 77% of these products were classified as being for occasional consumption only. Of the 15 YouTube channels analysed, 13 had 100% of their advertised products classified as for occasional consumption only (Table 4).

Activities for consumers were used in 33% of YouTube videos, with arts and crafts being the most commonly used activity. Promotional strategies were used in 61% of videos and premium offers were used in 24% of videos. Similar to Facebook, the most common promotional strategy used was having a famous sportsperson/team in the video and the most common premium offer used was having a competition (Table 4).

**Discussion**

The extent of unhealthy food advertising by popular food and beverage brands on Facebook is substantial in New Zealand, with food brands posting on average every three days, but some brands more than once a day. In comparison, advertising was lower on YouTube, with brands posting videos less than once a month on average on their respective channels. The total volume of advertising by those food brands is likely much larger as this study only looked at posts on food brand pages and channels, and not all advertising by those brands on Facebook and YouTube is listed on their pages and channels.

On both Facebook and YouTube, the food and beverage products advertised by brands were nearly all classified as occasional according to the Ministry of Health food and beverage classification system.20 The potential exposure to such ads is important as for the most popular brands it was estimated that about 10% of adolescents could potentially notice them in their Facebook newsfeeds. Social media advertisements use marketing techniques extensively.

Nearly every brand asked followers to like, comment, tag friends and share their posts, ensuring that their product was seen not only by their followers but also by the followers Facebook ‘friends’. Famous sportspersons and teams, such as the All Blacks, were most frequently used to promote products. By using these techniques, brands attract the consumer’s attention, increase their brand loyalty and make them more likely to go and buy their product.23,24 An Australian study similarly found that food brand pages widely used marketing features such as competitions based on user-generated content, interactive games and apps, and that adolescent and young adult Facebook users appeared most receptive to engaging with this content.13

The World Health Organization (WHO) has published a recent report25 recognising that digital marketing amplifies marketing in traditional media, achieving greater ad attention and recall, greater brand awareness and more positive brand attitudes, and greater intent to purchase.25 In addition, social media platforms collect
extensive personal data from users to deliver advertising and targeting children and adolescents, without effective regulation to protect children from this practice.25

Researchers do not have access to the same data that marketers have, which makes it difficult to gain insights into real exposure of children and adolescents to advertising on social media. While this study shows that social media is an important medium for New Zealand food marketers to engage with users and adolescents in particular, it is not yet possible to assess exposure of children and adolescents to advertising on social media or compliance of marketers with the new Code. From October 2017 onwards according to the new Code, marketers cannot anymore target any advertisements with occasional foods to adolescents younger than 14 years on social media. New methodologies have to be developed for monitoring social media food marketing, a need clearly recognised in the recent WHO report.25

Further research also needs to investigate food advertising across all media platforms and interactivity between the different media and how food and beverage advertising is perceived by teenagers.

Limitations of this research include that Facebook and YouTube posts were analysed retrospectively, and because some brands delete posts after a certain period of time, we may have missed some posts leading to an underestimation of the volume of posts made by brands. In addition, brands do not post all advertisements on their page or channel as they need to pay to have their posts seen and they can pay Facebook to distribute advertisements on newsfeeds of a wide range of targeted users (including users who do not like the particular brands) instead. For YouTube we only analysed food brand channels, but food brands can pay to advertise in a wide range of other popular non-food YouTube channels. In addition, the likes for the posts made by food brands include all likes, not just New Zealand likes.

Policy implications of this research include ensuring that food brands and companies cannot target children and adolescents on social media with occasional food advertising, informing young people and parents about the harmful effects of unhealthy food marketing and identifying international options to deal with this particular form of food marketing. The World Health Organization, in its recent report, encourages governments to acknowledge their duty to protect children online through regulations that extend the protection they offer children offline to online areas.25 The WHO proposes the development of a rights-based framework for the regulation of digital food marketing to children based on the rights to participation and protection accorded to children under the United Nations Convention on the Rights of the Child, which recognises the duty of states to protect the rights of children online, including their right to health. Article 13 of the WHO Framework Convention on Tobacco Control26 calls for Parties to recognise that “a comprehensive ban on advertising, promotion and sponsorship would reduce the consumption of tobacco products” and “to undertake a comprehensive ban of all tobacco advertising, promotion and sponsorship”, including “a comprehensive ban on cross-border advertising, promotion and sponsorship originating from its territory”. Progress has been made by States in committing to eliminate cross-border marketing of tobacco products within the European Union. A similar Framework Convention to Protect and Promote Healthy Diets, as previously proposed,27 could include similar provisions for advertising unhealthy foods to children.

Conclusion

Social media is an important medium for food marketers in New Zealand, and promotional strategies and premium offers are frequently used. Additional methodology needs to be developed to monitor exposure of children and adolescents to such advertisements and to assess compliance of food marketers with the new Advertising Standards Authority self-regulatory Code.
Competing interests:
All authors report grants from Health Research Council of New Zealand during the conduct of the study.

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REFERENCES:
17. Galbraith-Emami S, Lobstein T. The impact of initiatives to limit


The constantly evolving nature of trade governance in the 21st century is increasingly having a profound impact on public health and the development of public health policies globally. New rules governing international trade are increasingly affecting access to medicines, alcohol control and nutrition regulations. In particular, these issues are highly contentious in trade and tobacco control.

While much of the focus of the trade and tobacco control literature has concentrated on commercial aspects of trade liberalisation on tobacco consumption and legal implications of trade agreements on public health, recent studies have examined the political implications of trade agreements on tobacco control policies. This emerging literature highlights how tobacco companies have used trade agreements to try and block innovative public health proposals, and how the threat of legal action can help dissuade governments from implementing progressive policies.

The ‘regulatory chill’ hypothesis suggests that governments may weaken or withdraw public policies due to concerns over capital flight or potentially costly trade and investment lawsuits. Some critics of this hypothesis argue policymakers are unaware of trade and investment law, and consequently do not take these laws into consideration when making legislative and regulatory decisions. Other critics argue

### ABSTRACT

**AIMS:** To describe the process of enacting tobacco standardised packaging (SP) amidst tobacco industry legal threats in New Zealand.

**METHODS:** Relevant government and NGO documents, and media items were reviewed. Policymakers and health advocates in New Zealand were interviewed. The data were triangulated and thematically analysed.

**RESULTS:** In 2011, the New Zealand Government announced the goal of becoming a smokefree country (reducing smoking prevalence to 5%) by the year 2025, and considered adopting SP. In April 2012, the Government announced it would introduce SP, but tobacco companies threatened the Government with litigation in international courts for violating investment and intellectual property rights. In response, the Government adopted a ‘wait and see’ approach, waiting until two legal challenges against Australia’s SP law were resolved before it enacted its legislation in September 2016. Health advocates, limited due to funding constraints, attempted to alter the Government’s approach to the legal threats without success. Interviews with policymakers and health advocates confirmed these threats helped produce a regulatory chill, delaying the policymaking process by three years.

**CONCLUSION:** The New Zealand case illustrates how the threat of a potential international lawsuit can create a chilling effect by helping delay the implementation of public health policies.
it is difficult to prove that legal threats alter the regulatory process and produce a chilling effect. However, recent studies illustrate policymakers are increasingly aware of trade and investment law and incorporate these understandings into the policymaking process.

This article examines the politics of regulatory chill and the reactions of a nation-state to industry legal threats, by analysing the policy process for tobacco standardised packaging (SP) in New Zealand (2010–16). Instead of testing the regulatory chill hypothesis (whether a policy is enacted or weakened), this paper investigates the extent to which industry legal threats significantly contributed to political delays that have a profound impact on public health.

In September 2009, the Māori Affairs Select Committee of the New Zealand parliament started an inquiry into the tobacco industry and the disproportionate harm of tobacco use to the Māori population. In November 2010, the committee recommended New Zealand become ‘smokefree’ (interpreted as reducing smoking prevalence to 5%) by 2025. The committee recommended several policies to enable this goal, including SP. Over the next six years, tobacco companies pressured the New Zealand Government with legal threats to the SP proposal. We examine the effects of this pressure.

**Methods**

We reviewed New Zealand Government and health group documents, and New Zealand media items from official and media websites using standard snowball searches, beginning with search terms ‘plain packaging’, ‘standardised packaging’, ‘international trade’, ‘intellectual property’, ‘tobacco companies’, ‘threats’, as well as using key dates and specific actors. Between January and June 2015, we attempted to recruit via email and telephone 38 New Zealand interviewees closely involved in the SP process. Twenty-three agreed to be interviewed, 10 declined, and five never responded to multiple requests. Of the 23 interviewees, six were tobacco control advocates, four were academics, 11 were members of parliament (MPs) and one was a Health Ministry official. The interviewees agreed to waive their anonymity in accordance with a protocol approved by the University of California, Santa Cruz Committee on Human Research. We also interviewed one official from the Ministry of Foreign Affairs and Trade who requested anonymity. In the Results below, interviewees are cited by initials, with a key to the initials given in the online supplementary material (Supplementary Table 1). Results from these sources were triangulated and thematically analysed through standard process tracing frameworks.

**Results**

A series of delays to SP occurred from November 2010 to September 2016. All 23 interviewees (policymakers and advocates) confirmed that industry legal threats were either the most significant or a primary reason for delays (Supplementary Table 1). All interviewees (policymakers and advocates) confirmed that industry legal threats were either the most significant or a primary reason for delays (Supplementary Table 1).

**Introduction of standardised packaging (SP)**

From November 2010, the Cabinet considered the SP recommendation and in April 2012 agreed in principle to introduce SP (Figure 1). However, the New Zealand Government was divided on the issue of introducing SP. Associate Health Minister and Māori Party (an indigenous rights party within government) Member of Parliament (MP), Tariana Turia, was highly supportive of introducing SP, stating it was “a powerful tool” to reduce the appeal of tobacco products and smoking in general. Turia also stated SP would fulfill New Zealand’s commitment to the World Health Organization’s Framework Convention on Tobacco Control treaty (FCTC). The National Party-led coalition Government had delegated responsibility for tobacco control to Turia, who was a Minister outside Cabinet. In New Zealand, an Associate Minister’s delegated authority is constrained, as policy decisions are controlled by the Health Minister and Cabinet.

Meanwhile some members of Cabinet were less optimistic and more cautious about SP, including Health Minister Tony Ryall, who lacked a demonstrated commitment to the Smokefree 2025 goal. Prime Minister Key told reporters that Government was “likely” able to introduce...
SP legally, but that it was “not absolutely clear cut” and no “slam dunk” (Supplementary Table 2). National Party Trade Minister Tim Groser also said there were “some complexities” concerning the proposal’s legality needing to be addressed. The Health Ministry, which is responsible for drafting and implementing the SP legislation, held a 60-day public consultation period on the draft (the interim version is called a ‘Bill’) between August and October 2012.

Tobacco industry initial opposition

British American Tobacco (BAT) (68.3% market share in New Zealand), Imperial Tobacco (20.0%) and Philip Morris International (PMI) (7.1%) opposed SP. As with the opposition against SP in other countries, including Australia, Ireland, France and the UK, their comments centred around arguments that SP: 1) would not work, 2) would increase illicit tobacco trade, 3) would create unnecessary problems for retailers and 4) would violate domestic laws and international treaties governing intellectual property and investment. In particular, they argued the proposal violated New Zealand’s Bill of Rights and its obligations under various trade and investment agreements, including the Paris Convention for the Protection of Industrial Property, and the World Trade Organization (WTO) Agreements on Trade-Related Aspects of the Intellectual Property Rights (TRIPS) and Technical Barriers to Trade (TBT). If SP was enacted, tobacco companies threatened to sue the Government for compensation, which they claimed would amount to billions of dollars.

BAT media campaign

In August 2012, BAT ran a multi-media campaign titled “Agree Disagree” opposing the SP Bill with the slogan “We agree that tobacco is harmful. We disagree that plain packaging will work.” The campaign ran media advertising on television, radio and print and had its own website (www.agree-disagree.co.nz), which reiterated industry arguments submitted during the consultation period. Their television advertising achieved very high reach and frequency of exposure, and presented arguments that were either unsound or demonstrated fallacies.

Health group support

The main public health groups in New Zealand, and international health groups, lawyers, activists and academic scholars submitted comments supporting the Bill. They argued SP reduced the appeal of tobacco products by removing the glamorisation and contributed to the de-normatisation of tobacco, especially for youth and vulnerable populations. Health groups also identified there may be domestic and international legal implications associated with SP, but did not see these as a reason not to proceed. Instead, they argued SP was a justified public health action and met the Government’s commitments to the FCTC.

Ministry of Health regulatory impact statement and reports to Cabinet

In November 2012, the Health Ministry presented their report on the submissions, mentioning that several submitters argued SP violated several treaties. After consulting with other ministries, the Health Ministry also issued a regulatory impact statement (RIS) addressing potential impacts and risks of SP. The RIS stated that the Ministry of Foreign Affairs and Trade (MFAT) warned there was “a reasonably high risk of trade litigation,” (Supplementary Table 2). MFAT also noted that Australia, the first country to introduce SP, was facing two international legal challenges (one through WTO). MFAT estimated a 1.5–2 million NZD cost to defend a WTO case and potentially substantially more to defend an investment arbitration lawsuit.

As part of the executive policy process, Associate Health Minister Turia sent a report on SP on November 27, 2012 to the Cabinet Social Policy Committee. It expressed concerns over a potential legal challenge as a significant risk that “would require significant investment of resources”, estimating $3–$6 million for investment arbitration. The report acknowledged that risks would be significantly mitigated upon conclusion of the Australian
legal disputes. It therefore proposed developing “policy details to enable legislation to be considered for introduction by August/September 2013.” Consequently, the Government developed a ‘wait and see’ approach reliant upon the two Australian legal challenges for “greater legal certainty” before proceeding with SP in New Zealand.

Resuming the process of SP legislation

On 21 August 2013, Minister Turia issued another report proposing the Bill be introduced in parliament and sent to the Health Select Committee. In proposing SP, the report again took a cautious approach, stating the Bill “could be delayed if necessary”, reiterating the “uncertainty” of the timetable for the Australian legal challenges.

Although the Cabinet continued to consider legal challenges as a “high risk”, the August 2013 report addressed for the first time the issue of intellectual property rights. It acknowledged that the right to “register” trademarks did not grant tobacco companies the right to “use” the trademarks, as acknowledged by domestic rulings outside New Zealand, international rulings and the tobacco industry’s internal legal counsel. Following the August 2013 report, Minister Turia introduced the SP Bill to parliament in December 2013.

SP first reading

On 11 February 2014, the parliament had their first reading of the SP Bill. MPs in opposition to the Bill (from the small New Zealand First and ACT parties) reiterated the industry’s arguments by discussing the potential risk and cost to tax payers associated with a legal challenge. MPs in support of the Bill (from the Labour and Green parties) condemned these industry intimidation tactics and emphasised the importance of public health. The Bill was sent to the House Health Select Committee following a 142–1 vote.

Following the first reading, Associate Health Minister Turia and the National Party Cabinet disagreed on how the Bill should proceed. Turia congratulated the MPs for moving the Bill forward, and said that the Government should not be intimidated by tobacco companies or delay the legislation. Prime Minister Key, however, stated the Government would continue waiting for the Australian legal challenges before enacting legislation (Supplementary Table 2). Despite the Government’s cautious approach, the Bill was allowed to proceed to the House Health Select Committee.

Health House Select Committee 2014

In February and March 2014, the Health Select Committee received 191 substantive submissions on the Bill. These included some from international legal experts who argued that the SP proposal was consistent with international law, including WTO obligations. Both tobacco companies and health groups reiterated their positions on the Bill. In particular, health groups urged the Government to pass the Bill immediately without further delays.

Health Ministry response to Health Committee

On 18 June 2014, the Health Ministry gave their submission to the Health Select Committee in consultation with other ministries, especially MFAT. The Health Ministry accepted the international legal advice on the Bill’s legal standing, stating it was consistent with New Zealand’s WTO obligations concerning intellectual property rights and was non-discriminatory under trade and investment agreements (Supplementary Table 2). The submission stated the legal analysis provided by opponents of the Bill was “incomplete”, “selective” and did not “provide credible evidence to support their claims” (Supplementary Table 2).

Health Select Committee report

On 5 August 2014, the Health Select Committee submitted its report, which rejected the industry’s trademarks argument but did not address other legal issues pertaining to the Bill. The Health Select Committee also did not address whether the Bill should be delayed and instead recommended the Bill to the House for a second reading.

Two more years of cautious delay

On 20 September 2014, following the recommendation for a second reading, New Zealand held a general election. The National Party remained in government, however, Turia retired and the position of Associate Health Minister ‘responsible’ for tobacco control was filled by new Cabinet Minister Peseta Sam Lotu-liga, from the National
Party. The Māori Party lost two seats in parliament and became less influential as a support party for the National Party.

Health advocates interviewed for this study felt this change represented a drastic shift in leadership (Supplementary Table 1). Along with several MPs also interviewed for this study, they commented that former Minister Turia was a “bold” and “courageous” leader who had dedicated her political career to advancing Māori rights. While Lotu-liga did need agreement from senior ministers to prioritise the Bill, as did his predecessor, health advocates stated that, unlike Turia, he followed the caution of the National Party instead of challenging this approach.

In 2014, two former tobacco industry lobbyists, Christopher Bishop (Corporate Affairs Manager PMI, 2011–2013) and Todd Barclay (Corporate Affairs Manager PMI, 2013–2014) became National Party MPs in the new parliament. In 2012, Bishop was PMI's lead New Zealand spokesperson, appearing on television programmes to oppose the SP proposal. Health advocates noted a conflict of interest between their previous jobs and their duties as MPs, and worried they were contributing to delaying the Bill. Although there is no evidence to suggest these new MPs helped delay the process, their presence in government reflected long-term alliances between the National Party and the industry, and other strong contemporary links.

In February 2015, the UK and Ireland passed legislation requiring SP by May 2016. In response, health advocates and MPs began calling on the New Zealand Government to call the Bill for its second reading and not continue waiting on the Australian legal disputes. On 18 December 2015, the international tribunal examining the Australia-PMI legal dispute dismissed PMI's challenge, ruling that it did not have jurisdiction to hear PMI's claim. This tribunal ruled that initiation of the arbitration constituted an “abuse of right” because Philip Morris Asia did not have any relevant investment in Australia when the SP Bill was announced in April 2010, because PMI moved ownership of its Australian operations from Switzerland to Hong Kong in February 2011, 10 months after the Australian Government's SP announcement. Since one of the two Australian trade law disputes had been settled and the Australian High Court had ruled SP did not constitute acquiring the property (trademark), but was merely restricting the use of the trademark on the packaging and presentation of tobacco products, Prime Minister Key was questioned about the progress of SP. On 15 February 2016, he stated that the Government was “feeling a lot more confident.”

