The effect of alcohol price on dependent drinkers’ alcohol consumption

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Proceedings of the 232nd Scientific Meeting of the Otago Medical School Research Society
A cost effectiveness analysis of community water fluoridation in New Zealand
Caroline Fyfe, Barry Borman, Guy Scott, Stuart Birks
The study found that community water fluoridation (CWF) remains cost effective despite an overall reduction in the average number of decayed teeth in both fluoridated and non-fluoridated communities. CWF was more cost effective in larger communities compared to smaller communities when using national data on the effectiveness of CWF in preventing dental decay. Communities with a higher risk of dental decay, for example, those with a high level of economic deprivation or those with a higher proportion of Māori ethnicity, would find CWF more cost effective than communities where the risk of dental decay was low. The study updates the last economic analysis of community water fluoridation, published by Wright et al in 2001.

Retinal detachments in southern New Zealand: do poorer patients have poorer outcomes?
Daniel S Allbon, Neil Avery, Andrew Gray, Harry Bradshaw
Retinal detachments are a serious vision threatening condition and can be divided into macula on and macula off subtypes, with macula off detachments producing a significantly worse off visual outcome. This study looks at the association between socioeconomic status and evaluates the difference in macula on and off detachments presenting to Dunedin's Eye Department over a two year period. Our study observed that more retinal detachments occur in the low and medium deprivation groups, however noted a trend that in the most deprived group these patients presented significantly later and more commonly with macula off detachments and overall had a worse visual outcome.

Therapeutic hypothermia is independently associated with favourable outcome after resuscitation from out-of-hospital cardiac arrest: a retrospective, observational cohort study
Kerry A Benson-Cooper
Out-of-hospital cardiac arrest has an estimated incidence of 1:2000 people per annum. Although 30% survive to hospital, a significant proportion die or are discharged with major disability. Cooling patients after an out-of-hospital cardiac arrest was shown to improve their likelihood of surviving without major disability in 2002. In our intensive care department we introduced this treatment in 2002 and have shown that our patients also did better if they were cooled after an out of hospital cardiac arrest. The proportion of our patients who were able to be discharged with mild or minimal disability increased from 36% to 62% over three time periods and cooling was shown to be an independent factor associated with this improvement.

Health-related quality of life of Taranaki children with Type 1 Diabetes
Sarah A Mills, Paul L Hofman, Yannan Jiang, Yvonne C Anderson
Children and adolescents with chronic health conditions are more likely to have a poorer quality of life. We studied the quality of life of those children and adolescents in Taranaki who had type 1 diabetes, and compared them with the quality of life of their siblings, using a quality of life questionnaire. We were surprised to find that the quality of life between the children with diabetes and their siblings were similar, but this needs to be explored further with a larger cohort of New Zealand children and adolescents.
Targets and actions for non-communicable disease prevention and control in New Zealand

Chris Bullen, R Beaglehole, Michael Daube AO, Gerry Devlin, Sally Hughes, Boyd Swinburn

Non-communicable diseases (NCDs)—mainly heart disease, stroke, diabetes and chronic lung diseases—are the leading causes of death and health inequalities in men and women in New Zealand and globally. A large proportion of the death and disability caused by NCDs is potentially avoidable if a handful of proven prevention and treatment strategies were put in place. Some of these strategies, like tobacco control, actually save money. We adapted NCD global targets for New Zealand in the light of local progress, priorities and feasibility to propose a set of national targets that also line up with the World Health Organization’s global targets. With each target we have suggested a set of actions to achieve the target. We recommend urgent commitment to practical actions that make the most of opportunities to prevent and control NCDs and reduce inequalities in New Zealand.

The effect of alcohol price on dependent drinkers’ alcohol consumption

Carolyn Falkner, Grant Christie, Lifeng Zhou, Julian King

115 people dependent on alcohol (needing alcohol every day to avoid withdrawal symptoms) completed a questionnaire about their drinking. The results showed that they drank on average 24 standard drinks a day (equivalent to 3 bottles of wine) and spent a median of $25 NZD per day on alcohol. Most of these drinkers, in particular the heaviest drinkers, bought very inexpensive alcohol and would be impacted financially if a minimum price per standard drink was introduced. They would no longer be able to switch to a cheaper product if they were short of money and this may result in them having to reduce their drinking. The most common strategies used in the past by this group if they had no money were to not buy other essentials, borrow alcohol or go without alcohol.
EDITORIAL

Why we need to know more about the impact of price rises on dependent drinkers

Tim Stockwell

I would like to congratulate Falkner et al for adding to an incredibly sparse literature regarding how severely alcohol-dependent drinkers respond when they cannot afford alcohol. I also commend The New Zealand Medical Journal for being willing to publish a simple, descriptive study with sharp and current policy relevance—not just for New Zealand, but for many other countries currently considering the use of pricing policies to reduce alcohol-related harm.

Alcohol is the leading preventable cause of death among young adults globally and a major contributor to preventable death, disease and disability in the wider population. Multiple systematic reviews have identified interventions that reduce the affordability of alcohol as being the most effective for reducing this burden. In recent years, minimum pricing strategies have received particular attention, largely because they target the heaviest drinkers who tend to drink the cheapest alcohol, consumption of cheap alcohol is highly responsive to price changes and emerging evidence of public health benefits in Canada, where minimum pricing has been in place for several decades. It is probably also critical that this policy guarantees industry profits and, in many scenarios, also increases government revenues.

So, what's holding up wholesale implementation of a policy with so many virtues? A great deal. Setting floor prices and price fixing of any kind is anathema to proponents of free trade economics. Multinational companies with broad interests in a variety of products in addition to alcohol (eg, fast food) have strenuously opposed efforts in Europe, particularly Scotland, to create a precedent for exemptions to tough EU free trade laws—even though the minimum alcohol pricing would protect their considerable profits from alcohol. Then there is the profound unpopularity of any policy that increases the price of a popular product like alcohol. Macdonald et al have shown that the more a population drinks, the greater the unpopularity of raising alcohol prices. Opponents of alcohol pricing policies frequently invoke the folk wisdom that they 'punish the many for the sins of the few', ie, they mostly affect moderate drinkers and are ineffective for heavy drinkers. The idea is promoted that ‘an alcoholic’ will always manage to get their alcohol and that a price rise will simply mean they will do so by committing crimes and/or by substituting more dangerous illicit substances.