Although Prime Minister Key did not identify a date for the Bill’s second reading in parliament, he stated he expected it to become law by the end of the year. On 19 February 2016, MP Annette King again asked Minister Lotu-liga to explain the Bill’s delay in the House. Minister Lotu-liga responded that the bill would progress as priorities permitted.

Three of the four MPs from the National Party and NZ First Party interviewed for this study felt it prudent and pragmatic to await the result of the Australian legal challenges.
before enacting SP (Supplementary Table 1). SS,SO,BS They felt New Zealand, especially as a small nation, could learn from those cases and adopt the necessary adjustments to avoid any unnecessary and protracted legal battles. These MPs were concerned about the legal costs associated with trade disputes, which they argued required spending taxpayers’ dollars (Supplementary Table 1).SS

On the other hand, MPs from the Labour Party, Green Party and Māori Party argued this ‘wait and see’ approach ignored health priorities and undermined New Zealand's sovereignty (Supplementary Table 1).DS,L-W,FM,ILG,KH,TUF These MPs emphasised New Zealand's sovereign right to implement public health measures and said that it was alarming that a corporation could directly sue a government over attempts to advance public health. However, some MPs opposing the ‘wait and see’ approach empathised with the Government’s desire to avoid risk, considering the legal uncertainty (Supplementary Table 1).LW,ILG

Constrained health groups (Health Ministry realignment)
Throughout 2015 and 2016, health advocacy groups urged the Government to move forward with the second reading, but were reluctant to pressure the Health Ministry from whom they received the majority of their funding (Supplementary Table 1).PS,EC,LR,SE In 2014, the Ministry of Health announced they would ‘realign’ their tobacco control services and priorities between April 2015 and June 2016 with more focus on tobacco use cessation rather than prevention.53

More importantly, by June 2016, the government had cut funding for national tobacco control advocacy by 79% (from $1.7 million to $450,000) closing or largely curtailing the operations of several health groups.54 These included the two most active and experienced advocacy groups, the Smokefree Coalition and ASH New Zealand. Advocates interviewed for this study in June 2015 were concerned the Health Ministry's realignment would affect their funding to perform adequate advocacy operations (Supplementary Table 1).PS,EC,LR,SE Some interviewees argued this realignment prevented and in some sense ‘silenced’ the public health voices pressing the Government to adopt a Bill that had high public approval and strong supporting evidence (Supplementary Table 1).PS,EC,LR,SE

SP second reading
On 31 May 2016 (World No Tobacco Day), Associate Health Minister Lotu-liga announced the SP Bill would finally have its second reading in parliament in June 2016. Prime Minister Key also confirmed that tobacco industry legal threats were the primary reason for delaying the Bill, stating it had been prudent to wait. He said, however, that his officials were now advising him that it was safer to proceed (Supplementary Table 2).

On 23 August 2016, parliament held its second reading of the SP Bill, followed by a discussion in the committee of the whole House. A few MPs addressed the tobacco industry's legal threats and accused the Government of unnecessarily delaying the process of SP.55 MPs then voted on the Bill, which passed 108–13. The Bill had its third reading on 8 September 2016 and was given royal assent on 14 September 2016.

Discussion
The case of SP in New Zealand illustrates how an industry can use trade and investment agreements to delay the policy-making process for public health measures. Other possible contributing factors for political delays include the closeness of the Government to the tobacco industry, and the Government’s reluctance to be seen regulating industry and acting against foreign investors.41 The government could also have been using the legal threats as an excuse not to pass SP for other reasons. While these factors may have contributed to the delay, litigation threats were prominent in government explanations for the delays of SP, indicating the integral role played by concerns over legal risks.

The six-year period for this legislation compares with less than one year for the law banning tobacco advertising in New Zealand (1990) and less than three years (2001–2003) for the next major tobacco legislation.

While the trade and health literature has primarily focused on the direct effects of trade agreements on public health policies,7 this paper demonstrates that trade agree-
ments can also have indirect effects by disrupting the policymaking process. The ability of transnational corporations to use the mere threat of challenging a public health proposal in international court forces governments at a minimum to consider trade and investment law into the decision-making process.\textsuperscript{11} This can create legal risk and uncertainty for governments.

This paper broadens the regulatory chill literature by examining the chilling effect in terms of delay (time elapsed between introducing and enacting legislation) and its impact on public health. In comparison to the timeframes of other early adopters of SP—Australia (18 months), Ireland (22 months), the UK (35 months) and France (20 months)—New Zealand was by far the slowest (53 months). These political delays have substantial public health effects, including slowing the diffusion of best practices and delaying the effect of SP on smoking cessation and initiation. They also delay the reduction of government health expenditures and tobacco industry sales.

In February 2016, the Australian Department of Health released its Post-Implementation Review of SP, reporting significant health gains after two years of implementation, including delaying youth smoking initiation from 15.4 years to 15.9 years. Within the reduction of smoking prevalence over the two years from 19.4\% to 17.2\%, 0.55 of the drop was attributed to SP.\textsuperscript{56} The Department of Health estimated SP would generate health costs savings of $273 million over 10 years.\textsuperscript{56}

The New Zealand case also provides insight into how various political parties may react to industry legal threats and be more susceptible to regulatory chill. As in Australia,\textsuperscript{57} tobacco regulations may share bi-partisan support, but the intersections of trade and health, and trade and tobacco can be a dividing issue along party lines. Some MPs within centre-right and right parties evoked industry legal concerns tied to SP, and those in centre-left and left parties rejected these arguments. The case of New Zealand was similar to the UK,\textsuperscript{58} where the centre-right party leadership was cautious, and delayed enacting SP. In contrast, the centre-left and left leadership in Australia and Uruguay respectively was bold in rejecting the industry legal threats from the outset, and emphasised the public health importance of SP. This boldness can be attributed to strong leadership in these two countries, but research in both cases indicates that there were significant differences across party lines.\textsuperscript{8,57}

\textbf{Policy implications}

The tobacco companies’ threats to New Zealand highlight the industry’s long-standing fear of New Zealand’s tendency to adopt policies similar to Australia’s,\textsuperscript{12} and its fear of diffusion of best practices globally.\textsuperscript{59} Internationally, such threats help explain the slow diffusion of pictorial health warnings exceeding 50\% of the package, and of SP.

As of April 2018, other countries, including Georgia, Hungary, Norway, Romania, Slovenia and Thailand have enacted SP, and Canada, South Africa, Malaysia, Turkey, India, Panama, Brazil and Chile have announced plans to introduce SP.\textsuperscript{60,61} Health advocates and lawyers should inform governments, especially those that may have similar legal concerns, about the growing legal certainty of implementing these policies to avoid unnecessary delays in the regulatory process. Advocates can highlight the Australian,\textsuperscript{62} UK,\textsuperscript{63} French\textsuperscript{64} and Indian\textsuperscript{65} High Court decisions to uphold strong packaging and labeling policies. Advocates can also highlight an international trade tribunal ruling in favor of Uruguay’s strong tobacco packaging and labeling laws, also based on similar intellectual property, expropriation of trademark property and trade law, which can be applicable to SP and to wider public health policies.\textsuperscript{8} On 5 May 2017, news sources reported that the WTO dispute panel’s interim report upheld the Australian SP laws.\textsuperscript{66} Although the final ruling is expected in 2017, as of April 2018, it has not been made public. Given these favorable legal rulings governments should ignore any ‘wait and see’ arguments by the industry and their allies.

The New Zealand case also points to the importance of non-government funding resources in supporting tobacco control advocacy efforts,\textsuperscript{67–69} including legal expertise and support to help shape the Government’s reaction and response to the industry legal threats. Due to their reliance on government funding, primarily from the Health Ministry, some New Zealand health
advocacy groups may have been constrained in challenging the Government's decision to delay SP. Although New Zealand has a well-established tobacco control network, it lacked the extent of domestic legal expertise or international legal support found in other contexts to counter the industry's pressure.\textsuperscript{8,57} Sustainable funding for independent advocacy and legal assistance can possibly help minimise legal fears and limit the effects of regulatory chill.

Although New Zealand has finally enacted SP, health advocates should expect continued industry interference during the implementation phase.\textsuperscript{70,71} Delays to progress in Georgia are reported to be due to industry interference,\textsuperscript{72} and in Thailand the Ministry of Commerce has raised trade concerns and it appears the Government is waiting until the results of the WTO dispute with Australia before moving forward.\textsuperscript{73} In Uruguay\textsuperscript{8} and Australia,\textsuperscript{57} following the enactment of strong packaging and labeling regulations, tobacco companies sued in international courts, almost forcing the Uruguay Government to weaken its regulations. Unless the New Zealand Government issues the necessary regulations without undue delays, the Government runs the risk of not fulfilling its commitment to becoming smokefree by 2025. As of April 2017, it appears that the requirement for SP will not be implemented until June 2018.\textsuperscript{74}

Limitations

Cabinet politicians and some officials from MFAT declined requests to be interviewed for this study. Also, some information was withheld under Official Information Act provisions in the Regulatory Impact Statement and the reports to Cabinet, limiting a complete understanding of how the Key administration responded to the tobacco industry legal threats.

Conclusions

The New Zealand case illustrates how the threat of a potential international lawsuit can create a chilling effect by delaying public health policies. Other countries introducing or implementing similar policies should learn from these experiences and take steps to proactively avoid unnecessary political delays that have a profound impact on public health.
### Appendix

**Supplementary Table 1:** Key for interviewees interviewed in New Zealand in June 2015.

<table>
<thead>
<tr>
<th>Name of Interviewee</th>
<th>Initials for interviewee</th>
<th>Date of interview</th>
<th>Location of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anonymous interviewee at Ministry of Foreign Affairs and Trade</td>
<td>AI</td>
<td>18 June 2015</td>
<td>Wellington, New Zealand</td>
</tr>
<tr>
<td>Barbara Stewart</td>
<td>BS</td>
<td>18 June 2015</td>
<td>Wellington, New Zealand</td>
</tr>
<tr>
<td>Chris Bullen</td>
<td>CB</td>
<td>11 June 2015</td>
<td>Auckland, New Zealand</td>
</tr>
<tr>
<td>David Shearer</td>
<td>DS</td>
<td>18 June 2015</td>
<td>Wellington, New Zealand</td>
</tr>
<tr>
<td>Louise Delany</td>
<td>LD</td>
<td>16 June 2015</td>
<td>Wellington, New Zealand</td>
</tr>
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<td>Edward Cowley</td>
<td>EC</td>
<td>10 June 2015</td>
<td>Auckland, New Zealand</td>
</tr>
<tr>
<td>Fletcher Tabuteau</td>
<td>FT</td>
<td>17 June 2015</td>
<td>Wellington, New Zealand</td>
</tr>
<tr>
<td>George Laking</td>
<td>GL</td>
<td>12 June 2015</td>
<td>Auckland, New Zealand</td>
</tr>
<tr>
<td>Ian Lees-Galloway</td>
<td>ILG</td>
<td>17 June 2015</td>
<td>Wellington, New Zealand</td>
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<td>James Shaw</td>
<td>JS</td>
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<td>Wellington, New Zealand</td>
</tr>
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<td>Jane Kelsey</td>
<td>JK</td>
<td>12 June 2015</td>
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<tr>
<td>Kevin Hague</td>
<td>KH</td>
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<td>Wellington, New Zealand</td>
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<td>Louisa Ryan</td>
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<td>Louisa Wall</td>
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<td>Wellington, New Zealand</td>
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<tr>
<td>Marama Fox</td>
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<tr>
<td>Matthew Everett</td>
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<td>Prudence Stone</td>
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<td>RB</td>
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<td>Auckland, New Zealand</td>
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<tr>
<td>Scott Simpson</td>
<td>SS</td>
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<td>Shane Bradbrook</td>
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<td>Simon O’Connor</td>
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<td>Stephanie Erick</td>
<td>SE</td>
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<tr>
<td>Te Ururoa-Flavell</td>
<td>TUF</td>
<td>17 June 2015</td>
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## Supplementary Table 2: Standardised plain packaging (SPP) policy process in New Zealand (2010–2016).

<table>
<thead>
<tr>
<th>Event</th>
<th>Time-frame</th>
<th>Response to tobacco industry trade threats</th>
<th>Key statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Māori Affairs Select Committee Recommendation</td>
<td>November 2010</td>
<td>Acknowledged the threat but did not address the risks</td>
<td>Committee: “Tobacco companies have indicated they will legally challenge the plain packaging proposal. Imperial Tobacco told us that banning branded packaging was an infringement of their intellectual property, and they along with two other tobacco companies in New Zealand, opposed the move.”</td>
</tr>
<tr>
<td>Cabinet review and proposal</td>
<td>November 2010 - April 2012 (17 months)</td>
<td>Same</td>
<td>Prime Minister John Key: “There are lots of things we need to consider—I wouldn’t say it’s a slam dunk by any chance that plain packaging will take place but nor would I rule it out. It really is, genuinely, a true consultation period. As the National Party, we haven’t made the decision yet about whether we would support that any further.”</td>
</tr>
<tr>
<td></td>
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<td>Trade Minister Tim Groser: “I think it’s getting a bit ahead of the play here because there are some complexities around this. Plain packaging could remove the tobacco companies’ intellectual property. We need to listen carefully, especially to other companies that would be very concerned if we were setting a precedent on this. That might actually go against our own interests. We know what the real target is, but we need to consult the public and then we’ll need to have some very careful decisions to make sure that if we are going to move forward with legislation in this area, is properly designed to deal with those legitimate concerns. I’m really thinking outside tobacco.”</td>
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<tr>
<td>Ministry of Health consultation</td>
<td>July 2012 - November 2012 (4 months)</td>
<td>Same</td>
<td>Health Ministry consultation report: “Areas that submitters considered required attention in the RIS [Regulatory Impact Statement] included the need to…assess the actual impact of a WTO challenge, and that this should be focused broadly on the impacts for all of New Zealand’s traded products (not just tobacco)”</td>
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<tr>
<td>Cabinet reports and formal introduction</td>
<td>November 2012 - December 2013 (13 months)</td>
<td>Acknowledged high risk of potential litigation, and estimates of trade challenges</td>
<td>Regulatory Impact Statement (11/24/12): “The Ministry of Foreign Affairs and Trade (MFAT) considers that there is a reasonably high risk that if New Zealand implements plain packaging legislation, a World Trade Organization (WTO) dispute settlement case or investment arbitration may be brought against New Zealand. There is also the potential for challenges to be brought under regional or bilateral trade and investment agreements, particularly those containing investor-state dispute settlement clause. If a legal challenge was mounted against New Zealand by a tobacco company in relation to alleged breaches of international investment agreements, the remedy sought would include payment of compensation. Any claim for compensation would be based on the loss in value of the company’s investments including its trademarks. The potential loss to tobacco companies, if any, is presently unable to be quantified and the consultation process was not able to shed any further light on this matter. However, it is expected that data will emerge from Australian disputes that will be useful in quantifying any potential losses.”</td>
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<td>Cabinet paper (11/27/12): “There is a further risk of an international arbitration challenge from tobacco companies under bilateral investment treaties, such as that faced by Australia from Philip Morris Asia under Australia’s bilateral investment treaty with Hong Kong. Regardless of the strength of New Zealand’s case, the possibility of international dispute proceedings are a risk for New Zealand and defending them would require significant investment of resources. However, these risks will be significantly mitigated if the Australia disputes conclude prior to the enactment of New Zealand’s legislation. In that regard, it is possible that the WTO cases will conclude in time but the investment arbitration is likely to take a longer period of time…There will also be financial implications for the Government if New Zealand is forced to defend a WTO challenge or international investment arbitration, as happened in Australia’s case. The cost of defending such legal challenges is not known at this stage, but has been estimated to be in the order of $1.5 million–$2 million for a WTO challenge and $3–6 million for an investment arbitration…If necessary, New Zealand could delay the making of regulations until the Australia cases conclude and certainty regarding WTO legal implications is obtained.”</td>
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<td>Cabinet paper (8/21/13): “Once the bill is introduced, its passage through the House can adhere to standard timelines. This allows time for greater legal certainty over Australia’s plain packaging disputes at the World Trade Organization to emerge. As previously agreed, enacting the legislation, or at least bringing it into force through the subsequent regulations, could be delayed if necessary. Cabinet also noted that: the risk of international legal proceedings being brought against New Zealand under trade and investment agreements remains, but that greater legal certainty may be evident by the time that legislation is enacted in New Zealand if World Trade Organization (WTO) disputes against Australia advance in good time. If necessary, the enactment of the legislation or the making of regulations could be delayed until the Australian cases conclude and certainty regarding WTO legal implications is obtained.”</td>
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Parliament First Reading of Bill 11 February 2014

A majority of MPs rejected arguments against SPP and a few MPs addressed concerns

Hon. Tariana Turia (Māori): “We are convinced that plain packaging is a really important step on our path to being a smoke-free country by 2025, and that it will stack up against our World Trade Organization obligations. That is why we are pushing forward to take the legislation through the parliamentary processes without delay.”

“New Zealand takes all of its international obligations seriously. Our plain packaging regime has been developed to be consistent with our trade obligations, and our approach to negotiating new trade agreements continues to protect our ability to take public health measures such as plain packaging. The agreements and treaties can, and should, work together to boost both international trade and public health, and this is a good example of where we can achieve both objectives.”

“Although the tobacco industry may have laid down a threat if this legislation is passed, my message to it is that our country has a sovereign right and a legal right to protect its citizens. I am firmly of the opinion that it is not for any tobacco company to be telling us what we should be doing in our own land. Five thousand New Zealanders die from smoking a year, and that death toll places a responsibility on every politician to pass legislation in our land that will help save lives and increase well-being—legislation that makes a tangible, enduring impact on the lives of the people of this country. I commend this bill to the House for its first reading.”

Ian Lees-Galloway (Labour): “Effectively, the Government gets to decide when this legislation comes into force. The reason for that, of course, is concerns around being sued by the tobacco industry as a result of a potential breach of trade agreements. The real concern is that the Trans-Pacific Partnership will foist upon New Zealand rules and regulations that stop us from doing exactly this, which is to legislate in the best interests of the public health of New Zealanders. We must be vigilant. We must be vigilant and ensure that any trade agreements we sign up to do not allow us to fall into that trap. We are watching Australia closely, but I want New Zealanders to understand that the agreement that Australia has with Hong Kong was poorly drafted in this area and left Australia exposed to the type of litigation that it is facing. New Zealand’s trade agreements, generally speaking...our right—our sovereign right—to legislate in the interests of the public health of New Zealanders. New Zealand is a sovereign nation that ought to be able to say that we do not accept that 5,000 of our citizens are killed every year by tobacco.”