In their paper, Falkner et al instead tap into the wisdom of the very group of people being discussed: a group of 115 severely dependent drinkers undergoing detoxification. Firstly, they demonstrate that the proposed alcohol price minima in New Zealand of between NZ$1 and NZ$1.20 per 10g standard drink would directly impact the drinking of between 36% and 54% of the sample, who report typically purchasing their drinks at prices below these minima. Secondly, they confirm research from other countries showing that the heaviest drinkers gravitate towards the cheapest alcohol: those spending less than $1 per standard drink consumed on average a whopping 30 drinks per day. Thirdly, the coping strategies reported by this sample when they could not afford alcohol were often quite positive (eg, seeking treatment, going without alcohol) and very few said they would steal or seek out non-beverage alcohol. A number said they would use illicit drugs, though likely in the majority of cases this would have involved cannabis, a far less harmful drug than alcohol.
However, it must be acknowledged that the most common coping strategy of ‘doing without essentials’ is of potential concern both for the drinkers themselves and for any family members. Overall though, the results support the authors’ conclusion that, in a population most affected by the introduction of a minimum price for alcohol, there would be net decreases in consumption and also associated reductions in harm.

I would like to add a caution, however, around going too far beyond these encouraging early findings. This was a self-report survey including a number of hypothetical questions and of course answers that imply willingness to commit criminal acts may often be suppressed. Going forward, we will need studies to measure actual changes in behaviour before and after significant price changes. Should Scotland succeed in its legal battle with the European Union to be allowed to introduce a 50p minimum price for a unit of alcohol, other countries, such as Ireland and Estonia, have announced they plan to follow their lead once the legal issues are resolved. Furthermore, several Canadian jurisdictions are looking to strengthen their minimum pricing policies in light of the emerging local evidence of effectiveness. It is likely that opportunities will become available for more robust studies into the reality and extent of potential unintended negative consequences of minimum pricing. It will be important to extend the focus of such research to include the larger populations of drinkers who while not severely alcohol dependent, are nonetheless exceeding low-risk drinking guidelines. Will they also forego purchasing essentials such as food and clothing? Will this affect their family members adversely?

Finally, it is important to stress that while it is likely that there will be some unintended negative consequences, these need to be seen in contrast to the demonstrated benefits of minimum pricing policies. In Canada, recent research has shown that a 10% increase in the average minimum price per standard drink is associated with 9% reductions in alcohol-related hospital admissions and an 11% reduction in violent offences. Unintended consequences can also be mitigated. Given the cost savings and increased revenue opportunities for governments who implement alcohol pricing policies, measures could be taken to offset negative impacts on low-income groups. For example, in Canada there is growing interest in programs for homeless dependent drinkers, whereby regular low doses of beverage alcohol, shelter and food are provided in ‘managed alcohol programs’ with some evidence of effectively reducing harms.

So, in summary, Falkner et al’s study should encourage policymakers in New Zealand to consider the introduction of minimum alcohol pricing. Their findings encourage the view that in contrast to the demonstrated public health and safety benefits of this policy, feared negative consequences for vulnerable populations of heavy drinkers may be minor and manageable. Future research should continue Falkner et al’s focus on possible negative consequences for vulnerable populations and, if real, how they can be best mitigated.

Competing interests: Nil

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The effect of alcohol price on dependent drinkers’ alcohol consumption

Carolyn Falkner, Grant Christie, Lifeng Zhou, Julian King

ABSTRACT

AIMS: To investigate the current purchasing behaviours of a group of dependent drinkers and their potential response to future increases in the price of alcohol.

METHODS: 115 clients undergoing medical detoxification completed an anonymous survey about their daily alcohol consumption, its cost, their response to potential price increases and strategies previously used when unable to afford alcohol.

RESULTS: Mean and median number of standard drinks consumed per day was 24, at a median cost of $25 NZD (95%CI $22, $30). Thirty-six per cent (95%CI 26%, 46%) of the group bought alcohol at $1 or less per standard drink, and the median number of drinks consumed per day (30) by this group was significantly higher (p=0.0028) than the rest of the sample (22.5). The most common strategy used if no money was available to purchase alcohol was to forgo essentials. If facing a potential price rise, 77% (95%CI 69%, 85%) would switch wholly or partially to a cheaper product and 13% (95%CI 8%, 21%) would cut down their drinking.

CONCLUSIONS: Although the majority of our group would be financially impacted by an increase in the minimum price per standard drink, any potential impacts would be most significant in those buying the cheapest alcohol (who also drink the most), suggesting that minimum pricing may be an important harm minimisation strategy in this group. A minimum price per standard drink would limit the possibility of switching to an alternate cheaper product and likely result in an overall reduction in alcohol consumption in this group. Stealing alcohol, or the use of non-beverage alcohol, were seldom reported as previous strategies used in response to unaffordable alcohol and fears of such are not valid reasons for rejecting minimum pricing to reduce general population consumption.

The general population decreases its use of alcohol in response to an increase in price and it is generally accepted that the magnitude of this reduction varies between population subgroups.\(^1,4\)

Dependent drinkers (those experiencing physiological withdrawal symptoms on reduction or cessation of alcohol) are a small but important subgroup, with 1.3% of the New Zealand population fulfilling criteria for alcohol dependence in the previous year.\(^5\) Unfortunately, these drinkers are seldom investigated in general household surveys and very little is known about their response to an increase in the price of alcohol. If they do take part in research, they are usually classified within a ‘heavy drinking’ category, which generally describes a level of alcohol use that falls well below the volumes they actually consume.\(^6\) Information about the price sensitivity of these dependent drinkers is sparse.\(^2,3,6\) While some studies have shown significant reductions in alcohol-related disease mortality following tax increases,\(^4\) other review studies have produced more mixed results.\(^6\)

Many governments have considered instituting mechanisms which will increase the price of alcohol and thus reduce total per capita consumption. A minimum price per litre of alcohol is already currently operative in some countries, including the majority of Canadian provinces, and such measures are thought to reduce overall consumption of alcohol substantially.\(^1,7\) New Zealand is one of several countries currently investigating a minimum price per standard drink, with a recent New Zealand Ministry of Justice Report modelling three hypothetical minimum pricing options; $1.20, $1.10 and $1.\(^8\)
Recent work by Holmes et al has looked at the impact of potential minimum unit pricing policies in the UK on various population groups. Using the Sheffield Alcohol Policy Model, these authors postulated that under a minimum pricing regime, the largest changes in consumption would likely occur in harmful drinkers in the lowest quintile of income, as these are the drinkers most likely to be buying the cheapest alcohol. A minimum pricing regime is thought to result in a reduction in consumption in this group because it raises the price of all types of cheap alcohol and thus limits opportunities for heavy drinkers to ‘switch’ from their preferred alcohol to an alternative cheaper product.

This finding is consistent with studies of historical sales data in Sweden, which showed the biggest reduction in alcohol consumption was achieved when the price of lowest quality alcohol was increased, as quantity, rather than quality, of beverage was sacrificed.

Concerns that policies such as minimum pricing may result in dependent drinkers turning either to crime, substances which are more harmful, or more dangerous non-beverage alcohol, have not been borne out by the available evidence, with Black et al finding that such behaviour occurred rarely in their study of Edinburgh’s dependent drinkers, and Stockwell et al reporting many positive coping responses to less affordable alcohol in their group of homeless drinkers in British Columbia, Canada.

In this study, we aimed to investigate issues related to affordability of alcohol in a group of dependent drinkers attending an inpatient detoxification service. We investigated the amount spent per day on alcohol and explored key drivers behind choice of alcohol product in dependent drinkers. We aimed to understand better the impact any future price increases might have on the purchasing behaviour of our sample, including which strategies dependent drinkers have previously used when alcohol was unaffordable. We also asked about strategies they believed they might use if alcohol became unaffordable in the future, albeit that questions relating to hypothetical future behaviours are able to provide estimates of possible behavior change only.

**Methods**

The study population comprised a prospective sample of 115 alcohol-dependent clients (experiencing significant physiological withdrawal symptoms on alcohol cessation) admitted for medicated detoxification at an addiction service inpatient unit (IPU) between May 2013 and February 2014. The 11-bed IPU is part of a regional community alcohol and drug service (CADS) in Auckland, New Zealand and is a mixed-gender specialist detoxification unit.

Participants were diagnosed as alcohol dependent by an addiction medicine specialist, applying DSM IV criteria as part of the assessment process. Excluded were clients aged 17 or younger, clients with co-existing other substance abuse or dependence, clients who were too intoxicated or physically unwell to complete the research at the time of admission and those with significant cognitive impairment.

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Eligible clients were invited to participate on the first day of their detoxification by the lead researcher, following their routine medical admission to the unit. Participants self-completed an anonymous pencil and paper questionnaire. Completed questionnaires were deposited by participants in a closed box. Participants were permitted to have questions clarified by the lead researcher, but no specific assistance was given.

The survey included questions collecting demographic information, source (but not amount) of income and years of dependent drinking. Subsequent questions explored daily alcohol consumption, potential behaviour following a hypothetical increase in price, and past behaviours used when faced with no funds. All survey questions were multi-choice, apart from two questions which required amount and price of alcohol to be specified. These questions were adapted from those in studies by Black and Stockwell.

Participants were asked to note the amount and type of alcohol consumed on an average day prior to their admission. Amount of alcohol consumed per day was later converted to the number of standard drinks consumed per day using the Health Promotion Agency guidelines. Participants...
were asked to nominate the amount spent on alcohol for the day and thus a cost per standard drink was also calculated for each participant. If clients gave a range of alcohol used, the upper end of the range was taken, as it is generally accepted that only 40–60% of total alcohol sold is generally captured in surveys and alcohol intake is underreported across all drinking subgroups (although studies do disagree on which sectors of the population are more likely to underreport).21,22-24

Standard descriptive statistics were used to summarise the characteristics of the sample. Shapiro-Wilk and Kolmogorov-Smirnov tests were used for normality testing. Quantiles were provided for non-normally distributed continuous variables, with 95% confidence intervals. For primary binomial outcomes, proportions were calculated with exact confidence limits. Kruskal-Wallis test was used for two group comparisons of a continuous variable when t-test was not appropriate. The data was collated in Excel and analysed using SAS 9.3.

The study was conducted as an audit or related activity according to the National Ethics Advisory Committee guidelines for observational studies.19

Results
One hundred and fifteen clients took part in the survey. A further 9 eligible clients refused to participate (response rate 93%, 115/124).

Fourteen clients who presented during the study period were excluded: 8 due to physical unwellness; 5 due to intoxication; and 1 due to language issues as the questionnaire was self-completed and required a basic level of English reading comprehension. Four clients re-presented during the study period and were excluded from participating a second time.

Multiple choice questions were fully completed by all 115 participants; however two questions requiring free responses about amounts and cost of alcohol were not completed in sufficient detail by 22/115 participants and could not be included in the final analysis for this section. This set of 22 was no different to the main group with respect to demographic data.

Demographics
The sample was 57% (65) male with 40% (47) of the sample aged 45–54 (see Figure 1). Eighty-five percent (98) identified as New Zealand European and 9% (10) Māori. Only 15% (17) were in fulltime employment; 63% (73) derived at least some of their income from a social security benefit. Fifty-seven percent (66) of the sample had been drinking at a dependent level for at least 6 years and 40% (46) for 11 years or more.

Type and amount of alcohol consumed
61.7% (71) of clients reported using at least some wine and 47% (54) used exclusively wine. 10% (12) used exclusively beer and 13% (15) exclusively spirits.
A question about the amount of alcohol used was poorly answered, with 21 clients not providing sufficient information. However, there was enough data to calculate the number of standard drinks consumed per day for 82% (94) of respondents. The mean and median number of standard drinks consumed in a typical 24-hour period prior to admission was 24 (equivalent to 3 bottles of wine approximately) (95% CI for median, 20.4, 24.0), which equates to 168 units a week.

Eighty-four percent (79/94) of the sample consumed 16 or more standard drinks per day and 31% (29/94) of the sample drank 30 or more standard drinks per day. There was no statistically significant difference in the amount consumed by males versus females (Kruskal-Wallis test, p=0.07).

Cost per day and cost per standard drink

The mean daily cost of alcohol was calculated for 114 clients at $29.03, range $3 to $100. As the distribution was non-normal, median cost was calculated at $25 (95% CI, $22, $30).

Cost per standard drink was able to be calculated for 81% (93) of respondents. For the whole sample of 93 clients, mean cost per standard drink was $1.34, and median cost per standard drink was $1.17 (95% CI, $1.04, $1.25).

A significant difference (Kruskal-Wallis test, p=0.02) was found in the median cost per standard drink between the clients on a social security benefit (median $1.08) and those not receiving a benefit (median $1.25). See Table 1.

As outlined in Table 2, a large proportion of the sample bought alcohol at less than the $1.20, $1.10 and $1.00 per standard drink hypothetical minimum price points nominated by the Ministry of Justice. In particular, 36% (95% CI, 26%, 46%) of the clients bought alcohol at less than or equal to $1.00 per standard drink. Thirty-eight percent (95% CI, 26%, 52%) of the clients on a social security benefit bought at this price also.