Dr Paul Hutchinson (National): “The issues around the World Trade Organization (WTO) are that every country has the sovereign right to protect the health of its people. I do not believe the problem is so much about free trade and the WTO; I believe it is much more about scurrilous tobacco companies colluding with tobacco-producing countries to bring in expensive, delaying court action.”

Hon. Annette King (Labour): “I would have to say that I am a little disappointed that we have to wait for the passage of this legislation and that we are waiting to see what happens in the Australian court case. I think it’s good on the Australian tobacco companies: ‘Bring it on’. I am glad that they have got the money to be able to fund their legal—intervention. Well, that is a good point, Mr Banks. He just asked why we are waiting. It is a question that you need to put to the Prime Minister. The Prime Minister wants to wait to see what happens in the court case in Australia. I think the fear is probably that the tobacco companies might then take us to court. Well, I would give them the two-finger salute and say ‘Bring it on’, because we as a Parliament will first of all want to protect the health of New Zealanders.”

Kevin Hague (Green): “It is deeply disturbing, therefore, that the Government is proposing to delay the implementation of this bill until such time as the various court cases and actions against the Australian Government are settled...I agree with Dr Paul Hutchinson, who said that every nation has the sovereign right to protect the health of its people. I agree with that, and the Greens say that if that sovereign right is threatened, then there is all the more reason for the Government to stand up and protect that sovereign right...delaying the implementation of this legislation is caving in to the threats, extortion and delaying tactics of an evil industry.”

Metiria Turei (Green): “We—the country, the Government, the community—are being threatened by the tobacco industry. We saw in today’s paper that there are further threats by the tobacco industry for the consequences of this policy. We are quite right in saying, so be it, bring it on. We are in the job of making good policy for the health and well-being of our country, and none of us make any apologies for that whatsoever.”

Barbara Stewart (NZ First): “New Zealand would be the second country in the world to approve plain packaging, after Australia, and we are likely to meet the same legal challenges...I know that the New Zealand Herald article in December last year having the country...say to these big tobacco companies: ‘No, we do not accept that this is a breach of trade agreements’.”

Clare Curran (Labour): “I want to say that the argument that is used by big tobacco—the apologists who pretend that this is a debate about intellectual property rights or removing barriers to trade—is wrong and that that has been proven...the companies decided to fight plain packaging on trade grounds because it provided them a more solid footing than allowing health issues to enter the debate. For this reason, they focused their energies on the Intellectual Property agreements governed by WIPO and the investment protection contained in NAFTA agreements...despite being told repeatedly by WIPO—that they had no legal basis for their arguments, that there was no legal basis for any of those arguments, and—that their analysis was flawed, the companies persisted in telling the government—and this was Canada—and the public that plain packaging would be inconsistent with international intellectual property protections. Following the industry’s misrepresentation of international trade law, new health ministers in Canada and Australia force plain packaging as a tobacco control measure because they mistakenly believed it was contrary to their constitutional obligations under international law. A conclusion is not being drawn here. We are not seeing it in Australia. We should not be taking notice of big tobacco’s argument that this is an intellectual property argument, because it is not. There is no basis in law for that argument.”

Hon. Phil Goff (Labour): “I think that the Philip Morris case against the Australian Government is a disgrace. The Australian authorities tell me that they will succeed in that case. We should not lack the courage to confront the vested interests that promote for their own material benefit the peddling of tobacco as a lethal product. We should not be frightened to confront them. We should not be frightened to bring in this legislation on the date that we consider appropriate and to take on those corporates, because we would have the support of the World Health Organization. We would be aligned with the Framework Convention on Tobacco Control. That has been passed internationally by a responsible body, and I do not believe for a moment that another international body, the World Trade Organization, would in the end defend the right of companies to kill people with their products. It just does not stack up. It is not credible. I support this bill. I commend those with the courage to vote for this bill now, and urge the Government to bring it into effect as soon as possible so we can stop that last barrier of promotion of a lethal product by the vested interests of big tobacco...They may pretend that the debate is about intellectual property. They may pretend that the debate is about removing barriers to trade. I am a believer in reasonable protection for intellectual property and I am a strong believer that we should remove barriers to trade, but neither argument stacks up to defend the promotion of a product that kills people if used as the manufacturer intends.”

Hon. John Banks (National): “I ask my Māori Party and National Party colleagues to carefully consider the procedent they will set with this bill. This bill guts the intellectual property rights of tobacco companies. Some will ask: well, who cares? But we do want to gut the intellectual property rights of KFC or Red Bull sugar drinks? KFC and Red Bull sugar drinks are putting this country’s level of obesity up at the top of the OECD. They help to contribute to that. It may be seen as a long bow, but the removal of intellectual property rights to the names and brandings of their products from tobacco companies without compensation is wrong, because which international company selling products that are at this price level. The State is effectively seizing their property because it does not like the health effects of their still lawful business. It is still a lawful business.”

Media statements in response to First Reading

11 February 2014

Some MPs rejected arguments against SPP and some MPs addressed concerns

Hon. Tariana Turia (Māori): “While the tobacco industry may have laid down a threat that if this legislation is passed [it will be challenged] my message to them is that our country has a sovereign right and a legal right to protect its citizens. I am firmly of the opinion that it is not for any tobacco company to be telling us what we should be doing in our own land.”

John Banks (Act): “I don’t believe the State should seize property rights from legitimate companies selling legitimate products.”

Prime Minister John Key: “I don’t really see the point in us finally passing the legislation until we see exactly what happens in the Australian court case. We have a slightly different system, but there might just be some learnings and if there are learnings out of that, it would be sensible to potentially incorporate those in either our legislation or avoid significant costs.”

David Cunliffe (Labour): “If we have a legitimate health regulatory policy step, then we should pursue it in the public interest. The Government should not be running scared of tobacco interests because they’re worried about being sued.”
**Supplementary Table 2: Standardised plain packaging (SPP) policy process in New Zealand (2010–2016) (continued).**

<table>
<thead>
<tr>
<th>Ministry of Health report to Health Select Committee</th>
<th>18 June 2014</th>
<th>Rejected industry legal arguments</th>
<th>Acknowledged government may delay passage of the Bill</th>
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</table>
| P7 “The Government has announced that it wishes to take account of the implications of Australia’s legal cases at the WTO before deciding to pass the Bill. The Government is confident that tobacco plain packaging can be implemented in a way that is consistent with trade agreement obligations, and New Zealand is supportive of Australia’s defense of the challenges it is facing at the WTO. However, the timing of these international legal processes is beyond the Government’s control. The Bill is now likely to become a matter for the next Parliament to consider. If the WTO process progresses sufficiently or if the international litigation risks are reassessed, it is possible the Bill could be passed early in the term of the new Parliament. Equally the passage of the Bill may be significantly delayed, if that is found to be necessary.”<sup>86</sup>
| P14 “The weight of expert legal opinion was that the international legal challenges against plain packaging were unlikely to succeed.”<sup>84</sup>
| P19 “The Bill provides for regulations to be promulgated that will significantly limit tobacco companies’ ability to use their trade marks on tobacco packaging. However, any such restrictions would be in accordance with domestic and international law.”<sup>84</sup>
| P20 “Officials consider that plain packaging will be shown to meet its intended objective and that it does not impair freedom any more than necessary for the achievement of public health objectives. This view has been confirmed by the Ministry of Justice.”<sup>86</sup>
| P25 “Officials agree with the submissions of the academic and NGO legal experts that the Bill is consistent with New Zealand’s WTO obligations. Tobacco company Philip Morris’s submission, which annexes a report by Professor Christopher Gibson, is the only submission by an opponent of the Bill that attempts a thorough analysis of the compatibility of tobacco plain packaging measures with New Zealand’s WTO obligations. It is noteworthy that Professor Gibson’s report does not conclude that the Bill violates the TRIPS Agreement or the TBT Agreement. The WTO analysis submitted by the other opponents of the Bill is incomplete and appears selective, and those submitters did not provide clear evidence to support their claims. Those submissions failed to refer the Committee to relevant WTO jurisprudence that does not support their interpretation of New Zealand’s WTO obligations.”<sup>86</sup>
| P26 “Officials agree with the academic legal expert submissions that indicate tobacco plain packaging is consistent with New Zealand’s investment obligations under the trade and investment agreements that New Zealand is a party to. Tobacco plain packaging is nondiscriminatory and is a legitimate exercise of sovereign regulatory power that restricts certain uses of trade marks in order to protect public welfare, namely public health. Philip Morris’s two paragraph submission on this issue focuses on the risk of litigation rather than providing analysis or evidence to support their view. BAT alleges plain packaging violates New Zealand’s investment obligations, but the analysis is incomplete and BAT does not provide credible evidence to support their claims.”<sup>86</sup>

<table>
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<th>Parliament Second Reading of Bill and statements to the media</th>
<th>5 August 2014</th>
<th>Rejected industry legal arguments</th>
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</table>
| P “The bill would not have any effect on intellectual property rights to register, own and enforce trademarks and copyright in designs; it is only the use of trade marks and copyrighted designs as promotional devices on tobacco products and packaging that would be controlled.”<sup>86</sup>

<table>
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<th>November 2014–June 2016</th>
<th>A few MPs complained the threats delayed the process</th>
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| Prime Minister John Key: It was waiting, and I think the view I initially took was, given Australia was in the middle of this court case it probably didn’t make sense for us to embark on that, and then potentially face exactly the same costs for the taxpayer in defending another legal action. Last year I asked for advice on that matter, and the advice I got back was that they felt we were on very firm ground and didn’t feel there was really any issues. A number of others have moved on plain packaging and were doing so without court cases being brought against them. We’re feeling a lot more confident about that and the bill’s now progressing through and it’s my expectation it will become law at some point.<sup>86</sup>

Hon. Petaia Sam Lotu-Liga (National): Our stance remains the same that it is prudent to await the World Trade Organization decision.<sup>86</sup>

Hon. Annette King (Labour): What I will be critical of is the time that it has taken to get this bill here. We are talking almost two years—two years waiting to pass a piece of legislation that tightens the screws on tobacco control in New Zealand. Why did we wait two years? We waited because the Government refused to be a leader in the fight for tobacco control, with this measure. It wanted to wait to see what happened in Australia, because Australia had the guts to put in place plain packaging. It said: “We are an independent sovereign nation. We will make our own decisions about what we have in public health law.” And they went ahead, they passed their legislation, they brought in plain packaging, and they were sued by the tobacco companies. So rather than say “We are a sovereign nation. We are prepared to stand up for New Zealanders and pass our legislation,” we sat there wringing our hands and saying: “We need to wait and see.”

Simon O’Connor (National): I am conscious, too, of some of the counterarguments that have been put forward around intellectual and property rights. Although I can sort of understand that from one point of view, I think it is really important to make the distinction that, in this case, tobacco product owners still own the property rights, or the intellectual rights, they just are not allowed to use them for, I think, very good reason because, ultimately, the public good overrides that.<sup>86</sup>

Ian Lees-Galloway (Labour): Has that Government dragged the chain on this legislation on every single possible opportunity to slow the process down. So more than three years—more than three years—after the Government first decided it was going to introduce plain packaging, here we are, not passing the bill, not passing it into law, not actually beginning the regime of plain packaging—but here we are at the second reading… I have to say, of course, all of this is tied up in the business of the Trans-Pacific Partnership and free trade and investor-State dispute clauses, and the threat that the tobacco industry continues to make is that it will try to sue the New Zealand Government if this Parliament enacts legislation designed to protect the health of New Zealanders. I have to say that if it was an opponent of the Trans-Pacific Partnership—which I certainly am not. But if it was someone who was a benefactor of the Trans-Pacific Partnership, and if it was someone who was an enthusiast for investor-State dispute settlement clauses, I would be really hacked off with the tobacco industry right now. This is because the tobacco industry, with its threat to sue the New Zealand Government if this legislation is passed, is actually playing into all the fears people have about what will happen to this country if we sign up to the Trans-Pacific Partnership and if we pass the legislation enabling the Trans-Pacific Partnership. The tobacco industry—the Minister looks confused. The Minister is trying to figure out how this is associated with this bill. He does not do his reading if he does not understand it. This legislation, if it passes, will trigger the tobacco industry’s suing the New Zealand Government under investor-State dispute settlement clauses. That is what people fear—this Parliament not having the sovereign right to legislate in the interests of the public health of New Zealanders because we fear being sued by the tobacco industry, or by any other industry for that matter. Sam Lotu-liga, Associate Minister of Health, this legislation—the tobacco industry is threatening to sue the New Zealand Government if this legislation is passed. I am sure the tobacco industry will sue the New Zealand Government if this legislation is passed. That is why the Government has said that it had to put this legislation on the back-burner. It is more concerned about business interests. It is more concerned about the tobacco lobby than it is about the public health of New Zealanders.<sup>86</sup>

David Seymour (ACT): What is in dispute is whether or not smoking cessation is the only value that New Zealand holds. I think we have a number of other values that are important to New Zealand, including property rights and the right of a business to employ its brand… Nobody wants to defend the tobacco industry, but the principles behind New Zealand’s tradition of property rights, freedoms of trade and the freedom to do as you damn well please so long as you are not harming anyone else are also very important. That why I am opposed to this bill, which will have a minimal effect on smoking behaviour, as demonstrated in Australia. But it is a major step in eroding our tradition of property rights and freedom to trade. That is something that every legitimate business in New Zealand and every business person listening tonight should be very, very concerned about.<sup>86</sup>

Poto Williams (Labour): This bill also looks at ensuring that the property rights issues that the tobacco companies raised during the submissions are still own the property rights, or the intellectual rights; they are just not allowed to use them for, I think, very good reason because, ultimately, the public good overrides that.<sup>86</sup>

Hon. Annette King (Labour): However, the timing of these international legal processes is beyond the Government’s control. The Bill is now likely to become a matter for the next Parliament to consider. If the WTO process progresses sufficiently or if the international litigation risks are reassessed, it is possible the Bill could be passed early in the term of the new Parliament. Equally the passage of the Bill may be significantly delayed, if that is found to be necessary.”<sup>86</sup>

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| Final Vote and Approval in Full House | September 2016 | N/A | N/A |
Competing interests:
Eric Crosbie reports grants from National Cancer Institute Training Grant 2T32 CA113710-11 and Tobacco-Related Disease Research Program Dissertation Research Award 24DT-0003 during the conduct of the study.

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eric.crosbie@ucsf.edu

URL:

REFERENCES:
12. Crosbie E, Glantz SA. Tobacco industry argues domestic trademark laws and international treaties preclude cigarette health warning labels, despite consistent legal advice that the argument is invalid. Tobacco control. May 2014; 23(3):e7.


27. Imperial Tobacco New Zealand Limited. Submission on Smokefree Environments (Tobacco Plain Packaging) Amendment Bill. Wellington, New Zealand: House of Representatives Standing Committee on Health, 9 April 2013. Available at: http://www.parliament.nz/resource/en-NZ/50SCHE_EVI_00DB-HOH_BILL12969_1_A385113/6e51b2632a575e49502d374dcb2f63d2b9abf68a


49. Taylor R. Philip Morris Loses Latest Case Against Australia Cigarette-Pack Laws. Wall Street


Pertussis vaccination uptake in pregnancy: lessons to be learned from an integrated healthcare approach

Emma J Deverall, Benjamin Gilmore, Sam Illing, Roshini Peiris-John

Despite being a vaccine-preventable disease, pertussis causes significant morbidity and mortality worldwide, with 140,000–250,000 cases reported annually from 2012–2016. In New Zealand, pertussis epidemics occur every 3–5 years. Although immunisation rates have been increasing, pertussis remains a major public health issue in New Zealand. During the recent outbreak in 2012, over 5,500 cases were reported with over 350 cases per month reported from mid-2011 to late-2013. This outbreak resulted in hundreds of hospitalisations and three deaths of infants, including two who were too young to be immunised. Ethnic disparities in pertussis disease rates and vaccination coverage rates are evident. Māori have the lowest coverage rate (62%) with an incidence rate of 734 per 100,000 in under-one-year-olds, while Pacific peoples have a coverage rate of 73% and the highest incidence rate in under-one-year-olds (934 cases per 100,000).

Infants are the most at risk of serious disease complications and death from pertussis, and are best protected by maternal immunisation during pregnancy and on-time immunisation during infancy. Maternal immunisation is 91–93% effective at preventing spread to infants aged under eight weeks old. Prenatal immunisation has led to a 50% reduction in pertussis among infants under age 13 weeks in the UK, and has been estimated to reduce total annual

ABSTRACT

AIM: To determine the proportion of pregnant women vaccinated with the pertussis booster in the third trimester of their pregnancy, and explore factors influencing coverage.

METHODS: A clinical audit was undertaken at Rotorua hospital using electronic databases to determine pertussis immunisation among women who birthed from 25 March to 25 April, 2017 (n=111). Lead maternity carers (LMCs) were surveyed to assess knowledge of the vaccine and explore suggestions to increase vaccination coverage.

RESULTS: Only 44% (n=49) of women were vaccinated in 2017. Women 25 years and under, and women from Rotorua were less likely to be vaccinated. A woman not being recalled to the GP for vaccination was the biggest reason for not being vaccinated (n=27). Every woman in Taupo/Turangi was recalled in pregnancy, leading to greater vaccine uptake compared to women in Rotorua.

CONCLUSION: Overall, the proportion of pregnant women vaccinated for pertussis continue to be low with coverage being disproportionally lower for younger women. The integrated healthcare approach in Taupo/Turangi has resulted in improved vaccine uptake. Interventions that allow general practitioners, LMCs and primary health organisations to work together can improve vaccination rates of pregnant mothers in New Zealand.
infant cases by up to a third, hospitalisations by 39% and deaths by 51% in the US.5,6 Immunisation during pregnancy is now recommended by national health organisations in several countries, including the US, UK, Belgium and New Zealand.5,8,9

In 2013, New Zealand's Ministry of Health introduced fully funded pertussis immunisation for women between 28–38 weeks of gestation. However, the Ministry estimates maternal immunisation coverage to be as low as 13%, with considerable variation between district health boards.2 A recent letter in the New Zealand Medical Journal10 showed that mothers of over 80% of children with pertussis aged less than 20 weeks in Auckland had not received maternal vaccination. Their suggestion was to promote the effectiveness of the maternal vaccine to would-be parents, lead maternity carers (LMCs) and general practitioners (GPs).

An audit conducted at Rotorua hospital in 2015 indicated a 35% immunisation uptake. To improve the vaccination rate for women in the community, a package of care was developed to support and educate GPs in their provision of primary care to pregnant women. LMCs were offered secure email addresses to strengthen communication between them and other primary care providers. Rotorua Maternity Day Assessment Unit (DAU) also offered immunisation to women using hospital services. The study reported here aimed to determine the proportion of pregnant women vaccinated for pertussis in the third trimester of their pregnancy following the steps taken to improve coverage in Rotorua, examine variation by selected demographic variables and explore factors influencing coverage.