Those spending a dollar or less per standard drink (n=33) drank a mean of 29 standard drinks and a median of 30 standard drinks per day. This was significantly more than those spending more than a dollar per standard drink, who drank a mean of 21.5 and a median of 22.5 standard drinks per day (Kruskal-Wallis test P=0.0028). See Figure 2.

Impact of price

Fifty-nine percent (68/115) of the whole group indicated that price was an important consideration when purchasing alcohol. Forty-six percent (53) and 44% (51) indicated that alcohol content and taste, respectively, were also important.

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considerations. Clients were able to choose more than one response to this question.

Strategies to sustain alcohol use in the face of hypothetical price increase

The survey explored what strategies dependent drinkers would use to sustain their alcohol use, if their usual drink of choice became unaffordable. Fifty-eight percent (67) indicated that they would switch to a cheaper product and 28% (32) indicated that they would combine their usual drink with something cheaper. Eighty-nine (77%, 95%CI, 69%, 85%) clients indicated either of the above two. Thirteen percent (15) indicated they would cut down their drinking substantially in order to continue drinking their preferred alcohol.

Strategies used previously when no money was available

The survey then asked if participants had ever faced the situation of having no money for alcohol on a particular day. Two-thirds (76 clients) had experienced this and reported using one or more strategies, including forgoing essentials 41% (31/76), borrowing alcohol 36% (27/76) and going without 25% (19/76). Thirty percent (23/76) reported some form of drug use as a strategy: 17% (13/76) had used illicit drugs and 13% (10/76) had used prescription drugs. Other less common strategies are detailed in Figure 3. Strategies used appeared similar between those spending less than $1 a day and the rest of the sample.

Thirty-four percent of the clients (39/115) had not faced the issue of having no money for alcohol before and 15 of these were in the social welfare benefit group.

Discussion

This study provides information about the amount and cost of alcohol consumed per day by a group of dependent drinkers in Auckland, New Zealand. The behaviours and attitudes of this group to a potential increase in the price of alcohol are investigated including strategies they have previously employed when unable to afford alcohol.

Our group of dependent drinkers consumed an average of 24 standard drinks per day, which is slightly more than the other comparable studies of dependent drinkers. For example, Black et al describe an average weekly consumption of 197.7 UK units in their Edinburgh sample. A UK unit contains 8g ethanol whereas a New Zealand unit is 10g, thus our New Zealand group drink the equivalent of 210 UK units per week.
Our group of dependent drinkers spend a considerable amount of money on alcohol, at a median cost of $25 NZD per day. The median cost per standard drink for our study population as a whole was $1.17 NZD, with a significant difference found between the median cost per standard drink in those on a social security benefit ($1.08) compared to the remainder ($1.25). Our results suggest that a $1 minimum price per standard drink, such as that modelled in the recent New Zealand Ministry of Justice report, would affect at least 36% of our study population who are currently buying alcohol below this price point.8 At a minimum price of $1.20, over half of our group of dependent drinkers would be impacted.

Those most affected by a minimum price regime are likely to be people currently spending (or able to spend) the least on alcohol. Those in our sample who spent a dollar or less per standard drink on an average day also drink significantly more alcohol. Under any of the proposed minimum pricing regimes the cost of alcohol per day would increase the most for this group, suggesting it could be important as a harm minimisation measure.

Switching product in response to a price rise is a strategy that heavy drinkers use and has been described in the literature.30,25 Seventy-seven percent of our group hypothetically favoured switching partially or completely to a cheaper product. Under a minimum pricing regime, the cost per standard drink would be at the same minimum price for all products and this strategy would be less likely to be employed. As noted elsewhere, there would no longer be a financial incentive to switch product, as drinkers would be unable to maintain the same level of consumption without increasing their costs.1,14 When asked hypothetically whether they would cut down their drinking in the face of a price rise, only 13% indicated that they would. However when reporting on strategies previously used (when they had no money for alcohol), 25% reported “going without”, effectively reducing their alcohol consumption albeit only till they next had money.

Although this study is not able to confirm whether an increase in price would change consumption in this group of dependent drinkers, it is likely that past strategies reported by the group (in response to limited funds) would be used again and more often, particularly if minimum pricing was introduced due to its effects of limiting switching. The strategies used

**Figure 3:** Strategies used when no funds were available to buy alcohol.
by our group when facing the situation of having no money for the day were in line with those found in Black and Stockwell; ie, forgoing essentials, borrowing alcohol and going without.\textsuperscript{14,15} Whilst the most common strategies are unsustainable for long, they sit in stark contrast to the perception of the general public and other authors, who have expressed concern about increased criminal activity or use of harmful substitutes.\textsuperscript{8,12,13} Of note were the infrequent reports of potentially dangerous or illegal behaviour; only 2 participants mentioned non-beverage alcohol (such as methylated spirits) as a strategy they have actually employed and stealing alcohol was used as a strategy by just 9 clients. There have been concerns expressed that home brewing activity may increase if a minimum pricing regime was instituted.\textsuperscript{8} None of our study participants indicated that they had used this strategy in the past, although longer-term strategies such as this were not investigated specifically.

Use of other drugs had been used as a strategy when alcohol became unaffordable by 20\% of the total sample (and 30\% of those who had previously been without funds), with 13 reporting illicit drug use and 10 reporting prescription drug use. Potential participants with comorbid drug use were excluded from this survey, thus our results may be an underestimation of this behaviour in the wider subset of dependent drinker. The Alcohol Use 2012/13: New Zealand Health Survey notes that 11\% of the general population of New Zealanders had used a ‘drug substance’ (excluding tobacco) while drinking in the past year.\textsuperscript{26}

This survey contained one question which related to hypothetical future behaviour in the face of an unaffordable favoured product. As with other studies that include questions relating to hypothetical future purchasing behaviours, this study is only able to present estimates of possible behaviour change following increased alcohol cost.\textsuperscript{16,17} However, all of the other questions related to either current or past behaviours, which are arguably more robust with the responses to these questions consistent with other literature.\textsuperscript{14,15}

The self-completed nature of this survey resulted in some question responses being incomplete. The intent was to allow clients the privacy to complete questions as truthfully as possible, however, more complete information may have been gained had the survey been conducted as an interview.

This was a single site study, thus whilst valid for this Auckland-based sample, it is unclear how generalisable these findings are to New Zealand’s dependent drinkers as a whole. The ethnicity of the sample is not representative of the population of the Auckland region, with the European population over represented and other ethnicities under represented.

**Conclusion**

The results of this study indicate that dependent drinkers buy a large amount of predominantly inexpensive alcohol and would be financially impacted by any proposed increase in the minimum price per standard drink. Because this would severely restrict the ability of this group to switch to an alternate cheap alcohol product, it seems likely that a minimum pricing regime would result in an overall reduction in alcohol consumption in this group. Any potential impacts would be most significant in the subset currently buying the cheapest alcohol, which is also the group using the most alcohol, suggesting that such a regime may be an important harm minimisation strategy.

As has been shown in other literature, there is minimal evidence in this group of accessing non-beverage alcohol or of criminal activity to access alcohol when it becomes unaffordable. Fears of such behaviours are not valid reasons for rejecting a minimum pricing regime to reduce general per capita consumption at policy level.
Competing interests: Nil

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Retinal detachments in southern New Zealand: do poorer patients have poorer outcomes?

Daniel S Allbon, Neil Avery, Andrew Gray, Harry Bradshaw

ABSTRACT

AIMS: To investigate associations between socioeconomic status, retinal detachment type and post-operative visual outcomes in southern New Zealand.

METHODS: A retrospective review of all cases of rhegmatogenous retinal detachments in Dunedin Hospital over two years was performed. Patient demographics and macula involvement at presentation were the primary outcome measures. The New Zealand Deprivation Index was used to group patients into low (30% least deprived), medium (middle 40%) and high (30% most deprived). Patients were excluded if they were not from New Zealand, or had traumatic detachments.

RESULTS: During the study period, 95 retinal detachments in 94 patients were managed in Dunedin Hospital. Only 15% of retinal detachments occurred in the most deprived. More deprived patients had longer delays before assessment in hospital (mean of 29.8 days versus 10.1 days for the least deprived and 12.8 days for the medium category, overall p=0.025). There was no evidence of an association between deprivation and macula-off status (overall p=0.650) or visual acuity at one or three months (p=0.063 and p=0.328 respectively). Nor was there an association between referral pathway and macula-off status (p=0.242).

CONCLUSIONS: Retinal detachment in southern New Zealand may be less common amongst those with the most deprived socioeconomic status who also experience longer delays till first treatment; but there was no association between socioeconomic status and patients being macula-off at presentation, or having poorer visual outcomes. More targeted patient education towards our most deprived citizens may reduce delays in treatment, and result in better visual outcomes.

Rhegmatogenous retinal detachments (RRD) are a serious, yet relatively rare, ocular condition with an incidence ranging from 5–18.2 per 100,000, which can have significant impact on morbidity and quality of life. RRD occur from liquefied vitreous moving through a break in the retina into the potential epithelio-retinal interspace between the sensory retina and retinal pigment epithelium. RRD typically require surgical intervention to anatomically reattach the retina, with current success rates ranging from 80% to greater than 90%.

Retinal detachments can be broadly divided into macula on, where the subretinal fluid (SRF) has not detached the macula and visually important fovea; and macula-off, where the SRF has tracked past and detached the macula. Post-operative visual acuity recovery differs significantly between the two types, with better visual acuity associated with macula-on detachments compared to macula-off. There is also a third group with a split macula detachment where there is partial splitting/detaching of the macula in which visual acuity (VA) may or may not be fully affected.

Recent research in the UK has shown a significant association with low socioeconomic deprivation and rhegmatogenous retinal detachments; specifically that those more affluent are more at risk of a RRD. Previous research has identified that myopia is a strong independent risk factor for developing RRD. Furthermore, myopia has been associated with higher IQ and educational achievement and thus better socioeconomic status.
This finding typically goes against the common pattern, whereby a higher socioeconomic deprivation is typically associated with a higher incidence of disease and notably in ophthalmology and visual impairment.\textsuperscript{5,9,10}

This study is a retrospective review into presenting RRD which were referred to, and managed in, Dunedin Hospital over a 2-year period. It aims to investigate the socioeconomic and demographic characteristics of RRD in southern New Zealand and identify if patients presenting with macula-off RRD are more at risk being from a higher level of socioeconomic deprivation. Furthermore, it investigates if there is an association between macula-on or -off RRD and referral source (ie, optometrist or medically-trained physicians), along with the visual outcome at one and three months post-operatively.

Methods

Participants were selected from all patients undergoing surgery for RRD at Dunedin Public Hospital. This is the only tertiary centre catering for the Southern District Health Board (DHB) which covers the regional provinces Otago and Southland, covering a population of 297,423.\textsuperscript{11} The Southern DHB covers the largest geographic area of all DHBs across the country, spanning over 62,356 square kilometres, and as such, patients are referred to our service through a variety of local and often rural services.\textsuperscript{12} All cases were reviewed and operated on by one vitreoretinal surgeon.

Data was collected over a two-year period, from September, 2012–October, 2014, and included patient demographics, source of referral, duration of symptoms, type of RRD at presentation, post-operative visual acuity, and post-operative complications.

Post-operative complications included re-detachments and anatomic failure, and these re-detachments underwent further ocular operations for repair. Reoperation data included removal of heavy liquid/oil which occurred approximately two weeks after the initial primary repair, and washout or gas exchange either due to a significant hyphaema, or significant ocular hypertension respectively.

The refractive error, to identify myopic status, was assessed based on referral information and clinical history and documentation. Myopic status was defined as a minimum of -0.5 dioptres of sphere.

Socioeconomic deprivation was measured using the New Zealand Deprivation Index, 2013 (NZDep2013). This measures the deprivation within a meshblock or geographically-defined area in New Zealand. A deprivation score is created using 8 variables from the latest 2013 census, which takes into account income, employment, communication, transport, support, qualifications, home ownership and living space. The deprivation score is defined into deciles from 1–10, with 1 being the least deprived and 10 the most deprived. For the purposes of this study, deprivation deciles were grouped 1–3, 4–7 and 8–10 equating to low, medium and high levels of deprivation respectively.\textsuperscript{13}

Inclusion criteria: all patients who developed rhegmatogenous retinal detachment, including retinal dialyses, who were managed at Dunedin Hospital. There was no minimum size of RRD included, but was instead clinically assessed by a single vitreoretinal surgeon and deemed appropriate to operate, either requiring a pars plana vitrectomy or scleral buckle. Patients who had previously undergone intraocular surgery, including previous retinal surgery, were included.

Exclusion criteria: patients were excluded if they were treated solely with laser retinopexy. Non-New Zealand residents, or any patient who presented with tractional and/or traumatic retinal detachments, ie, globe rupture or penetrating eye injury, and exudative retinal detachments were also excluded. Note: no patient was treated by pneumatic retinopexy.