**Methods**

All women who birthed in Rotorua hospital from 25 March 2017 to 25 April 2017 were included (n=113). The birth registry (available on the Rotorua electronic health system) was accessed to extract information about the variables of interest: whether the patient had received pertussis vaccination in this pregnancy, age, ethnicity, parity, GP and LMC. If they had not received the vaccine, it was asked if the women had been in pregnancy, seen but not recalled, declined the vaccine or lost to follow up. If the general practitioner (GP) was listed as ‘not found’ on hospital records, this was confirmed by accessing patient records within the patient management system through the Rotorua Area Primary Health Services (RAPHs) or by calling GP practices. If no GP was identified then the mother was excluded from the audit. Women who were vaccinated in the DAU were identified by accessing DAU records of LMCs.

The LMCs of the women who gave birth during the study period were surveyed to assess views and knowledge of the vaccine as well as to explore suggestions to increase immunisation rates. Information collected included knowledge of subsidy, safety, appropriate trimester, use of the secure emails provided as an intervention after the last audit and reasons for not use, and recommendations for improving coverage. The questionnaire was interviewer administered at the birthing unit at Rotorua hospital or by a telephone call.

Ethical approval for the study was received from the Rotorua Hospital Ethics Committee.

**Results**

A total of 113 women gave birth within the audit period. Two women were excluded as they were enrolled in GP practices outside of the Lakes District Health Board (the study location). This left 111 women eligible for the audit.

The overall proportion of pregnant women vaccinated for pertussis from March–April 2017 was 44% (n=49). Those 25 years and under, and living outside of Taupo/Turangi, were less likely to be vaccinated (Table 1). Māori (cf. non-Māori) and nulliparous women (cf. multiparous women) were less likely to be vaccinated, although these differences were not statistically significant. Almost half (49%) of the women (n=45) were vaccinated by a GP. Twelve women (11%) had unknown immunisation status as they were not enrolled at a practice and their notes could not be accessed.

Women in Taupo/Turangi were more likely to be vaccinated at a rate of 76% compared to 45% in Rotorua. Taupo women have access to a greater number of interventions within an integrated healthcare approach. Rather than arrange secure emails for LMCs,
### Table 1: Characteristics of study population by vaccination status.

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<th>Total (n=111)</th>
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<td>≤25 years</td>
<td>50</td>
<td>15 (30.0%)</td>
<td>26 (52.0%)</td>
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<td>&gt;25 years</td>
<td>58</td>
<td>34 (58.6%)</td>
<td>21 (36.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>54</td>
<td>20 (37.0%)</td>
<td>28 (51.9%)</td>
<td>0.224</td>
</tr>
<tr>
<td>NZ European</td>
<td>32</td>
<td>15 (46.9%)</td>
<td>14 (43.8%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>25</td>
<td>14 (56.0%)</td>
<td>8 (32.0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO</td>
<td>46</td>
<td>19 (41.3%)</td>
<td>22 (47.8%)</td>
<td>0.598</td>
</tr>
<tr>
<td>P1+</td>
<td>65</td>
<td>30 (46.2%)</td>
<td>28 (43.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Location&lt;sup&gt;d&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taupo/Turangi</td>
<td>21</td>
<td>16 (76.2%)</td>
<td>5 (22.7%)</td>
<td>0.012</td>
</tr>
<tr>
<td>Rotorua</td>
<td>69</td>
<td>31 (44.9%)</td>
<td>38 (55.1%)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Excludes women with unknown vaccination status (n=12).

<sup>b</sup>Chi-square test.

<sup>c</sup>Excludes women with age unknown (n=3), all were not vaccinated.

<sup>d</sup>Excludes women from areas outside of Taupo/Turangi and Rotorua (n=9), only two of whom were vaccinated.

### Table 2: Reasons for not being vaccinated.

<table>
<thead>
<tr>
<th></th>
<th>Not seen in the pregnancy (n=16)</th>
<th>Seen; no recall (n=27)</th>
<th>Vaccination declined (n=3)</th>
<th>Seen; recalled, lost to follow-up (n=1)</th>
<th>Unknown (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤25 years</td>
<td>8</td>
<td>15</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>&gt;25 years</td>
<td>8</td>
<td>12</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unknown</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>9</td>
<td>14</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NZ European</td>
<td>2</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO</td>
<td>6</td>
<td>13</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>P1+</td>
<td>10</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taupo/Turangi</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Rotorua</td>
<td>14</td>
<td>21</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>6</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Taupo maternity unit takes responsibility for notifying GPs of their patient's pregnancy. GPs are then able to enter patients for recall to discuss vaccination, and a nurse attends antenatal classes for opportunistic immunisation. After-hours vaccination is available at the pharmacy. In Turangi the Community Child Health Nurse from Pinnacle Midlands Health Network vaccinates pregnant women at a monthly clinic.

A woman not being recalled to the GP for vaccination was the biggest reason for not being vaccinated (Table 2). Every woman in Taupo/Turangi was recalled in pregnancy. Only three women declined the vaccine and only one was lost to follow up after recall.

There were 24 LMCs responsible for births during the study period; one was on leave at the time of surveying, leaving 23 eligible.

While all midwives routinely discussed vaccination with their patients, and understood it was subsidised, four (17.3%) were unsure the vaccine was safe, and two (8.7%) were unsure if it was effective.

None of the midwives used the secure emails provided by Rotorua, as an intervention was put in place after the last audit. Reasons for this included: hard to access (n=8); not set up (n=7); women referred from GPs (n=3); laborious (n=2); problems with account (n=2); and cost (n=1). Midwives felt that advertising through local and social media (n=5), along with patient education resources (n=7) may help improve vaccination rates.

Discussion

Overall, the proportion of pregnant women receiving pertussis booster vaccination within Rotorua DHB continues to be low, with coverage disproportionately lower for younger women, and little improvement in coverage from 2015 to 2017. The proportion of pregnant women receiving pertussis vaccination in Taupo/Turangi, however, was greater than women in Rotorua.

This was an audit consisting of a small sample from a secondary hospital, and care must be taken when interpreting the results. The main limitation of the audit is that 11% of the original population could not have their immunisation status identified due to not being registered at a GP clinic. Although largely unlikely, there may also have been incorrect documentation of immunisation by providers who opportunistically vaccinated mothers in locations away from their GP clinics. Despite these limitations, this study provides useful insights into current practice and explores opportunities for improving uptake.

Previous studies in New Zealand have shown pertussis vaccination uptake to be influenced by mothers' desire to protect their baby (96%), following health professional advice (84%), awareness of pertussis in the community (50%) and being funded (43%). Those who did not accept the vaccine were either unaware of it (73%), had safety concerns (68%) or were doubtful of its effectiveness (56%). Pregnant mothers whose midwife recommended vaccination are more likely to be immunised. While we found all midwives routinely discussed vaccination with their patients, one in four were unsure of its safety and effectiveness. Programmes to update midwives on current knowledge on vaccine safety and effectiveness would be useful.

Clearly, immunisation uptake could be improved by increasing awareness of funded pertussis immunisation during pregnancy and by increasing opportunistic immunisation. Although we found LMCs are relatively well informed, it appears that the message for all pregnant women to be offered pertussis vaccination in pregnancy is not being comprehensively translated into practice with variations found between localities.

In Rotorua, unvaccinated women were commonly seen by their GP, yet not recalled for vaccination. It is not possible to determine if this was a missed opportunity for vaccination, as data on gestational age when seen or the purpose of the visit was not recorded.

Overall, there is a need for more focus on improving delivery of vaccines to young pregnant women. The significantly higher rate of pertussis vaccination for women living in Taupo may be due to the way in which multiple healthcare providers bring vaccination to the community, rather than any attempt to bring the women to the vaccine. Key components of this programme are:
1. Notifying GPs of pregnancy: finding new ways to promote communication between GPs and LMCs, such as the Taupo-maternity unit letter, could also work;
2. Vaccinations available in antenatal clinics and;
3. Opportunistic vaccination at pharmacies and parent education sessions. Community-based opportunistic vaccination in Rotorua could include local maraes.

The availability of a greater number of interventions within an integrated healthcare approach in Taupo/Turangi has led to a higher uptake of vaccination among pregnant women compared to women in Rotorua. It is essential that we continue to develop and foster the relationships and resources that allow GPs, LMCs and primary health organisations to work together to improve the vaccination rate of pregnant mothers. Adoption of the integrated healthcare approach, as found in Taupo/Turangi, could help improve the vaccination rate of all pregnant mothers in New Zealand.

Competing interests:
Nil.

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REFERENCES:


Diagnosis of abdominal tuberculosis in Christchurch New Zealand: a case series

James MM Bevin, Simon C Dalton, Chris J Wakeman, Will RG Perry

ABSTRACT

AIM: Abdominal tuberculosis presents with non-specific symptoms, including generalised abdominal pain. Prompt and accurate diagnosis is critical to improving outcomes and avoiding complications. We conducted a retrospective review of cases of abdominal tuberculosis presenting to Christchurch Hospital to explore the epidemiology, clinical features and diagnostic modalities used.

METHOD: Cases were identified by searching for relevant ICD discharge codes from January 1996 to January 2016. Data on age, clinical presentation, investigations and microbiological results were obtained.

RESULTS: There were 20 patients diagnosed with abdominal tuberculosis over the study period. The median age was 34. Thirteen patients were male (65%), seven female (35%). The majority (11) were from Asia (predominantly India), five were African, and three were New Zealand Europeans. Abdominal pain was the most common presenting symptom (70%) followed by fevers (50%) and night sweats (50%). The C-reactive protein was elevated in 15 patients (75%), anaemia was found in 11 (55%) and nine had abnormal liver function tests (45%). Abdominal ultrasound (US) and computed tomography (CT) showed generic inflammatory change in all patients in this series (100%). Laparoscopy was undertaken in 10 (50%) patients, all of which had positive laparoscopic biopsies. Ascitic fluid was obtained in nine, with stains for acid-fast bacilli uniformly negative, however three (33%) had mycobacterial growth from culture. Six colonoscopies were performed: in three (50%) culture and/or histology was positive. Three lymph node biopsies and two formal laparotomies were the remaining diagnostic techniques employed with two biopsies and one laparotomy yielding positive results. Overall, of the 20 cases, 15 (75%) were able to be definitively confirmed, with the remaining five treated presumptively for probable abdominal tuberculosis.

CONCLUSION: Abdominal tuberculosis is an uncommon presentation at our institution, with an average of one case each year. The typical patient was a young immigrant from Asia or Africa. Diagnostic laparoscopy was the most common and uniformly reliable means of obtaining a definitive diagnosis.

Prior to the 1960s, tuberculosis (TB) was more commonly found in New Zealand than it is today.¹ This decline in incidence was bought about by increasing standards of living, control of bovine tuberculosis through slaughter of reactive animals, pasteurisation of milk and the introduction of anti-tuberculous medications. However, it has not been eradicated as anticipated, largely due to rising migrant populations, poverty, inadequate access to healthcare and overcrowded housing.²

In comparison to the pulmonary form of the disease, abdominal manifestations of tuberculosis are infrequent and the clinical presentation tends to be ambiguous with non-specific abdominal pain and a constellation of systemic features. It lends itself to a wide ranging differential that can include infection, inflammatory bowel disease and malignancy.³ Prompt and accurate diagnosis leads to earlier tuberculosis treatment, which creates advantages not only with regard to patient prognosis but also in savings to the health system. As such, major institutions should be well-equipped to deal with abdominal tuberculosis.

This series aims to establish how cases of abdominal tuberculosis have both presented and been diagnosed at Christchurch Public Hospital and whether this is in line with current practice elsewhere.
Method
A retrospective study of patients admitted to Christchurch Public Hospital from January 1996 to January 2016 was carried out. Patients were identified by code for discharge diagnosis A183: “Tuberculosis of intestines, peritoneum or mesenteric glands”. Data on age, clinical presentation, investigations and treatment were obtained from a combination of clinical records and electronic patient information databases. Ethical approval for this study was obtained from the New Zealand Health and Disability Ethics Committees (HDEC).

Results
Twenty patients were diagnosed with abdominal TB between 1996 and 2016. Thirteen patients were male, seven were female. The median age was 34. Six patients were of Indian origin, five Asian, five African, three New Zealand European and one Melanesian. The three New Zealand Europeans were the only members of our cohort who had not recently immigrated.

Presenting features
Abdominal pain was the predominant presenting feature. Fourteen patients reported a history of generalised abdominal pain. Fevers and night sweats were the next most common complaint in 10 patients, followed by associated weight loss in eight, diarrhoea in five and anorexia in four patients. One patient presented with urinary incontinence, which was later found to be from an inflammatory mass making contact with the bladder.

On examination, only 10 of the 20 patients had a generalised tender abdomen. Of these, six abdomens were also noted to be grossly distended. Only three patients had other examination findings, including a mass found on palpation of the abdomen.

Six patients gave a history of pulmonary TB, however no information was available regarding prior treatment for this. Another six reported possible contact with TB in the past.

Investigations
A CRP over 5mg/L (75%) was the most consistent finding. Other findings including anaemia (55%), elevated transaminases (45%) and elevated white cell count (10%) were less frequent.

On abdominal ultrasound, TB is suggested by the presence of one or more of the following features: lymphadenopathy, ascites, free fluid or thickened small bowel loops. An ultrasound scan of the abdomen was performed in 10 of the patients and all had at least one of the findings consistent with abdominal tuberculosis.

Abdominal CT was performed in every patient in this series and all had some or all of the following positive findings suggested in the literature: retroperitoneal or mesenteric lymphadenopathy, thickened small bowel, free fluid or mesenteric stranding. Of the 20 CT scans, only 12 reports contained TB in the differential diagnosis. These 12 cases were the patients with known or potential TB contact in the history. The other eight cases of abdominal TB (without reported TB exposure) had only malignancy and/or inflammatory bowel disease considered in the radiological reports.

Ascitic fluid samples were taken in nine cases; Ziehl-Neelsen (ZN) stains were uniformly negative and culture was positive in only three. Colonoscopy was performed in six patients. In four of these inflammation and ulceration was found. Histology showed granulomatous inflammation. Culture of the biopsy was positive for Mycobacterium tuberculosis in three and negative in one. The other two colonoscopies were reported as normal.

Typical macroscopic findings of abdominal TB include diffuse involvement of the visceral and parietal peritoneum, white ‘miliary’ nodules, mesenteric lymph nodes, ‘violin string’ fibrinous strands, omental thickening and small bowel lesions. Laparoscopy was performed in 10 of the 20 cases and nine patients had these macroscopic findings. The remaining laparoscopy was converted to laparotomy due to small bowel injury from insertion of the trocar. In this case the appearance of the bowel was suggestive of tuberculosis. All 10 patients were later diagnosed with tuberculosis; confirmed on histology and culture from intra-abdominal lymph nodes or omental/peritoneal tuberculous nodules.

Three cases had image-guided lymph node biopsies. Central low attenuation and peripheral enhancement were consistent imaging findings. Two cases were of abdominal nodes; the first demonstrated granulomatous inflammation on cytology.
and was both culture and PCR positive for M. tuberculosis, whereas the second had limited cellular material and was culture negative. The final image-guided lymph node biopsy was from a cervical node with granulomatous inflammation seen on cytology and subsequent growth of M. tuberculosis from culture. The latter two cases were treated as presumed abdominal TB based on consistent imaging findings in the terminal ileum and peritoneum.

All 20 cases had specimens sent for sent for histology/cytology—all but one of these demonstrated granulomatous inflammation. Furthermore, all cases had TB culture requested—M. tuberculosis was isolated from culture in 14 cases. In one other case M. tuberculosis was detected by PCR with no subsequent growth from culture. All 14 positive cultures were uniformly susceptible to standard anti-tuberculous medications with no drug resistance identified.

Overall, of the 20 cases, 15 were able to be definitively confirmed, with the remaining five treated presumptively for probable abdominal tuberculosis.

### Table 1: Comparison of case series for positive findings on investigations and clinical presentations.

<table>
<thead>
<tr>
<th></th>
<th>S Rai ’95–’01</th>
<th>Krishnan et al ’99–’05</th>
<th>Uzunkoy et al ’96–’03</th>
<th>Muneef et al ’84–’97</th>
<th>Islam et al ’08–’10</th>
<th>Bevin et al CPH ’96–’15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>24</td>
<td>41</td>
<td>11</td>
<td>46</td>
<td>81</td>
<td>20</td>
</tr>
<tr>
<td>Country</td>
<td>UK</td>
<td>India</td>
<td>Turkey</td>
<td>Saudi Arabia</td>
<td>South Africa</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Weight loss</td>
<td>87%</td>
<td>81%</td>
<td>68%</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>88%</td>
<td>29%</td>
<td>72%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Night sweats/fever</td>
<td>55%</td>
<td>36%</td>
<td>70%</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated CRP/ESR</td>
<td>&gt;90%</td>
<td></td>
<td>78%</td>
<td>75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated white cell count</td>
<td>&gt;90%</td>
<td></td>
<td>33%</td>
<td></td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Anaemia</td>
<td>&gt;90%</td>
<td></td>
<td>63%</td>
<td></td>
<td>55%</td>
<td></td>
</tr>
<tr>
<td>Mantoux</td>
<td>22%</td>
<td>18%</td>
<td>27%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdomen x-ray</td>
<td>21%</td>
<td></td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USS abdomen</td>
<td>32%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>CT scan abdomen</td>
<td>55%</td>
<td>100%</td>
<td>100%</td>
<td>90%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Culture ascitic fluid</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>7%</td>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td>Laparoscopy/laparotomy</td>
<td>92%</td>
<td>95%</td>
<td>100%</td>
<td>96.4%</td>
<td>94%</td>
<td>100%</td>
</tr>
<tr>
<td>Colonoscopy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50%</td>
</tr>
</tbody>
</table>

### Discussion

Tuberculosis remains a global scourge and unfortunately the symptoms can be non-specific.2

The clinical presentations and positive findings of investigations from various published case series are summarised in Table 1. The most common symptom of abdominal pain in our series was also the leading symptom in two other series from the UK and Saudi Arabia.6,8 The number of presentations with abdominal pain in every series reviewed was similar to the 70% of patients in our series—the only exception to this being a publication from India in which only 29% had presented with abdominal pain.7 A Turkish study listed weight loss as the most common presentation finding in 81% of cases—nearly double our experience.3 Furthermore, the series from the UK by Rai et al had a high proportion of weight loss, whereas Muneef et al in Saudi Arabia found a lower proportion more in line with our findings.6,8

Night sweats and fevers were never the most frequent presenting symptom at any
institution. Half of our patients experienced night sweats and/or fevers and this proportion is similar to all other case series reviewed.\textsuperscript{5,6,8}

Overall, the presenting symptoms found in this series are broadly similar to those identified overseas. Likewise, other studies have also found the majority of patients to have an elevated inflammatory marker.\textsuperscript{6,8} No other study found any diagnostic utility in other blood tests, however Rai et al also found over 90\% of their cases had anaemia.\textsuperscript{6} All studies agreed that the blood derangements commonly found could not reliably make a rapid diagnosis of abdominal tuberculosis.