As one patient provided information on two detachments, mixed-effects logistic regression models with a random patient effect, were used to examine associations between NZDep2013 group and each of macula-off detachment and visual acuity at 1 month and 3 months. Mixed-effects logistic regression was also used to investigate any association between referral pathway and macula-off. Length of symptoms for patients (not RRDs) was compared between
NZDep2013 groups using a Kruskal-Wallis test, with post-hoc Dunn’s tests. In order to investigate whether any association between deprivation and the length of symptoms was explained by referral pathway as a potential mediator, adjusted linear regression models using log-transformed length of symptoms were also investigated after residual diagnostics were examined. All statistical analyses were conducted using Stata 13.1 and two-sided p<0.05 was considered statistically significant.

Results

Demographics
There were 98 cases of RRD seen at Dunedin Public Hospital, of which three cases were excluded as they were visiting tourists, leaving a total of 95 RRD in 94 patients. One patient presented with simultaneous bilateral RRDs and both are included in analyses were appropriate. The mean (SD) age was 55.5 (17.1) years, ranging between 12 and 89 years. There were 61 males (65%) compared to 33 females (35%). There were 48 macula-on detachments (51%), 41 macula-off detachments (43%) and 6 macula splitting detachments (6%). 55 RRD occurred in the right eye, compared to 41 RRD in the left.

Table 1 shows the prevalence of myopic refractive error and previous ocular surgery compared by deprivation group, which was not significant (p=0.102). Nor was there evidence that myopic refractive error was associated with macula-off detachment (data not shown, p=0.228). Similarly, within this table there was no significance found when looking at the prevalence of previous ocular surgery compared by deprivation group (p=0.841). Nor was there evidence that previous ocular surgery was associated with macula-off detachment (data not shown, p=0.281).

Table 2 shows the distribution of RRD and deprivation status. From mixed logistic regression, there was no evidence that the proportion of macula-off/splitting versus macula-on differed by NZDep2013 category (p=0.650).

Referral source and type of RD
Among the source of referrals, optometrists were the most common referrer with...
39 patients (41.4%), 30 were referred by medical physicians (32%), 11 were referred by ophthalmologists (public and/or private) (11.7%), 7 were self-referrals (7.4%) and 7 incidentally noted on examination for other reasons (7.4%).

Table 3 shows the referral source and type of detachment. Looking at the distribution of macula-on versus macula-off/splitting, there was no evidence of a difference between medical physician and other referrals (p=0.242).

Table 4 shows the distribution of referrers by deprivation groups. There was no evidence of an association between referrer and deprivation groups (Fisher’s Exact p=0.328).

The mean duration of symptoms before assessment in hospital was 10.1 days in the low deprivation group, 12.8 days in the medium deprivation group and 29.8 days in the high deprivation group. This differed overall (Kruskal-Wallis p=0.025) with Dunn’s test showing pairwise differences between low and high (p=0.011) and medium and high (p=0.003), but not between low and medium (p=0.333). In a linear regression model using log-transformed symptom duration, although the resulting model residuals were not ideal, similar results in terms of significance were obtained to the above when looking at deprivation (overall p=0.015; low versus high p=0.010; medium versus high p=0.005; low versus medium p=0.905). These results were relatively unaffected in terms of statistical significance and also in terms of the model coefficients when also adjusting for referral source as medical physician versus other (overall p=0.012; low versus high p=0.008; medium versus high p=0.004; low versus medium p=0.951), although again the model residuals were marginal in terms of acceptability.

Deprivation and visual outcome

Table 6 shows visual acuity at one and three months post. There was a tendency for means to differ at one month (p=0.063) but no evidence at three months (p=0.328).

Table 7 shows the reoperation rates and complications in regards to anatomic failure. There was only one case of anatomic failure seen in the high deprivation group. In total, 8% of the population re-detached and underwent another oper-
ative procedure, 6% required removal of oil/heavy liquid and 4% required a washout or gas exchange due to hyphaema or significant ocular hypertension. There was no evidence of an association between having any event and deprivation (Chi-squared p=0.473) or for the type of event and deprivation amongst those with an event (Fisher's exact p=0.495).

Discussion

In this study of RRD within southern New Zealand, the overall incidence was 15.97 per 100,000 population, this lies within the reported normal range from 5–18.2 per 100,000 population.\(^1,2\)

Reviewing the patient demographics, there was a ratio of 1.85 male to female (p=0.729). This pattern is consistent with international research, which found a similar gender ratio in a larger population, 1.68:1 (p<0.0001).\(^5\) Likewise, a meta-analysis of previous studies detailing the difference in sexes and retinal detachments reported a male predominance between 52–59% (p<0.001).\(^2\) There was a predominance of detachments occurring in the right eye compared to the left, 51 versus 44 eyes (54%), although non-significant, this predominance of right eyes fits within a international meta-analysis 53.5%–56.7% (p>0.0001).\(^5\)

Looking at the length of symptom duration prior to hospital presentation, the low deprivation group was seen earliest, with a mean of 10.1 days, with the medium deprivation group following closely at 12.8 days, however the high deprivation group presented significantly later at 29.8 days. This was significant when comparing between the low and high deprivation groups (p=0.011) and the medium and high deprivation groups (p=0.003), and overall (p=0.025). This may be due to a number of reasons, including lower levels of education and limited access to services due to financial constraints. There was no evidence that also adjusting for referral source (medical physician versus other) explained this difference, and so referral pathway does not appear to mediate this association.

There appeared to be a pattern of more retinal detachments occurring in the more affluent populations; 85% compared to the high deprivation group, 15%. This corresponds similarly with research in Scotland, where 84% of all detachments occurred in the more affluent populations (p<0.0001).\(^9\)

The medium deprivation group received the highest number of retinal detachments compared to all groups, making up just under half (49%) of all retinal detachments in our study. This finding may be partially explained by the medium deprivation group having also the highest number of myopes, given the associated risk of RRD with myopia.\(^6\)

Within the low and medium deprivation groups the rate of macula-off detachments was similar, 41% and 40% respectively, compared to the high deprivation group at 57%. This was not statistically significant, though is suggestive that more deprived patients are more likely to be macula-off at presentation. This association was also reported by Mitry et al in a Scottish population, where those from the most deprived group were significantly more likely to present with macula-off detachments compared to the least deprived, 65% versus 51% respectively (p=0.0089). This is likely a result of delays in initial assessment and treatment observed in this study and places the more deprived patients at risk of a worse visual outcome.\(^5\)

With regard to referral source of retinal detachments and its association with

| Table 7: Deprivation status versus reoperation rates and complications |
|-----------------|----------------|----------------|----------------|----------------|----------------|
| Deprivation     | Re-Detachment | Removal of Oil/Heavy Liquid | Washout/Gas Exchange | Anatomic Failure | Any | None | Total |
| Low             | 3 (9%)        | 4 (12%)         | 2 (6%)             | 0 (0%)          | 9 (26%)       | 25 (74%) | 34    |
| Medium          | 4 (9%)        | 1 (2%)          | 2 (4%)             | 0 (0%)          | 7 (15%)       | 40 (85%) | 47*   |
| High            | 1 (7%)        | 1 (7%)          | 0 (0%)             | 1 (7%)          | 3 (21%)       | 11 (79%) | 14    |
| Total           | 8 (8%)        | 6 (6%)          | 4 (4%)             | 1 (1%)          | 19 (20%)      | 75 (80%) | 95    |

* Note the medium deprivation group contains one patient with bilateral detachments.
socioeconomic status, no statistically significant difference was found between referral source and type of retinal detachment (p=0.242). We did observe a non-significant trend of ophthalmologists and optometrists referring in more macula-on detachments, at 73% and 55% respectively, compared to medically trained physicians (such as general practitioners (GP) and emergency department physicians) at 33%. In New Zealand, there is public funding for GP visits and hospital visits, though no public funding for optometry or private specialist visits, limiting the most deprived groups’ access to these practitioners. This may relate to the finding above of delays in initial hospital treatment for more deprived groups, as optometrists and private ophthalmologists are more likely to be able to assess and refer at an earlier stage than generally trained physicians. This may follow on explaining the higher rates of macula-off detachments found in the more deprived group, however we found no significant evidence of any association between referrer and deprivation group (p=0.328). To our knowledge, no research has previously looked at the referral source of detachments and a larger study is most likely needed to find if this pattern is of clinical significance.

The visual outcome at one month post surgery was similar when comparing the low and medium deprivation groups having a logmar visual acuity of +0.33 and +0.37, respectively, whilst the high deprivation group had a logmar of +0.52. Again, this trend was not significant (p=0.328), but did suggest that those in the most deprived group have worse visual outcomes, likely as a result of delays in treatment and subsequently increased risk of macula-off RRD. We did not find any association with regard to complications and reoperation rates between socioeconomic groups (p=0.473).

In this study the majority of retinal detachments occurred in the more affluent populations. We observed a higher proportion of macula-off detachments occurring in the most deprived population group compared to their less deprived counterparts. Despite this lack of significance, the above mentioned pattern fits with international research. We also noted a non-significant trend of a worse visual outcome at one and three months in the most deprived group compared to the low and moderately deprived. Importantly, we found that the most deprived population groups presented significantly later when compared to their counterparts. This has significant implications given that we know that Ross found the visual recovery in relation to increasing duration of detachment declines in an exponential fashion and Saidkasimova et al also found that visual recovery and successful surgical repair are affected by delayed presentation. These results suggest that more education, support and targeting of patients in high areas of deprivation is required to improve understanding, presentation times and outcomes for these patients.

Competing interests: Nil

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Health-related quality of life of Taranaki children with Type 1 Diabetes
Sarah A Mills, Paul L Hofman, Yannan Jiang, Yvonne C Anderson

ABSTRACT

AIM: To evaluate health-related quality of life (HRQOL) in children/adolescents with type 1 diabetes in Taranaki compared to siblings without diabetes/chronic disease.

METHODS: The Pediatric Quality of Life Inventory (PedsQLTM) was requested in those with type 1 diabetes (n=67), their parent(s), and their siblings (where available). Age, gender, ethnicity, Deprivation Index, and clinical information were collected. Regression analysis was conducted to explore differences in HRQOL scores between diabetes patients and their siblings, adjusting for confounding factors. Predictive effects of aspects of diabetes on HRQOL were evaluated.

RESULTS: 56 diabetes patients participated (84% response), and responses from 35 siblings were obtained. Exclusions (n=14) included those with type 1 diabetes for <6 months, type 2 diabetes, and other long-term medical or psychiatric conditions. Good level of agreement was found between parent-proxy and child report. There was no difference in HRQOL between the diabetes group and their siblings (mean -4.37, 95%CI [-10.67, 1.92]; p=0.17). Poorer diabetes control was associated with worse HRQOL (mean -0.32, 95%CI [-0.63, -0.01]; p=0.04).

CONCLUSIONS: Surprisingly, HRQOL in children/adolescents with type 1 diabetes was similar to their siblings. This was encouraging as type 1 diabetes may not adversely affect HRQOL to the degree expected in Taranaki children.

A diagnosis of type 1 diabetes leads to a significant change in lifestyle for the affected child or teenager and their family. Considerable and unrelenting personal and family stress arise from the regular administration of subcutaneous insulin, frequent blood glucose testing, monitoring, dietary alterations and management of hypo- and hyperglycaemia. It is not surprising, therefore, that type 1 diabetes would be associated with a reduction in an individual’s health-related quality of life (HRQOL).

‘Quality of life’ has been defined as “a broad range of human experience related to one’s overall well-being... defined by subjective experiences, states and perceptions.” It is increasingly recognised as an important part of any assessment of health and well-being, and in the overall understanding of chronic illness. A number of different measurement tools have been validated and proven useful to detect ‘hidden’ morbidities, improve patient-doctor communication, and improve clinical decision-making. Some advocate the assessment of HRQOL as part of best clinical practice, and quantifying HRQOL may predict future health-care costs. HRQOL tools can allow for comparisons between healthy populations and those struggling with chronic conditions, such as asthma or diabetes.

The impact of living with type 1 diabetes has been well described, and it is generally reported that children and adolescents with diabetes show sub-optimal quality of life compared with their peers. The concern is not only around negative effects on day-to-day functioning, but whether impairment in quality of life reflects long-term impacts on mental health. A number of studies in children with diabetes have found poorer HRQOL, and later higher psychiatric morbidity compared with a group of age- and gender-matched controls. However, a meta-analysis of 22 studies found only a mildly elevated overall...
risk of psychological difficulties, including depression, anxiety and behavioural problems in children with diabetes. HRQOL has not previously been studied in New Zealand children with diabetes.

The primary objective of this study was to evaluate the quality of life of children and adolescents with type 1 diabetes in the Taranaki region (New Zealand) compared to a group of their siblings without diabetes or chronic disease.