This is also true of imaging—over 90\% of cases in three other series had generic inflammatory changes on CT or ultrasound that could not distinguish between differential diagnoses.\textsuperscript{4,5,8}

Rapid distinction from the major alternate diagnoses of inflammatory bowel disease and malignancy is critical as there is evidence that delaying treatment, even by as little as 30 days, can have a detrimental effect on the patient’s prognosis.\textsuperscript{9} A delay of up to eight weeks for microbiological confirmation from culture before initiating treatment is therefore undesirable. As such a more efficient alternative means of diagnosis is required without losing the specificity of microbiology.

The use of laparoscopy and culture of a surgical specimen is widely accepted as the investigation of choice for abdominal tuberculosis.\textsuperscript{6} The appearance of the bowel in laparoscopy is one potential way to presumptively diagnose tuberculosis. To recognise the appearance it is important to understand the mechanism of spread of this disease. The main methods of gastrointestinal infection of M. tuberculosis are swallowing infected sputum from active lung disease and local invasion from adjacent viscera.\textsuperscript{2} As shown in Table 1, laparoscopy has excellent diagnostic yield. It is suggested that this is because direct observation of the entire peritoneal space is feasible and biopsies of specific nodules can be easily carried out. A review of the literature suggests rates ranging from 92–100\% presumed diagnosis on laparoscopy being confirmed later by microbiology. Our series showed that diagnostic laparoscopy was the most common means of obtaining a definitive diagnosis and was successful in every case.

One case at Christchurch Hospital resulted in a small bowel injury during a diagnostic laparoscopy—this is the only reported adverse outcome from the 10 diagnostic laparoscopies reviewed in this series. In the literature, of 208 total laparoscopies reviewed there were 10 adverse outcomes leading to conversions to laparotomy. Two of these were for bowel perforation during trocar insertions, one for omental haematoma during trocar insertion, three for intra-operative bleeding, two for adhesions and two for ‘technical difficulties’ with laparoscopy.\textsuperscript{4,8} Laparoscopy in these patients is challenging and if used indiscriminately could result in a far greater number of surgical complications, particularly as TB infection in the abdomen will produce highly vascularised adhesions, which are friable and difficult to manipulate restricting mobilisation of the bowel. As such, the presence of adhesions will usually indicate conversion to laparotomy. Surgical expertise is required when continuing this operation via laparotomy as these patients are chronically ill and complications are best avoided.

The Canterbury Inflammatory Bowel Disease (IBD) project has previously shown that that Canterbury has high levels of IBD compared to the rest of the New Zealand.\textsuperscript{11} The typical IBD patient is also approximately the same age as someone likely to be suffering from abdominal TB. The median age of Ulcerative Colitis and Crohn’s was found to be 43.7 and 39.9 respectively.\textsuperscript{11} They both present with similar vague complaints and inflammatory changes on imaging. Our data revealed 13 out of 20 admission notes and radiology reports listing abdominal TB in the differential diagnosis; in comparison, IBD was listed in 17 of the 20 cases. It may be that the large burden of IBD in our region has led healthcare staff into aggressive and early diagnosis of IBD while not fully exploring other potential differential diagnoses. As colonoscopy is a commonly used diagnostic tool in IBD, this reasoning could also explain why our series was the only series to use colonoscopy as a diagnostic method.

Overall, Christchurch Public Hospital has had a low volume case load of abdominal tuberculosis with one case per year on
average. Patients have vague presenting symptoms and generic inflammatory changes on imaging which makes efficient diagnosis of TB difficult. The literature indicates that laparoscopy followed by a positive microbiological result has the best diagnostic utility and we found that diagnostic laparoscopy was the most common means of obtaining a diagnosis of abdominal TB in Christchurch with excellent diagnostic yield similar to other published series.

Due to there being only one discharge diagnosis code applying to this set of patients, it is reasonable to believe we have underestimated the sample size by not including those who were not coded correctly and those simply misdiagnosed. This study is further limited by a small sample size and technological advances over the 20 years of the series which has changed the accuracy of most microbiological and biochemical tests.

Competing interests:
Nil.

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REFERENCES:
Metronidazole stewardship initiative at Christchurch hospitals—achievable with immediate benefits

Sharon J Gardiner, Sarah CL Metcalf, Paul KL Chin, Matthew P Doogue, Simon C Dalton, Stephen T Chambers

ABSTRACT

AIMS: To evaluate an antimicrobial stewardship (AMS) initiative to change hospital prescribing practice for metronidazole.

METHODS: In October 2015, the Canterbury District Health Board (CDHB) AMS committee changed advice for metronidazole to promote two times daily dosing for most indications, prioritisation of the oral route and avoidance of double anaerobic cover. Adoption of the initiative was facilitated via change in prescribing guidelines, education and ongoing pharmacy support. Usage and expenditure on metronidazole for adult inpatients were compared for the five years pre- and two years post-change. Other district health boards (DHBs) were surveyed to determine their dosing recommendation for metronidazole IV.

RESULTS: Mean annual metronidazole IV use, as defined daily doses per 1,000 occupied bed days, decreased by 43% post-initiative. Use of non-IV (oral or rectal) formulations increased by 104%. Total savings associated with the initiative were approximately $33,400 in drug costs plus $78,200 per annum in IV giving sets and post-dose flushes. Twelve of 20 (60%) DHBs (including CDHB) endorse twice daily IV dosing.

CONCLUSIONS: In addition to financial savings, reduction in IV doses has potential benefits, including avoidance of IV catheter-associated complications such as bloodstream infections. Approaches to metronidazole dosing vary across DHBs and could benefit from national coordination.

Metronidazole is a synthetic nitroimidazole developed in the 1950s to treat urogenital infections caused by the parasite, *Trichomonas vaginalis*. Its activity against anaerobic bacteria was later discovered serendipitously in 1962 and now forms the basis for most of its use in hospitalised patients.

Metronidazole has a unique pharmacological profile that includes rapid concentration-dependent bactericidal action against susceptible anaerobic bacteria and low resistance rates within these organisms. It also has an excellent oral bioavailability (>90%), favourable penetration to the site of infection and a long half-life (by antimicrobial standards) of eight hours. However, despite more than 50 years of use and an established role in the treatment of anaerobic infections, there is no consensus on the ideal dosing strategy for metronidazole administered intravenously (IV). Indeed, international guidelines on the treatment of intra-abdominal infections in adults endorse a two-fold variation in daily dose (1,000–2,000mg) administered at four different dose intervals (6-, 8-, 12- or 24-hourly) (Table 1).

An antimicrobial stewardship (AMS) perspective is needed to rationalise these regimens, which are not equivalent in terms of cost or administration complexity, and may differ in both efficacy and adverse effects.

Canterbury District Health Board (CDHB) had a long history of dosing metronidazole IV as 500mg every eight hours, and orally (PO) as 400mg three times daily, for treatment of anaerobic bacterial infections.
In 2015, our AMS committee considered literature recommendations for metronidazole dosing together with contemporary knowledge of pharmacokinetic-pharmacodynamic relationships, risk of bloodstream infections with IV access, administration issues and cost. A multifaceted AMS initiative was developed for adult inpatients at CDHB and comprised:

1. Prioritisation of the oral route, with the IV route only to be used in the presence of compromised gastrointestinal absorption, or a patient designated ‘nil by mouth’,
2. Twice daily dosing for most indications, as PO 600mg twice daily or IV 500mg 12-hourly,
3. Avoidance of unnecessary duplication of anaerobic cover, by not co-administering metronidazole with amoxicillin+clavulanic acid, carbapenems (eg, meropenem), clindamycin, moxifloxacin or piperacillin+tazobactam.

*Clostridium difficile*-associated diarrhoea, *H. pylori* eradication regimens and sexual/reproductive health indications other than pelvic inflammatory disease were excluded from this initiative.

The purpose of this paper is to describe the multipronged AMS initiative undertaken to change prescribing practices at CDHB and the resultant impact on metronidazole usage and expenditure.

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### Methods

After consultation with senior medical officers, and nursing and pharmacy staff from relevant areas such as general surgery, the following initiative was implemented in October 2015:

1. Updating online CDHB antimicrobial guidelines for intra-abdominal infections, sepsis, pelvic inflammatory disease and deep neck space infections to reflect the twice daily dosing strategy and prioritisation of the oral route,
2. Updating the e-prescribing and administration system used at CDHB to include the new dosing guidelines,
3. Verbal education sessions for medical, nursing and pharmacy staff,
4. Written bulletins and a poster disseminated to clinical staff,
5. Pharmacist support of the initiative via ongoing education on the wards,
6. Ward drug stocks were altered to improve access to metronidazole 200mg oral tablets for the 600mg oral dose.

Metronidazole usage and expenditure from 1 October 2010 until 30 September 2017 (five years pre- and two years post-initiative) were assessed with data extracted from the hospital pharmacy dispensing software (ePharmacy, v1.7, DXC Technology, Virginia) into Microsoft Excel (2013).

---

**Table 1:** Recommended metronidazole IV dosing strategies for intra-abdominal infections.

<table>
<thead>
<tr>
<th>Source</th>
<th>1,000mg per 24h</th>
<th>1,500mg per 24h</th>
<th>2,000mg per 24h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500mg q12h</td>
<td>1,000mg q24h</td>
<td>500mg q8h</td>
</tr>
<tr>
<td>Infectious Diseases Society of America⁷</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Surgical Infection Society (USA)⁸</td>
<td>Y*</td>
<td>Y*</td>
<td></td>
</tr>
<tr>
<td>World Society of Emergency Surgery⁹</td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Therapeutic Guidelines of Australia¹⁰</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Zealand Formulary¹¹</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Metronidazole datasheet¹²</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

*with a loading dose of 1,000mg IV.
Systemic metronidazole use was determined from issues to ward imprests and to individual patients for adult inpatients to reflect the population targeted by the initiative. Adult inpatients were those admitted to Christchurch, Christchurch Women’s, Burwood or the Princess Margaret Hospitals after exclusion of psychiatric, paediatric and day stay areas as per established local method.13

All formulations administered to treat systemic infections were included: 500mg/100mL IV infusion bags, 200mg tablets, 400mg tablets, 200mg/5mL suspension and 500mg rectal suppositories. Topical and vaginal formulations were excluded. Use was expressed as defined daily doses (DDD) per quarter and per year normalised to 1,000 bed days. This was calculated for the individual formulations, for IV versus non-IV routes of administration, and for total systemic metronidazole use. Expenditure was determined using the pharmacy purchasing price per unit. This was essentially static (less than 10% variation) over the seven-year study period for the 200mg tablet (NZ$0.10), 400mg tablet (NZ$0.18), 200mg/5mL suspension 100mL (~NZ$25.63) and 500mg suppository (~NZ$2.60). The metronidazole IV 500mg infusion bag changed from a price of $2.46 to $1.39 in February 2015. Costs of administration consumables was taken simplistically as $6.63 per IV dose for the cost of a giving set (Alaris secondary set, CareFusion, Switzerland) and 100mL sodium chloride 0.9% infusion bag (post-dose flush).

Between September and November 2017, the other 19 New Zealand district health boards (DHBs) were surveyed electronically and via telephone to determine the dosing strategy used for metronidazole IV and, where relevant, the date when a twice daily dosing strategy was adopted.

**Results**

This AMS initiative was associated with a 43% decrease in metronidazole IV use (Table 2 and Figure 1), which translates to around 11,800 avoided IV doses annually (data not shown). By contrast, non-IV administration of metronidazole increased by 104%, largely due to a 339% increase in use of the 200mg tablets. Thus, the proportion of metronidazole-administered IV decreased from 80% prior to the initiative to 52% post-initiative.

Mean annual expenditure on metronidazole in adult inpatients decreased by 59% following the initiative, with additional savings in consumables and nursing time. The total saving was approximately $111,600 per year, comprising $33,400 and $78,200 in drug cost and consumables, respectively.

Eleven of the 19 remaining DHBs reported a 12-hourly dosing strategy for metronidazole IV. Hence, 60% (12 of 20) of all DHBs (including CDHB) now recommend twice daily dosing. All of these advise a dose of 500 mg 12-hourly while one DHB recommended 15mg/kg 12-hourly, a two-fold greater dose (ie, 1,000mg 12-hourly for a 70kg person). The earliest adopter reported that twice daily dosing was included in their guidelines since the 1990s. The remaining 11 DHBs (including CDHB) changed to 12-hourly between 2011 and 2017.

**Table 2:** Mean annual metronidazole usage and expenditure for adult inpatients for the five years before and after commencement of the initiative in October 2015.

<table>
<thead>
<tr>
<th></th>
<th>DDDs per 1,000 occupied bed days (mean usage per year)</th>
<th>Expenditure (unadjusted mean cost per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>200mg tablets</td>
<td>3.1</td>
<td>13.6</td>
</tr>
<tr>
<td>400mg tablets</td>
<td>3.9</td>
<td>1.3</td>
</tr>
<tr>
<td>200mg/5mL susp</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>500mg suppository</td>
<td>0.05</td>
<td>0.07</td>
</tr>
<tr>
<td>Total non-IV</td>
<td>7.6</td>
<td>15.5</td>
</tr>
<tr>
<td>500mg IV</td>
<td>29.9</td>
<td>16.9</td>
</tr>
<tr>
<td>Total non-IV + IV</td>
<td>37.5</td>
<td>32.4</td>
</tr>
</tbody>
</table>

*Changes ≤5% are arbitrarily reported as unchanged

Note: susp = suspension, IV = intravenous
Discussion

This AMS initiative to avoid unnecessary metronidazole IV doses in CDHB public hospitals was associated with a 43% decrease in use of the IV formulation and a 104% increase in use of the non-IV route. Despite overall metronidazole use decreasing minimally (14%), the shifts in route of administration resulted in substantial healthcare savings. Drug costs were 59% lower post-initiative resulting in savings of $33,400 per annum. An additional $78,200 was saved in consumables through avoidance of 11,800 IV doses annually. Additional benefits and savings that we have not quantified relate to nursing time, avoided complications of IV access such as bloodstream infections and facilitated discharge from hospital.

While there is a lack of clinical trials comparing outcomes with different dosing strategies, the concept of giving metronidazole twice daily is not new. In 1989, Earl et al\textsuperscript{14} stated that IV 500mg or PO 400mg twice daily had been used at their hospital for “many years” with “apparent success”. They reported that this regimen produced adequate metronidazole serum concentrations in 48 surgical patients, defined as a trough concentration above both 2mg/L and the minimum inhibitory concentration (MIC) of most relevant anaerobes.\textsuperscript{14} Nearly three decades later, Sprandel et al\textsuperscript{15} determined that the probability of attaining a target area under the concentration-time curve (AUC\textsubscript{0-24h})/MIC ratio ≥ 70 was ≥ 99.8% for 1,000mg and 1,500mg daily for organisms with an MIC <2mg/L. However, for an MIC of 4mg/L, this decreased to 28.5% and 80.0%, respectively, showing an advantage for the higher dose. Almost all (213/218) of the B. fragilis isolates studied had MICs <1mg/L, and the remaining five isolates had MICs of 2mg/L.\textsuperscript{15} This is in keeping with New Zealand research.\textsuperscript{5} Collectively, these studies support an IV dose of 1,000mg per 24 hours as achieving satisfactory concentrations in most circumstances. Given the formulation available in New Zealand (a 100mL infusion bag containing 500mg), we elected to give this in two divided doses, in line with the Therapeutic Guidelines of Australia.\textsuperscript{10} In the absence of a 500mg oral dose formulation, we chose an oral dose of 600mg to achieve similar concentrations to the IV dose and for clinicians to replace IV with oral metronidazole with confidence in similar outcomes.

The data used in this analysis has limitations as it was derived from pharmacy dispensing software. It reflects ‘mass’ shifts in stock from pharmacy to clinical areas rather than dispensings, prescriptions or administrations to patients. While the assumption is that this stock movement reflects usage in patients it is undoubtedly less accurate than information obtained from electronic prescribing and administration software. This has only been used for a short time at Canterbury DHB and cannot,
therefore, be used to assess changes in usage over a long period of time. However, e-prescribing data for the six months to September 2017, shows that 81% of metronidazole IV is prescribed as 12-hourly on our general surgical wards (data not shown).

The slow change observed in New Zealand DHBs and variability in guidelines suggests that AMS in New Zealand would benefit from national guidance and a coordinated approach. All of our DHBs are under-resourced for AMS, and only half employ dedicated staff to manage AMS in New Zealand public hospitals. While we believe that AMS programmes should be driven with a quality rather than financial focus, it is clear that this initiative provides a compelling economic case for employing staff dedicated to AMS.

Competing interests:
Nil.

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Poisoning due to tutin in honey—a report of an outbreak in New Zealand

Michael Beasley, Dell Hood, Philippa Anderson, John Reeve, Robin J Slaughter

ABSTRACT

AIM: In autumn 2008, an outbreak of toxic honey poisoning was identified. The outbreak was not recognised initially until three cases from one family group presented to hospital, with a common factor of recent consumption of locally produced honey. The aim of this study was to investigate potential cases of this honey poisoning and determine which toxin was involved.

METHOD: The incident was investigated retrospectively by Waikato District Health Board’s Population Health unit and the New Zealand Food Safety Authority (NZFSA). Identified patients were followed up by questionnaire to gather case information. HortResearch (now Plant and Food Research) tested honey samples for toxins.

RESULTS: The causative agent was identified as tutin, which comes from the New Zealand native plant tutu (Coriaria arborea) which has long been known as a potential source of contamination of honey produced in the warmer parts of New Zealand. Retrospective case investigation identified a total of 22 possible or probable cases, based on a clinical case definition. The spectrum of toxic effects reported were broadly similar to those previously described for tutin, derived either directly from the plant itself or indirectly from honey. There were 13 samples of honey, linked to symptomatic individuals, which were available for testing. Of these, 10 were positive for tutin and its hydroxy metabolite hyenanchin (hydroxytutin) and one was positive for hyenanchin alone.

CONCLUSION: Toxic honey production is a significant risk in parts of New Zealand. Beekeepers and health professionals need to be informed of this risk and know how best to manage it. Due to this poisoning incident, public and professional awareness of honey poisoning has been substantially enhanced. This incident led to development of new food safety standards for New Zealand honey.