Methods

Participants

All children and adolescents with type 1 diabetes in the Taranaki region and their parents were approached during the multi-disciplinary diabetes clinics in May–July, 2013. At this time, there were 67 children and adolescents with diabetes in the region (background population 23,127 children/young people less than 15 years of age). All patients were managed by a team of paediatricians, a dietitian, and a diabetes nurse educator, who were able to refer patients to Child and Adolescent Mental Health Services (CAMHS), if deemed necessary. Study approval was obtained by the Taranaki Base Hospital Clinical Board, and the Māori Health Unit. The study was classed as an audit for study purposes by the New Zealand Health and Disability Ethics Committee.

Exclusion criteria for diabetes group analysis included: those diagnosed within the last 6 months; those with type 2 diabetes or cystic fibrosis (CF)-related diabetes; and those with psychological or other medical conditions (active CAMHS involvement, complex congenital heart disease, and attention deficit hyperactivity disorder [ADHD]).

The Pediatric Quality of Life Inventory (PedsQL™) measurement model was specifically designed to evaluate HRQOL in children and adolescents, with both parent-proxy and child self-report versions. The 23-item Generic Core Scale questionnaire is divided into four areas, assessing problems over the preceding month related to physical, emotional, social and school functioning. The reliability and content validity of this instrument has been demonstrated. The developers of the PedsQL™ propose using one standard-deviation below the population mean as a meaningful cut-off for those at risk of impaired HRQOL compared to other children.

Parent-proxy questionnaires in all age groups (2–17 years) and patient self-report questionnaires in those aged 8–17 years were completed in the waiting room prior to, or after, clinical appointments. Parent-proxy questionnaires and self-reports for those aged 8–16 years were also collected for all siblings. The same parent answered the proxy reports for all participating offspring, so if there was more than one sibling, all were included. Questionnaires were also collected from diabetes patients who were without siblings, or whose siblings were outside the age range (2–17 years).

Demographic information was collected and New Zealand Deprivation Index score was calculated based on home address, using 2006 census data on household income. The score is divided into deciles; one representing the least deprived area and 10 the most deprived. Diabetes-related information was collected, including clinical details, duration of disease, average glycated Haemoglobin (HbA1c) over past year, associated diagnoses, and hospital admissions (admissions at diagnosis were excluded in analyses). HbA1c was collected in clinic, using point-of-care testing with the DCA 2000 Analyzer (Siemens Medical Solutions Diagnostics, Puteaux, France).

For those patients with diabetes included in analysis, average HbA1c were divided into three levels of control used in clinic, based on the International Society for Pediatric and Adolescent Diabetes (ISPAD) guidelines, with optimal control defined as <58mmol/mol (HbA1c <7.5% DCCT standardised), suboptimal control 58–75mmol/mol (7.5–9%) and high risk of metabolic complications >75mmol/mol (>9%).

Quality of life measures

The PedsQL™ 4.0 Generic Core Scale was used for both the sibling and diabetes groups. Item answers were reverse scored and linearly transformed to a 1–100 scale, with higher scores representing a better health-related quality of life (Generic Scaled Score). The Generic Core Total Score results were divided into two outcomes: the Psychosocial Health Summary Score.
and Physical Health Summary Score. The summary scores were then converted to Psychosocial Scaled Score and Physical Health Scaled Scores.

Statistical analyses
Statistical analyses were performed using SAS version 9.3 (SAS Institute Inc. Cary NC) and R version 2.15 (R Foundations for Statistical Computing). All statistical tests were two-sided at a 5% significance level. Correlation and agreement between the parent proxy- and child self-reports for those aged 8 years and older, were evaluated using the Spearman’s correlation coefficients and the Bland-Altman plots. Any missing parent proxy-reports were replaced with the child self-report, if the information was available (ie, child was >8 years of age).

Simple t-tests were first conducted to compare the Scaled Scores between the diabetes group and their siblings. Linear regression models were next fitted to explore the mean difference in scaled scores between the two groups adjusting for important confounding factors (age group, gender, ethnicity, and deprivation index). For the type 1 diabetes group, linear regression models were used to investigate the predictive effects of HbA1c (the mean and levels of control), duration of diabetes and any hospital admission for diabetes on the scaled scores, adjusting for the same confounding factors. Regression coefficients and 95% confidence intervals were estimated.

Results
This study achieved an 84% response rate in our total diabetes population (n=56/67). Fourteen patients were subsequently excluded (those with type 2 diabetes [n=3], Cystic fibrosis [n=1], ADHD [n=2], CAMHS involvement [n=4], diagnosis within 6 months [n=3] and other medical conditions [n=1]). Results from 42 type 1 diabetes patients were analysed and compared with siblings aged 2–16 years without diabetes or chronic illness who participated in this study.

Parent-proxy reports for the PedsQL Generic Core Scale were obtained for 93% of those who participated in the diabetes group (n=39/42; 3 adolescents attended clinic without a parent). Self-reports from 100% of older children and adolescents in the diabetes group (aged 8–17 years) were completed (n=35/35).

Questionnaires were completed on the sibling comparisons, with parent-proxy reports returned on the whole group and self-reports obtained on 96% of the siblings aged 8–16 years (n=25/26).

The demographic data of the participants are given in Table 1. There were no differences in demographic parameters between groups, apart from deprivation index, which was higher in the diabetes group. This arose from some diabetes patients having multiple siblings included, and some with no, unwilling or ineligible siblings (n=38). This was adjusted for in regression analysis.

<table>
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<th>Table 1: Demographic characteristics of patients with type 1 diabetes and their siblings. Data are means ± SD (ranges) or n (%).</th>
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<tbody>
<tr>
<td><strong>Type 1 diabetes</strong></td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Gender (males)</td>
</tr>
<tr>
<td>Ethnicity</td>
</tr>
<tr>
<td>New Zealand European</td>
</tr>
<tr>
<td>Māori</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Age group</td>
</tr>
<tr>
<td>2–7 years</td>
</tr>
<tr>
<td>8–12 years</td>
</tr>
<tr>
<td>13–17 years</td>
</tr>
<tr>
<td>Deprivation index</td>
</tr>
</tbody>
</table>
Table 2: Clinical characteristics of patients with type 1 diabetes. Data are means ± SD (ranges) or n (%).

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diabetes duration (years)</strong></td>
<td>42</td>
<td>5.1 ± 3.6 (0.75–13.58)</td>
</tr>
<tr>
<td><strong>HbA1c (mmol/mol)</strong></td>
<td></td>
<td>72.5 ± 18.5 (36.8–130)</td>
</tr>
<tr>
<td><strong>Glycaemic control (HbA1c)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk (&gt;75 mmol/mol or &gt;9%)</td>
<td>12</td>
<td>(29%)</td>
</tr>
<tr>
<td>Suboptimal (58–75mmol/mol or 7.5–9%)</td>
<td>25</td>