Toxic honey is a well-defined phenomenon that has been described since the time of the ancient Greeks.1 Poisoning from toxic honey occurs when phytotoxins from plant species are present in honey, usually via direct transfer in nectar or pollen. Because none of New Zealand’s native bees produce honey, the eating of locally produced honey did not begin until after the introduction of the honeybee Apis mellifera by missionaries in Northland in 1839. However, it was not until some decades later, in the late 1880s, that vomiting, headache and delirium was reported after eating locally produced honey from both managed hives and wild honey bees.2 Outbreaks of toxic honey have continued to occur sporadically in New Zealand over the last 130 years.

In a detailed review of honey poisoning in New Zealand published in 1965, Palmer-Jones records both the history of clinical recognition of the syndrome and the sequence of events which finally solved the mystery of how tutin, the toxin known to be present in the native plant Tutu (Coriaria arborea), was transferred to honey where it could then produce human toxicity.5 Tutu is a native shrub or small tree which is common throughout New Zealand. It has distinctive flowers, berries and foliage (Figures 1 and 2). It is an early coloniser of cleared land, with seeds spread by birds. All parts of the plant are toxic, other than the fleshy petals around the seeds. These were used as a sweet flavouring and medicine by Māori, who knew that eating the entire
berry resulted in poisoning and sometimes death. Serious and sometimes fatal human poisoning from eating the berries was formally documented by European settlers.\(^3\)

The first attempt to isolate the toxin in tutu was around 1870,\(^3\) and experimental studies were underway by ~1890,\(^4\) and continued through the early 1900s to better characterise its toxicity.\(^5\)–\(^7\) Tutin is also found in Coriaria species in South America, and the related toxin coriamyrtin in species in the western Mediterranean,\(^8\) mainly in France, Spain and Morocco. However, there appears to be little evidence to suggest that these species have been responsible for honey poisoning, which is more explicitly reported in association with New Zealand.\(^8\)–\(^10\)

The symptom spectrum of toxic honey poisoning was noted to be similar to tutu poisoning,\(^2\) so this plant became a major suspected source. However, tutu flowers do not contain nectar and the toxin tutin is not present in pollen, which bees take for its protein. Therefore a mechanism of transfer was unclear. The toxin was known to be present in the sap, leaves and seeds.\(^2\)–\(^3\)

The transfer of tutin to honey was noted to occur only where an insect, Scolypopa australis, the passion vine hopper or ‘lace wing’ was also present. This pest insect, which was accidentally introduced from Australia around 1870, sucks sap from young green shoots. When it is feeding on tutu plants, the sticky intestinal secretions (‘honeydew’) which it excretes contain tutin.\(^2\) This insect is found only in warm regions, and this explains why honey poisoning has only been described in the warmer parts of New Zealand (particularly the northern half of the North Island and Marlborough), even though tutu grows throughout the country.

**Figure 1:** Tutu berry. © Used with permission. Photo Credit: Trevor James.

**Figure 2:** Tutu mature foliage. © Used with permission. Photo Credit: Trevor James.
At the time of the incident, it was believed that bees took honeydew only when their normal foods were in short supply, but subsequent investigation has revealed that bees take some honeydew at any time. In the areas in New Zealand from where toxic honey poisoning has been reported, flowers of native vegetation usually provide sufficient nectar and pollen, but it is likely that bees consume more of this toxic honeydew in drought conditions.

The major risk to human health is the consumption of honey directly from the comb, which avoids the usual dilution when honey is separated from the comb and large volumes from different sources are mixed.

As well as tutin, the less toxic hyenanchin (also known as hydroxytutin or mellitoxin) is typically also present in toxic honey. Tutin and hyenanchin are similar compounds; their chemical structures are presented in Figure 3. Hyenanchin is produced by the vine hopper’s metabolism of tutin.

**Method: outbreak investigation**

On 21 March 2008, a small rural hospital in Waikato, New Zealand reported that three people from a six-person family group had presented to their emergency department on two separate occasions with acute onset of vomiting and headache after eating locally produced comb honey. Two of the three had grand mal seizures. The association of the illness with the ingestion of comb honey was recognised because the illness affected only those who ate the honey, and because the third case presented some hours later, having no other food intake in common and having eaten the implicated honey for the first time at a later meal. The outbreak was notified to the public health service within hours of the presentation of the third family member.

The beekeeper who produced the honey was contacted for information about the

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**Figure 3:** Chemical structures of tutin (a), hyenanchin (b), picrotoxinin (c) and picrotin (d).
source of his product, and the amount which had been distributed for sale. It then emerged that the beekeeper had himself experienced a very similar illness with gastrointestinal symptoms and seizures about five weeks earlier. Symptom onset was around three hours after he had eaten around 20ml of the same comb honey which he had harvested the previous day. He had eaten “a taste” of the honey at the time of harvest without incident. Although he had received care from the same hospital, the association with ingestion of comb honey had not been recognised by patient or clinicians.

The working diagnosis was that the honey was contaminated with tutin, a phytotoxin present in the native shrub tutu. Urgent retrieval of the implicated honey was initiated from the three outlets where it had been sold. Because the notification occurred at the beginning of the Easter holiday, media assistance was sought to advise the public not to eat any comb honey, and to return any uneaten product from the implicated producer. Publicity was used to identify further cases.

The New Zealand Food Safety Authority (NZFSA), at that time the statutory body responsible for food safety, managed food safety issues arising from this incident while Waikato District Health Board’s Population Health managed the outbreak investigation and control measures, in an inter-agency collaborative emergency response. NZFSA has subsequently implemented longer-term measures to ensure the safety of commercially produced honey in New Zealand. NZFSA has since merged into the Ministry for Primary Industries.

Media coverage of this poisoning incident allowed retrospective identification of 22 people who had consumed the implicated honey. As no other method of case finding was possible, additional cases may have occurred outside New Zealand, as retailers recalled selling some of the contaminated honey to international visitors returning home.

The questionnaire used to gather case information was hastily devised and was based on the few relevant published papers which could be obtained in a short time. (See Appendix) It was administered around the country by various public health staff, many without clinical training. The interpretation of some questions may have been variable.

Based on the information collected the final case definitions used were:

- **Possible case** = vomiting OR any neurological symptom within 24 hours of eating comb honey.
- **Probable case** = vomiting AND any neurological symptom within 24 hours of eating comb honey.
- **Confirmed case** = Possible or probable case where tutin or hyenanchin was detected in honey consumed by the case.

The flow chart used to categorise cases is depicted below (Figure 4).

The questionnaire included questions about the source and quantity of honey consumed. Unsold honey packages and any remaining honey were collected from cases’ homes. Analysis for tutin and hyenanchin (hydroxytutin) was carried out later at HortResearch, then a government-owned laboratory in Hamilton (HortResearch has since been incorporated into a new agency, Plant and Food Research). The method of analysis for tutin and hyenanchin was liquid chromatography–mass spectrometry (LC-MS/MS) after aqueous extraction and partitioning into solvent.

Fifty-three of the 300-gram individual comb packages of honey were sold, under two different product names identifying the two hive sites from where the honey had been harvested. Subsequent toxin analysis revealed that the honey from only one of these locations contained tutin. All but seven of the sold packages were traced, although not all could be recovered.
Results of outbreak investigation

Of the 22 “probable” or “possible” cases initially defined on clinical grounds, 11 fitted the definition of a confirmed case after the relevant honey samples had been tested (Table 1). Initially, 18 cases were defined as probable cases and there were 10 samples of honey from this group available for testing. Of these samples, nine were subsequently confirmed as testing positive for tutin and hyenanchin. Four cases were initially classed as possible cases and three of these had honey samples available for testing.

Two of these sample tested were confirmed as containing toxins. Overall, this gave 11 confirmed cases, nine probable cases and two possible cases (Figure 4).

The signs and symptoms which developed in the probable and confirmed cases are presented in Figure 5. The onset of the clinical effects ranged from 0.5 to 17h with a median of 7.5h. Nausea and vomiting were commonly observed and there were eight cases of seizures. The amount consumed ranged from a “smear” to up to 200g of honey. The majority of these patients were male (70%) with an age range of between 3 and 76 years (Table 1).
Table 1: The key features of confirmed and probable cases.

<table>
<thead>
<tr>
<th></th>
<th>Confirmed cases</th>
<th>Probable cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Age</td>
<td>3–74</td>
<td>12–76</td>
</tr>
<tr>
<td>Percent male</td>
<td>64%</td>
<td>77%</td>
</tr>
<tr>
<td>Ingestion—symptom onset interval</td>
<td>Median 7.2 hours</td>
<td>Median 8 hours</td>
</tr>
<tr>
<td></td>
<td>Range 0.5–17 hours</td>
<td>Range 0.5–17 hours</td>
</tr>
<tr>
<td>Honey consumed</td>
<td>“smear” – ~70 grams</td>
<td>“smear” - ~200 grams</td>
</tr>
<tr>
<td>Hospitalised/hospital visit</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Saw GP only</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>No medical attention</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Seizures</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 5: Signs and symptoms that developed in probable and confirmed cases.

Discussion

Both tutin and hyenanchin are structurally similar to picrotoxinin (see Figure 3), the active principle of picrotoxin, found in plants of the Order *Menispermacea*.[10,12] These compounds block the inhibitory actions of the neurotransmitter GABA (γ-aminobutyric acid) that are mediated via GABA<sub>A</sub> receptors at various sites in the body.[13] This antagonising of inhibitory processes results in central nervous system stimulatory effects which characteristically include seizures, but can also involve increased activity of the vasomotor, respiratory and autonomic centres in the medulla and/or cortex.[13] Early researchers had concluded that tutin increased the excitability of the “medullary centres”.[5-7]
Central nervous system stimulation was a prominent feature among this series of cases with 40% (8/20) of probable and confirmed cases suffering from one or more seizures. The effects observed correlate well with the observed symptoms of human tutin poisoning; after a characteristic delay of three to six hours, nausea and vomiting develop, often followed by tremor and/or grand mal seizures, which may be severe and recurrent. Nausea and vomiting can persist for many hours. Other effects can include tachycardia, tachypnoea, difficulty breathing, delirium, blurred vision, anxiety, agitation, excitement, weakness, dizziness, amnesia, stupor and coma. Death is usually due to respiratory arrest.3,14–16 There were no prolonged periods of unconsciousness or deaths associated with this cluster.

Drug- or toxin-induced seizures are typically of relatively short duration, usually manageable with standard treatments, including benzodiazepines as first line agents (which as GABA receptor agonists, would seem particularly appropriate for tutin and hyenanchin).13,14 With most toxins, one would not generally expect any major long-term neurological sequelae in the great majority of patients. However, seizures are a “hallmark” effect of picrotoxin-like compounds and might be more protracted in this context than with many other toxic causes. The two cases that had more than one seizure in this series were managed conservatively with initial restrictions on their driving. There are accounts of incomplete neurological recovery following tutu poisoning.3,5,6 The observation of amnesia in this series of cases is not new. It has been previously noted that tutu poisoning may result in loss of memory and “incapacity for work”.2,3 Tachycardia was also commonly reported in this series of cases, and likely arose in part from increased central sympathetic outflow. Experimental studies of the related picrotoxin found it could produce an initial short-lived phase of decreased heart rate and blood pressure, attributed to activation of central parasympathetic centres, followed by a second phase of sinus tachycardia and/or increased blood pressure, attributed to central sympathetic activation.17,18 At very high doses, early bradyarrhythmias and later ventricular tachyarrhythmias were noted, the latter thought due to coronary artery spasm.19 Indeed, some experimental similarities had been earlier noted with tutin itself with Fitchett and Malcolm commenting on tachycardia, arteriolar constriction and increases (or decreases) in blood pressure.5–7

The respiratory symptoms in the current cases were not classified in detail; however, increased respiratory rate and effort is well described with picrotoxin, where it is linked to stimulation of the respiratory centre.20 The same effect is described with tutu (and coriamyrtin) poisoning, followed however in severe cases by respiratory depression including apnoea, also noted experimentally.5,6

There are considerable similarities to the effects noted from poisonings from closely related plants in Chile and the Western Mediterranean, containing tutin and coriamyrtin respectively,8,21 but the constellation of factors leading to honey poisoning from tutu in New Zealand does not appear to occur with similar species elsewhere.

At the time of this outbreak, the kinetics of tutin (and hyenanchin) in humans were largely unknown. Even the experimental kinetic data was limited,3,5,6 though it (and that regarding picrotoxin)22 suggested these compounds have a relatively short half-life, probably a few hours at most. The data from this outbreak also suggest the duration of most adverse effects is relatively short, being a matter of a few days only, but it appears some effects can last for longer. A pharmacokinetic study performed following this outbreak in six healthy males given tutin-contaminated honey (tutin dose 1.8ug/kg) showed two peak plasma concentrations; the first at 0.9 hours and a higher peak at 15 hours. This double-peak effect may help explain the range of onset times for clinical effects (0.5 to 17 hours) found in this case series. Limited adverse effects were noted in this low-dose pharmacokinetic study with only mild transient headache developing in one subject and mild light-headedness developing in another. The half-life of tutin was determined to be 5.4 hours.11 Immediately after this episode, the then New Zealand Food Safety Authority (NZFSA) began reviewing policy and procedures related to beekeeping in New Zealand to refine existing safety measures in relation to tutu-related risks. Detailed discussion
of these is beyond the scope of this report. The policy and food standards related to managing the risk of tutin in honey are available online at http://www.foodsafety.govt.nz/industry/sectors/honey-bee/tutin/index.htm. To support the review, NZFSA commissioned the purification of tutin and then several toxicity studies. These experimental studies identified the doses of tutin that cause no observable adverse effects, and that hyenanchnin was essentially not toxic at amounts where tutin would cause death. Experimentally, the median oral lethal dose (LD$_{50}$) of tutin in mice is 4.7mg/kg body-weight.$^{23}$ The acute toxicity study of tutin demonstrated a "no observed adverse effect level" (NOAEL) of tutin in test animals of 0.25mg tutin/kg body weight$^{23}$ from which NZFSA derived an interim upper acceptable concentration of tutin in honey$^{24}$ (as mentioned NZFSA is now within the Ministry for Primary Industries). Subsequent to this interim standard, the human pharmacokinetic study$^{11}$ enabled a more robust maximum residue limit to be established and the maximum concentration of tutin in honey set in the Joint Australia New Zealand Food Standards Code is now 0.7mg/kg.

A 2016 New Zealand standard has been produced to ensure honey producers comply with the Food Standards Code. This 2016 standard requires that all honey be shown to comply with the Food Standards Code when packed, and there are five options to do this. Either the honey has to be tested and demonstrated to comply, or shown to be of low risk of non-compliance. The four options for showing that the honey is low risk are either the honey was proven to have been harvested outside of the time period when scolytopopa are present, or it has been shown that the honey was from hives stationed where there is no tutu present within bee foraging range, or from hives stationed south of 42 degrees south latitude, or after three years of targeted monitoring, the concentration of tutin in the extracted honey is always not more than 0.035mg/kg, or targeted honey has tutin concentrations not more than 0.01mg/kg if the honey is from comb honey for sale.$^{24}$

Limitations

This investigation was based on retrospective information, obtained in most cases by telephone interview, and sometimes undertaken by non-clinical staff. It is likely that the interpretation of the information provided by the cases varied. Where possible this was validated with clinical information, but only 13 of 22 cases had sought medical advice, and the treating clinicians had recognised the likely cause of the illness only in the last case to present. Additionally, the publicity given to this outbreak would have augmented existing recall bias. However, the symptoms reported by the confirmed and probable cases are generally consistent with other New Zealand cases reports of toxic honey ingestion, and from "direct" poisoning from ingestion of the tutu plant itself.$^{2,14,15}$

Dry summers in the area of distribution of the passion vine hopper in northern New Zealand are not uncommon, and given incontrovertible evidence that the risk management strategies for honey production in place until the summer of 2007–2008 were inadequate, it is highly likely that there have been other outbreaks of tutin poisoning. Dispersed outbreaks arising from a widely distributed common source are difficult to identify and may go unnoticed. Tutin poisoning may explain other cases of isolated seizures in adults without identified neurological abnormality.

Conclusions

Toxic honey production is a significant risk in parts of New Zealand if honey safety is not managed effectively. Poisoning can result from the ingestion of processed as well as comb honey. With amateur and professional beekeeping now burgeoning, the risk of consumption of toxic freshly harvested comb honey may increase. It is critical that beekeepers are informed of this risk and know how best to manage it.

It is also important that clinicians consider the diagnosis of toxic honey ingestion in patients who present with nausea, vomiting and symptoms of central...
nervous system agitation. Extrinsic toxins had understandably not been considered in the differential diagnosis of any case seen by a medical practitioner prior to the presentation of the family cluster, although in retrospect, the association of CNS stimulation with nausea and vomiting is characteristic. Foodborne toxin ingestion needs to be considered as a possibility, particularly where prior risk of seizures was remote. This, however, may be difficult as tutin poisoning had had little or no publicity for many decades. As well as a generational loss of knowledge about tutin toxicity in New Zealand honey (given that the last previously documented outbreak occurred in 1974), many healthcare workers in this country are overseas trained, and thus less likely to be familiar with the toxicity of New Zealand native plants.

One of the undoubted outcomes from this episode is that public and professional awareness of this form of honey poisoning has been substantially enhanced.

Appendix

Questionnaire used in investigation

HOUSEHOLD HEADER INFORMATION

TOXIC HONEY POISONING OUTBREAK

NOTIFIER IDENTIFICATION

Name of reporting source ___________________________________________________________
Contact ph: _______________________________
Date: ____/____/____

CASE IDENTIFICATION

Name of Case: _______________________________________________________________________
Address of Case: _____________________________________________________________________
Phone numbers: home _________________ Work: ___________________ Other: ____________
NHI Number: ____________________________________________

CASE DEMOGRAPHY

Date of Birth: _________/_________/_______
OR
Age: _________ (days/months/years)
Sex: M/F
Approx Weight* _______________________
Ethnicity: NZ Māori / NZ European-Pakeha / Pacific Island / Other European/ Other: 
____________________
Occupation: __________________________________________________________
Place of work/school/pre-school: _______________________________________________

*Either weight in kg or use descriptor – large adult etc

HONEY PRODUCT DETAILS

Form of Honey: Comb / Liquid / Creamed
PACK DETAILS:
Trade or Brand Name: _________________________________________________________________
Product size or weight: ________________________________________________________________
Any Date Mark or Batch Number: _______________________________________________________

PURCHASE DETAILS
Where purchased: ____________________________________________________________________
Date purchased: _________________________________
Where/How the honey been stored since purchase: ________________________________________

Is there any additional product: Y/N (ADVISE CUSTOMER TO SEAL THE LEFT-OVER PRODUCT AND HOLD. WE WILL ARRANGE COLLECTION)
What address this currently at: _________________________________________________________

RELATED CASES/CONTACTS
Anyone else been unwell following honey consumption: Y/N
Anyone consumed the honey and not been sick: Y/N
Aware of anyone else may have received this honey (whether or not consumed): Y/N
N.B. Interviewer - If Y please complete the contact list

CONSUMPTION DETAILS
Date and time honey eaten: _____________________________________________________________

Amount eaten: ___________________________________________________________________

SYMPTOMS
Date and time became ill: ______________________________________________________________
Visit Doctor: Y/N Name and address: ____________________________________________________
Hospital Y/N
<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>ONSET DATE/TIME</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle spasms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle weakness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blurred vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red eyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid heart beat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delirium</td>
<td></td>
<td></td>
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<tr>
<td>Giddiness</td>
<td></td>
<td></td>
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<tr>
<td>Increased Excitability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stupor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convulsions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amnesia (memory loss)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Case is happy for information to go to NZFSA  Y/N
ANY ADDITIONAL COMMENTS/INFORMATION:

NAME OF INTERVIEWER: ____________________________________________________________
DATE AND TIME OF INTERVIEW: _________________________
REFERENCES:


The Otago Medical School Anatomy Museum Collection: Taonga for learning in the 21st Century

Louisa JM Baillie, Christopher L Smith

Alumni of The Otago Medical School, and many others, will remember their time in the W.D. Trotter Anatomy Museum. Its rich and diverse collection of now over 3,000 catalogued anatomy specimens and models for learning and research has been amassed by staff over nearly 140 years. Included are wax models by the Ziegler and Tramond studios, 77 authentic painted plaster models by the Leipzig firm of Steger,1 clastique papier mâché models by Louis Auzoux's factory, as well as many in-house wet and plastinated specimens and models including fiberglass, wax and hand-carved wooden examples.2 There are even replicas of classical statues by D Bruciani and Co. of London. The display is enhanced by being housed in an elegant, tall space with a mezzanine floor that borders three sides, and warm aesthetics with wooden framed glass cabinets, rimu stair railings and diffuse natural lighting. Yet this collection is vulnerable to attrition, because of space stress at an institution that has a squeeze on every square metre, and surety of ongoing funding required to maintain it. This vulnerability has been further heightened by the trend at some schools to replace, rather than augment, this type of learning with digital resources. In Britain alone, over the past 30 years, many medical schools have modernised their collections in favour of digital learning methods, and in the process have discarded the old 3D models.3 Therefore, retention of all resources in this Anatomy Museum for active use in teaching has been against the international trend.

However, the retention of all models including those from the 19th and 20th century is now placing the Museum in an enviable position. Not only are many now appreciated for their artistic merit and irreplaceable value, they are being refocused on as powerful anatomy learning aids that complement and deepen learning experiences from other pedagogy, including digital methods.4–9 Indeed, Drake and Pawlina recently recommended to “remove those anatomical models from the glass cabinets. Take the plastic figures down from shelves, dust them off and teach the students to learn them well.”4 Reasons why learning from 3D objects is so effective are corroborated by recent research on sensory input from touch and kinesthetics.10–12

Dr Louis Auzoux’s large (scale 10:1) clastique papier mâché ear model is an iconic and endearing item of this museum’s collection. A feature of Auzoux’s human anatomy models is that they were designed to be pulled apart, imitating dissection of the organs and structures presented. The very nature of their design therefore means heavy use and handling over an extended period of time. This particular ear model was introduced to the W.D. Trotter museum in the 1880s, and has been continuously used for hands-on teaching ever since (Figure 1).
This ear model continues to be in high demand as its clastic design means pieces can be removed to see deeper structures, the anatomical structures themselves are very detailed, and all can be clearly viewed because of its large scale. Professor George Dias (Head and Neck Lecturer, Otago Medical School) particularly appreciates it when teaching postgraduate surgical and ophthalmology students. He says he always feels guilty handling such a delicate museum piece, but no other images or diagrams from textbooks or digital media quite show the structures he likes to focus on with such clarity and intricate detail. In fact, he says this particular model is the only one he has come across which so clearly demonstrates the branches and pathways of the facial nerves. “As a student I struggled to follow and understand the pathways of the intracranial nerves. It wasn’t until I arrived in the Department in 1995 and laid eyes and hands on this model that I truly understood the pathway of the 7th nerve. It is so beautifully demonstrated on this model” (Figure 2).

The following teaching explanation is by Professor George Dias:

1. 7th nerve, with Nervous Intermedius adjacent, enters the external auditory meatus
2. 7th nerve courses through the facial canal in the petrous region of the facial bone. It is running above the vestible of the inner ear
3. 7th nerve exits the stylomastoid foramen as a pure motor nerve, having shed all the Nervous Intermedius fibres.

**Figure 1:** Professor George Dias showing pathway of 7th cervical nerve to a student.

**Figure 2:** Detail of pathway of 7th cervical nerve.

Dotted lines indicate borders between parts of the clastic model.
In 2015, conscious of the value of this model, Chris Smith (curator, Anatomy Museum) investigated ways of reproducing it to allow the retirement of the original, using the replica in its place for teaching. Reproducing this also afforded an opportunity to trial the potential of scanning and 3D printing for other Museum items (the Auzoux collection alone comprises of 15 pieces, from a 90-year purchase period from the 1880s to 1970s). CT scanning was chosen as the most appropriate approach given the complex 3D nature of the model, including many concave surfaces (undercuts). All eight parts of the clastic ear were CT scanned using a Siemens SOMATOM Emotion CT scanner. The DICOM digital images obtained were then converted to .stl files and printed in 1:1 ratio using ABS plastic. The 3D print included internal hollow regions in the large parts, an advantage as their weight to hold was lightened to be approximately the same as the originals. However, what wasn’t anticipated was significant surface shape distortion, due to ‘noise’, or interference, because metal wire within the internal structures interfered with radiation from the CT scanner (Figure 3). This was an unexpected outcome as it had been hoped that the firm outsourced to print the scan files would edit and ‘clean up’ the files before printing.

One of the structures, the cochlea presented as two parts, was so poorly reproduced that it could not be salvaged by hand sculpting (Figure 4).

Figure 3: Arrows indicate interference artefact from wire substructure of vessels in printed reproduction.

Figure 4: Cochlea print (left) next to original cochlea (right).
Dr Louisa Baillie, working as an anatomical scientific artist, salvaged and modified the remaining six structures to become as anatomically similar to the original pieces as possible. This was achieved in the Anatomy Museum workshop, using dentistry grinding burrs, razor blades and sandpaper to subtract (carve back) and epoxy filler and Kneadite “green stuff” to add on. Finally, Dr Baillie hand-sanded pieces to 400 grit smoothness, sprayed them with plastic adhesion promoter, and then intricately painted them using high gloss enamels colour matched to the original model (Figure 5).

She reproduced a timpanic membrane, similar in translucency to the original, using tissue paper, shellac, teased red cotton and a clear plastic spray (Figure 6).

Figure 5: Original (left) and copy (right) of Auzoux ear.

Figure 6: Timpanic membrane, a translucent ochre colour, viewed from the middle ear.
Additionally, quirky details that showed creative problem solving by Dr Auzoux were also reproduced. These include pipe cleaner to describe the cilia hairs in the semi-circular canals (Figure 7), 0.22 rifle shells as shafts to receive long pins from the external ear part, and the long pins themselves are presented in the same material as the original—No. 8 wire.

While a lengthy and costly process, we hope that this project will provide us with the expertise, knowledge and network of people to recreate further anatomical taonga in this collection, thus allowing their continued use in teaching. It may be that resources from our enormously popular museum, so carefully collected and cared for by past and present staff, can be reproduced and disseminated beyond in-house use, including back to some of the countries from where they originated, to aid the teaching of new generations of learners.

Competing interests: Nil.

Acknowledgements: Grateful thanks to Steve Swindells, technical manager of the Dental Laboratory, Otago University Dental School. He showed generous enthusiasm for this project and kindly loaned grinding burrs and a base machine so that carving of the ear parts could be achieved.

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REFERENCES:


Hypercalcemia is often due to unpredictable illness. When hyperparathyroidism and malignancy are ruled out, rare causes of hypercalcemia need to be investigated. Hypercalcemia due to silicone injections has rarely been reported; however, there is concern that there will be more cases in the future as the popularity of cosmetic silicone is growing.

Case report
A 35-year-old Caucasian male bodybuilder was referred to the clinic with left flank pain and dysuria. Symptoms started three months ago with recurrent attacks of left flank pain that is non-radiating, exacerbated by movement and associated with dysuria and intermittency. The patient's history is positive for peptic ulcer disease, and he has had multiple injections of vitamins, testosterone and growth hormones for increasing body mass during the past 17 years. Injections were accompanied with supplements and diuretics. Ten years before presentation, the patient had a session of multiple injections of silicone in the shoulder, arms and forearms, which was complicated later on and necessitated a sub-mucosal excision of a silicone mass from his right forearm. The patient had no allergies and had no family history of disease.

On inspection, the large size of the upper limbs can be noted. The physical examination was positive for mild left flank tenderness, gynecomastia and bilateral mild testicular atrophy. The patient was admitted for a suspected urinary tract infection. His initial laboratory findings showed numerous WBCs on urine analysis, creatinine of 2.3mg/dl (normal range 0.7–1.36), calcium of 13.1mg/dl (normal range 8.6–10.3), and uric acid of 13.3mg/dl (normal range 3.6–7.7). The patient was primarily diagnosed with a UTI associated with acute renal failure, hypercalcemia and hyperuricemia. Urine culture was taken, and the patient was started on antibiotics with ceftriaxone 2g by intravenous-drip daily. He was also hydrated with 1L normal saline every eight hours, and started on allopurinol 300mg orally daily.

Pan CT scan revealed bilateral nephrocalcinosis and the presence of mesenteric and retroperitoneal ganglions; no other significant findings were noted. Despite initial management, calcium levels in serum remained high. The patient underwent two sessions of hemodialysis to restore calcium back to normal. Further laboratory workup ruled out hyperparathyroidism, vitamin D intoxication, hyperthyroidism, malignancy, sarcoidosis and multiple myeloma (Table 1).
A biopsy from the right triceps tendon showed active granulomas with giant cells, fibrous backgrounds and histiocytes (Figure 1). Magnification showed persistent silicone particles in the tissue (Figure 2). The diagnosis of silicone-induced granulomatous hypercalcemia was made. The patient was started on oral corticosteroids, 40mg daily for three weeks, and was tapered by 5mg weekly afterwards. Calcium and creatinine levels gradually returned to normal, and symptoms resolved. A repeat blood test, one-month post treatment showed a calcium level of 9.1mg/dl.

Discussion
Silicone injections have been used widely over the past 40 years for soft tissue enhancement. The most common of the silicone polymers, the biologically inert medical fluid 360, has been implicated in a variety of adverse reactions, including granulomas, disfiguring nodules, and lymphedema, with latent periods ranging from three weeks to 20 years.1

The pathogenesis of granuloma formation in similar cases is still not well established. T-cell activation triggered by infection,

### Table 1: Important lab findings.

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Unit</th>
<th>Normal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parathyroid hormone (PTH)</td>
<td>3.95</td>
<td>pg/ml</td>
<td>15–65</td>
</tr>
<tr>
<td>Parathyroid hormone related-protein (PTH-rP)</td>
<td>&lt;0.8</td>
<td>pmol/L</td>
<td>&lt;1.3</td>
</tr>
<tr>
<td>Thyroid-stimulating hormone (TSH)</td>
<td>2.30</td>
<td>µU/ml</td>
<td>0.27–4.2</td>
</tr>
<tr>
<td>Testosterone</td>
<td>2.40</td>
<td>ng/ml</td>
<td>2.8–8</td>
</tr>
<tr>
<td>Vitamin D2+D3</td>
<td>19.29</td>
<td>ng/ml</td>
<td>30–70</td>
</tr>
<tr>
<td>Calcium (urine)</td>
<td>462</td>
<td>mg/24hr</td>
<td>100–320</td>
</tr>
<tr>
<td>Ionized calcium</td>
<td>1.31</td>
<td>mMol/l</td>
<td>0.95–1.3</td>
</tr>
<tr>
<td>Angiotensin-converting enzyme (ACE)</td>
<td>60</td>
<td>ACE Units</td>
<td>20–70</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (ESR)</td>
<td>30</td>
<td>mm/hr</td>
<td>0–15</td>
</tr>
</tbody>
</table>

Figure 1: A biopsy from the right triceps tendon showed fibrosed and sclerosed granulomas (1), active granulomas with giant cells (2) and fibrous backgrounds with histiocytes (3).
trauma, adulterants added to the silicone, or denatured host proteins has been proposed. Once activated, T-cells release cytokines, which promote granuloma formation. Although granulomas represent an adverse effect of silicone injections independent of the purity of silicone used, they have rarely been considered as a cause of hypercalcemia. This patient necessitated two sessions of dialysis to reverse his persistent hypercalcemia. It is vital to note that bisphosphonates need 48 hours to reach optimal effect. Therefore, dialysis can be lifesaving.

**Conclusion**

Silicone-induced hypercalcemia should be on high alert because of the increasing trend of body contour enhancements with injections, implants and fillers. Dialysis can be lifesaving in resistant cases of silicone-induced hypercalcemia. It is advised that silicone injections be performed by trained physicians using medical-grade silicone.

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**Competing interests:**
Nil.

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A 50-year-old man was referred to dental hospital from the general surgery department in January 2012, with a 10-month history of draining lesion on left cheek (Figure 1). He had seen many different doctors, including physicians, dermatologists, general surgeons and plastic surgeons before reporting to our hospital. He had been given antibacterial, antifungal and topical corticosteroid treatment. He had also undergone surgical intervention twice. He also reported history of pain with molar tooth on the same side few years back. Physical examination was normal apart from skin lesion.

A Cone Beam Computed Tomography (CBCT) after injecting a radio-opaque contrast in the lesion was performed (Figure 2). CBCT showed that contrast travelled from cutaneous surface to roots of molar tooth in maxilla. The condition was diagnosed as chronic suppurative odontogenic infection with facial cutaneous sinus tract.

We treated our patient with root canal treatment (removal of infected pulp of tooth). At a six-year follow-up in January 2018, the patient is doing well, with no cutaneous drainage. The lesion has healed with a minor scar formation (Figure 3).

Figure 1: Cutaneous lesion on the face.
Discussion

Cases of facial lesions of dental origin have been commonly reported in medical, dental and dermatology literature. They are frequently misdiagnosed due to wide differential diagnosis. Differential diagnosis includes actinomycosis, pustule, osteomyelitis, neoplasms, carbuncle, infected epidermoid cyst, pyogenic granuloma, chronic tuberculosis, salivary gland fistula and gumma of tertiary syphilis. The correct diagnosis of such lesions should be suspected by gross appearance of lesion. They present as erythematous, smooth and non-tender lesions of 1mm to 20mm in diameter, with crusty and periodic drainage in most cases. Patient may present with history of dental pain or trauma few years back. Of all such cases, approximately 80% are mandibular and 20% are maxillary in origin. A simple dental procedure like root canal therapy or extraction of involved tooth may lead to successful outcome.
Competing interests:
Nil.

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REFERENCES:
If only Teina Pora had a MedicAlert bracelet

Anita Gibbs

Teina Pora was an 18-year-old Māori male who was convicted in 1994 of the rape and murder of Susan Burdett in 1992. Pora did not commit these crimes but he spent 21 years in prison before his case was heard by the UK Privy Council in London and his convictions were quashed. Crucial to his release and acquittal was the discovery that Pora had Fetal Alcohol Spectrum Disorder (FASD), a neuro-disability arising from prenatal alcohol exposure with lifelong impacts, most noticeably impairments of executive functioning leading to impulsiveness, poor reasoning, problem-solving skills and memory deficits. The primary impairments of FASD include physical and neurological impacts and they often co-occur with conduct and language disorders, and mental health issues, and lead many with FASD to poor educational outcomes, school exclusion, relationship problems, addictions and arrests. Teina Pora admitted to crimes he did not commit and he had a disability that made him vulnerable to doing this. I wonder if his story would have been different had he been diagnosed with FASD as a child and offered the protection of early intervention as well as a raft of other supports, for example, wearing a MedicAlert bracelet as young adults with FASD in Canada now do. By being diagnosed and wearing a MedicAlert device, perhaps Pora might have received a more appropriate response from arresting police officers and medical professionals involved with his case.

A study just out from Western Australia confirms that up to 90% of young people incarcerated have a severe neuro-impairment, many of whom will have FASD, but more often not than most of these will be undiagnosed. In New Zealand, we currently have no prevalence data for FASD but robust international evidence tells us that up to 5% of the general population will have FASD, and a much greater proportion of vulnerable groups—children in care, adopted children, offenders, indigenous populations and those with other disorders or mental health issues. FASD rates are higher than rates of autism or ADHD. The productivity losses due to FASD in New Zealand are estimated to range from $49 million to $200 million and the social and emotional burden on families supporting those with FASD is immense. Given these wide ranging costs, surely it is time to pay more attention to the scale of FASD as both a health issue and social problem.

In the last 10 years, New Zealand has begun to implement measures to assess and diagnose FASD, as well as develop action for intervention, but this is currently happening in only a few places. FASD assessments need to be conducted by a multidisciplinary team and due to their complexity can cost up to $8,000. The medical and allied health professions are in need of training and upskilling to screen, understand and help individuals and families where FASD is an issue as well as organisational support that enables them to sustain these important services. The New Zealand FASD Action Plan has led to a few initiatives to pilot training materials and hopefully increase clinical diagnostic and assessment capacity. The action plan, while detailed and positive, has only $12 million from the public purse allocated to its implementation over four years, compared for example to Alberta, Canada (population similar to New Zealand), which spends around $18 million per annum on FASD services and research to cost-effectively prevent and treat FASD. Also sobering is the fact that the New Zealand Treasury levied almost one billion dollars in alcohol excise duties last year, and this has not been used to fund action to increase training, services or research in this now well-established area of neuro-disability.
In a recent UK Lancet publication, philosopher Havi Carel points out the extensive everyday struggle that children with FASD have and that we all need to understand this experience and accommodate the ‘virtue in deficit’ that having this disability entails.\(^1\) Each year New Zealand has up to 2,000 children born with likely FASD, and with 1,000s of other undiagnosed children, youth and adults, it is time to offer more support. Even a small intervention like MedicAlert bracelets can offset some of the negative impacts of school exclusion or arrest. The evidence-based research, mostly out of North America, highlights the importance of early diagnosis and intervention, having a stable home life and ensuring that a range of appropriate accommodations and targeted interventions that help build self-control are implemented.\(^2,3,12\) Medical and allied health professionals can play an important role in both the prevention of FASD and intervention when FASD is suspected. There are guidelines available for a range of health professionals and under the New Zealand FASD Plan more training is coming.\(^2,9\)

People with FASD can flourish with targeted help and support. We need to at the very least ensure that their rights as disabled citizens are upheld.\(^9\) They should have access to good-quality health provision, especially early screening and assessment, but they should also be acknowledged as having a neuro-disability that warrants life-course provision of support, and the right to be the definers of what that support might entail to enable them to live good lives in the same way as people with other impairments can live good lives. Teina Pora lost 21 years of his life in prison, yet he showed great ‘virtue in deficit’ and was poorly compensated, but his story compels us to intervene and ensure the next generation of Pora’s are treated better and helped before the damage is done.

**Competing interests:**
Nil.

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**REFERENCES:**


5. Malone, G. How a bracelet is helping first responders understand fetal alcohol spectrum disorder. TVO,


Permanent pacemaker implantation after cardiac surgery: rates, predictors and a novel risk score

Tom Kai Ming Wang, Diego Arroyo, Andrew Martin, Alastair McGeorge, Michael Gillham

Disturbances in native cardiac electric conduction after cardiac surgery manifest as transient or persistent bradyarrhythmia, the latter necessitating permanent pacemaker (PPM) implantation in a minority of patients after observation for 5–7 days. Accurate pre-operative risk stratification for PPM requirement may reduce bradyarrhythmic complications and length of hospital stay, but this is done suboptimally in the clinical setting, and studies have reported mixed findings of predictors. We aim to review and identify predictors of PPM implantation after cardiac surgery at our centre.

Methods

All patients who had cardiac surgery at Auckland City Hospital during June 2014–October 2016 who had PPM implantation during the same admission and after cardiac surgery were reviewed. A random sample of the identical number of patients of other cardiac surgery patients were obtained as controls. Clinical characteristics including demographics, past history, presentation, pre-operative ECG, surgery type and times were extracted from computerised records and EuroSCORE II was calculated.

Pre-operative ECGs were divided into 4 categories defined as 1: normal, 2: arrhythmia (in the absence of any heart block), 3: low-grade block (not a standalone pacemaker indication such as first degree, left or right bundle branch, bifascicular block, Wenckebach), and 4: high grade block (that is pacemaker indication, eg. 2nd degree type 2 or complete heart block). Surgery types were divided into category 1: isolated coronary, 2: 1 valve+/-coronary, 3: 2 valves+/-coronary and 4: other (such as aortic surgery, congenital heart surgery, triple valve surgery).

Mean+/−standard deviation and percentage (frequency) were used to present quantitative and qualitative variables, and Hosmer-Lemeshow and Fisher’s Exact Tests used for univariable analysis of these respectively. Logistic regression was used to identify independent predictors of PPM implantation, and construct an additive model for predicting this. Its accuracy is assessed using the area under the receiver-operator characteristics curve c-statistic. P-values <0.05 were deemed statistically significant and all tests were two-tailed. SPSS (Version 17.0, SPSS Inc., Chicago, IL, USA) was used for statistical analyses.

Results

Of 2,446 cardiac surgeries undertaken, 4.0% (98) received a post-operative PPM during the study period, so 98 controls were selected for comparison, with characteristics presented in Table 1. PPM patients were on average older, had higher prevalence of previous surgery and lower prevalence of previous myocardial infarction, higher EuroSCORE II, higher proportion with higher grade block and valvular surgery in univariate analysis. In particular, PPM incidence was 0.6% (7/1165) for coronary surgery, 7.1% (45/636) for single valve+/-coronary surgery, 9.0% (12/133) for double valve+/-coronary surgery and 7.0% (34/489) for other cardiac surgeries.
<table>
<thead>
<tr>
<th></th>
<th>No PPM</th>
<th>PPM</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>98</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>63.7+-12.8</td>
<td>68.1+-12.0</td>
<td><strong>0.007</strong></td>
</tr>
<tr>
<td>Female</td>
<td>29.6% (29)</td>
<td>28.6% (28)</td>
<td><strong>1.000</strong></td>
</tr>
<tr>
<td>Body mass index</td>
<td>28.2+-6.0</td>
<td>28.6+-5.9</td>
<td><strong>0.263</strong></td>
</tr>
<tr>
<td><strong>Past history</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>7.1% (7)</td>
<td>17.3% (17)</td>
<td><strong>0.048</strong></td>
</tr>
<tr>
<td>Hypertension</td>
<td>76.5% (75)</td>
<td>71.4% (70)</td>
<td><strong>0.515</strong></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>25.5% (25)</td>
<td>29.6% (29)</td>
<td><strong>0.632</strong></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>23.5% (23)</td>
<td>11.2% (11)</td>
<td><strong>0.037</strong></td>
</tr>
<tr>
<td>Creatinine clearance (mL/min)</td>
<td>76+-29</td>
<td>83+-44</td>
<td><strong>0.490</strong></td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYHA class</td>
<td>2.1+-0.7</td>
<td>2.2+-0.7</td>
<td><strong>0.380</strong></td>
</tr>
<tr>
<td>Elective surgery</td>
<td>39.8% (39)</td>
<td>41.8% (41)</td>
<td><strong>0.799</strong></td>
</tr>
<tr>
<td>Urgent surgery</td>
<td>54.1% (53)</td>
<td>54.1% (53)</td>
<td><strong>0.515</strong></td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>6.1% (6)</td>
<td>4.1% (4)</td>
<td></td>
</tr>
<tr>
<td>EuroSCORE II (%)</td>
<td>3.7+-7.8%</td>
<td>6.6+-8.3%</td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td><strong>Pre-operative ECG</strong></td>
<td></td>
<td></td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td>Normal</td>
<td>64.3% (63)</td>
<td>30.6% (30)</td>
<td></td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>14.3% (14)</td>
<td>24.5% (24)</td>
<td></td>
</tr>
<tr>
<td>Low-grade block</td>
<td>21.4% (21)</td>
<td>36.7% (36)</td>
<td><strong>0.027</strong></td>
</tr>
<tr>
<td>High-grade block</td>
<td>0.0% (0)</td>
<td>8.2% (8)</td>
<td><strong>0.007</strong></td>
</tr>
<tr>
<td>Broad complex (QRS&gt;120ms)</td>
<td>7.1% (7)</td>
<td>21.4% (21)</td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td><strong>Surgery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td></td>
<td></td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td>Coronary only</td>
<td>50.0% (49)</td>
<td>7.1% (7)</td>
<td></td>
</tr>
<tr>
<td>1 Valve+/-coronary</td>
<td>27.6% (27)</td>
<td>45.9% (45)</td>
<td></td>
</tr>
<tr>
<td>2 Valve+/-coronary</td>
<td>6.1% (6)</td>
<td>12.2% (12)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>16.3% (16)</td>
<td>34.7% (34)</td>
<td></td>
</tr>
<tr>
<td>CPB time</td>
<td>115+-63</td>
<td>144+-66</td>
<td><strong>&lt;0.001</strong></td>
</tr>
<tr>
<td>Cross clamp time</td>
<td>77+-43</td>
<td>102+-58</td>
<td><strong>0.001</strong></td>
</tr>
<tr>
<td><strong>Pacemaker indications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrhythmia with bradycardia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-grade block</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-grade block</td>
<td></td>
<td></td>
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</tbody>
</table>
Multivariable analysis performed based on the above univariable analysis parameters, and combining category 4 and 2 of operation type as one group, identified pre-operative ECG and operation type as independent predictors of PPM implantation after cardiac surgery. Odds ratios (95% confidence intervals) per category were 1.65 (1.08–2.53) and 5.2 (2.47–10.9) respectively. As such, a simple additive risk model out of seven of these two variables was created: a) pre-operative ECG score 0 for normal, 1 for arrhythmia, 2 for low-grade block and 3 for high-grade block; and b) type of surgery score 0 for isolated coronary, 2 for 1 valve+/-coronary or other, 4 for 2 valve+/-coronary. C-statistics of this model and individual parameters for PPM implantation predictor are shown in Table 2. The risk model had the highest c-statistic of 0.78, and if the score cutpoint was set at 3, gave sensitivity of 70.4% and specificity of 77.6%.

**Discussion**

PPM was implanted in 4.0% of our cardiac surgery cohort, comparable to the 1.4–8.5% incidence reported in contemporary studies. Pre-operative ECG findings of bundle branch block or other heart block, and valvular heart surgery were also found to be predictors in other studies like ours, although we found that multi-valve surgery had independently higher risk than single-valve surgery. Other predictors previously identified include redo operation and pulmonary hypertension, age, emergency admission, diabetes, renal impairment and heart failure, which are common risk factors to operative mortality. To our knowledge, we have developed the first risk score for predicting PPM requirement after cardiac surgery, based on the two important predictors of pre-operative ECG and surgery type, which performed moderately well with c=0.78. The score out of 7 can be clinically utilised as 0–1 as low risk, 2–3 as moderate risk and 4–7 as high risk. The clinical implication is that in low-risk patients, temporary epicardial wires could be turned off and removed earlier, and those moderate and particularly high-risk patients would need close monitoring early on for, and ongoing monitoring with low threshold of PPM implantation of, any conduction disturbance post-operatively. The simplicity of the score should aid rather than hinder utility even if performance maybe somewhat hindered.

This study has several limitations. It is a single-centre retrospective observational study. The study sample size was small so power was limited. It was a case-control rather than cohort study design, and the controls, although randomly selected, weren’t matched to the pacemaker group, however this allowed us to assess and highlight the differences in characteristics between the two groups. We did not specifically examine long-term outcomes, including survival, pacing burden and late pacemaker dependency, but focused only on what factors predicted patients getting PPM in the first place. The score has not been externally validated, which would be a next step. Nevertheless, our analysis identified two important parameters of pre-operative ECG and type of cardiac surgery and constructed a user-friendly additive risk model to predict PPM after cardiac surgery with moderately good accuracy.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>C-statistic</th>
<th>95% confidence interval</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.61</td>
<td>0.53–0.69</td>
<td>0.007</td>
</tr>
<tr>
<td>EuroSCORE II</td>
<td>0.65</td>
<td>0.57–0.73</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pre-operative ECG</td>
<td>0.68</td>
<td>0.61–0.76</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Operation type</td>
<td>0.72</td>
<td>0.64–0.79</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PPM risk model*</td>
<td>0.78</td>
<td>0.72–0.85</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Change to risk model is based on two parameters and total score of 7: a) pre-operative ECG score 0 for normal, 1 for arrhythmia, 2 for low-grade block and 3 for high-grade block; and b) type of surgery score 0 for isolated coronary, 2 for 1 valve+/-coronary or other, 4 for 2 valve+/-coronary.
Competing interests:
Nil.

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REFERENCES:
Gnome medicine: what does genomic medicine mean to our patients and us?
Sara Filoche, Kevin Dew, Anthony Dowell

“Gnome medicine did you say?” With more than a hint of incredulity, this was the response from my (SF) mum when I talked to her about my work. We then went on to laugh about the misunderstanding. I use this example, not to humiliate my mum (she has given permission for me to use her response) but to highlight the divide between clinicians, scientists and the everyday person. My mum is not alone in her response. In the UK there is an engagement project “Socialising the Genome” funded by Genomics England, the Wellcome Trust and the Wellcome Trust Sanger Institute, which aims to “explore what people already understand about DNA and genomics—even if they think they know nothing—and how they are currently talking about it.”

In their letter, Parry and Middleton discussed how some genomics professionals “argue fiercely that the public should be educated to use and understand technically precise genomics terminology.” However, Parry and Middleton went on to say that they felt that insisting on such an approach would present “a marked barrier to communication and also creates an unhelpful power differential of expert versus other.”

Genomic medicine, sometimes also known as personalised medicine, is a way to customise medical care to your body’s unique genetic makeup—where treatment plans can be tailored to the individual. Rather than looking at one gene, genomic medicine looks at all of the genes, using techniques such as next-generation sequencing. It takes into account family health history and environmental factors. A key aspect of the success of genomic medicine is related to public acceptance: in particular around collecting family health histories and the development of biobanks that contain large numbers of individuals’ genomic DNA, linked with other health, lifestyle and administrative data—which raises significant, and as yet unresolved, consideration around governance, caretaking, informed consent and sharing (or not) findings with family members.

Genomic medicine is poised to transform patient care, and it will become more common as genomic medicine is being mainstreamed (ie, no longer a specialist service). But as one of the investigators from the socialising the genome project stated, “We don’t yet know how to make genomics an everyday conversation for people currently unconnected to it”. If the people that genomic medicine is intending to benefit are excluded from the dialogue as this technology advances, the divide will only widen and it will remain inaccessible (and distrusted) on many different levels.

How about health providers? The uptake of genomic technology into clinical practice will depend on providers’ perspectives of its utility in patient care. Currently we don’t have a good handle on what these are, nor on the educational needs. If we look overseas, evidence barriers to adopting genomic medicine are cited as many, with “variable knowledge and comfort with genetic concepts” being leading concerns.

The rise of direct-to-consumer testing (DTC) with kits such as 23andMe will likely increasingly reach our practices, as patients may turn up for help interpreting their health report, as an example, because they have been found to have the ε4 variant in the APOE gene associated with late onset Alzheimer’s disease.

As health researchers, medical sociologists and practitioners, we would like to highlight a gap in our engagement and education
around genomic medicine in Aotearoa New Zealand with both our patients and providers. We don’t know what messages about genomics are meaningful to people (our patients) in Aotearoa, nor do we know what practitioners want and need to deliver it. Are we genome ready? We would contend not really, and we would welcome the opportunity to work with health providers, stakeholders and researchers to become so.

**Competing interests:** Nil.

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**Corresponding author:** Sara Filoche, Department of Obstetrics and Gynaecology and Department of Pathology and Molecular Medicine, University of Otago, Wellington. sara.filoche@otago.ac.nz


**REFERENCES:**


Aspirin or rivaroxaban for VTE prophylaxis after hip or knee arthroplasty?

Clinical trials and meta-analyses have suggested that aspirin may be effective for the prevention of venous thromboembolism (proximal deep-vein thrombosis or pulmonary embolism) after total hip or total knee arthroplasty, but comparisons with direct oral anticoagulants are lacking for prophylaxis beyond hospital discharge.

This report is of a trial that addresses this issue. A total of 3,424 patients (1,804 undergoing total hip arthroplasty and 1,620 undergoing total knee arthroplasty) were enrolled in the trial. All received oral rivaroxaban (10mg) until the fifth postoperative day. The patients were then randomised to continue rivaroxaban or switch to aspirin (81mg) daily for nine days (knee patients) or 30 days for the hip patients.

It was concluded that among patients who received five days of rivaroxaban prophylaxis after total hip or total knee arthroplasty, extended prophylaxis with aspirin was not significantly different from rivaroxaban in the prevention of symptomatic venous thromboembolism. Clinically important bleeding risks were similar in both groups of patients.


Adjunctive rifampicin for *Staphylococcus aureus* bacteraemia

*Staphylococcus aureus* bacteraemia is a common cause of severe community-acquired and hospital-acquired infection worldwide. Adjunctive rifampicin has been hypothesised to improve results when used in addition to standard treatment. This report is of a randomised trial which aimed to clarify this issue.

Seven hundred and fifty-eight patients were involved. All received treatment with an anti-staphylococcal drug—penicillin, fluclaxacillin or methicillin. Those with methicillin-resistant organisms were treated with a glycopeptide (vancomycin). Half of the patients were also treated with rifampicin and the other half a placebo.

The result of this trial was that adjunctive rifampicin provided no overall benefit over standard antibiotic therapy in adults with *S aureus* bacteraemia.

* Lancet 2018; 391:668–78

Burden of atrial fibrillation in Māori and Pacific people in New Zealand

Atrial fibrillation (AF) is a major risk factor for stroke and cardiovascular events. Previous studies suggest that Māori and Pacific people have a higher incidence of AF than people of European ancestry.

Data obtained from 37 New Zealand general practices is reviewed in this study, which involved 135,840 subjects, including 19,918 Māori and 43,634 Pacific people. The incidence of AF was found to be similar to that noted in other countries, and strongly age-related. However, it was discovered that AF was diagnosed 10 years earlier in the Polynesian patients compared with their European counterparts— Māori 60 years, Pacific 61 years and European 71 years.

In view of these findings it was suggested that AF screening and stroke thromboprophylaxis in Māori and Pacific people could start below the age of 65 years in New Zealand.

* Internal Medicine Journal 2018; 48:301–309

URL:
Innocent Intra-Orbital Growth

By Edgar Whitaker, M.R.C.S., Ophthalmic Surgeon, Palmerston North Hospital

The following is a rare case of innocent intra-orbital new growth having formidable effects upon the eyesight:

Patient, a married woman, just suckling her fourth child, came under my notice in November, 1916. She then had prominence of the left eye for twelve years, but “the last seven months much more so.” This period coincided, in her opinion, with the bearing and suckling of her child. No pain in the eye, very little discomfort.

The condition then was: Left eye proptosed half an inch in front of level of the right eye, which is normal. The eyelid can completely cover the ball and the movements are not restricted. There is no perception or projection of light. There is no pulsation in the ball and it cannot be pushed back into orbit.

The ophthalmoscope shows a small patch of pigment on the upper inner side of the disc, the disc being very white. The veins dilated double normal. Arteries about as usual. The fundus was quite intact, there was no irregularity of surface of any kind such as would be shown by pressure of growth or invasion. The media were clear.

The diagnosis was, I thought, clear that it was not a malignant tumour, and as the patient had a large goitre and was suckling there was a possibility of the swelling going down if suckling and stress ceased.

The swelling did go down considerably.

In February, 1918, the patient came with the history that the last few months the eye had become very much more prominent.

On examination there was still no invasion of eyeball, no pulsation, no pain, but the swelling was twice as big as fifteen months previously and the patient thought that it had grown rapidly lately.

I advised removal of the whole eye and tumour and sent her down to Dr. Harty for an opinion. He was away, but Dr. Webster was kind enough to see her and had the orbit skiagraphed. It did not show very much, save that the orbital cavity appeared less distinct than usual. He thought the tumour non-malignant and advised removal as completely as possible.

Patient was admitted to hospital on her return and I removed the eyeball. A smooth, round, blue-grey walled cyst was exposed, about the size of a large walnut, unattached to the orbital wall save to the optic foramen. The lengthened optic nerve was intimately attached to one wall of the cyst, which contained pale yellow clear fluid.

The whole cyst was removed and sent to Professor Murray Drennan, whose report is attached. Recovery was uneventful.

Report by Professor Murray Drennan:—
“The eyeball shows of little note. Cyst presents considerable difficulty. The optic nerve enters on one side and then is lost in the cyst. The wall of cyst consists of fibrous and granulation tissue, in parts of which are many vessels with thick hyaline walls. Many fat-laden cells are present in cyst wall and in optic nerve; also cells with blood pigment. The appearances suggest that a tumour, probably myxomatous, has been originally present on optic nerve. Haemorrhage into it has occurred with organisation, so that now only the latter appearances remain.”

URL: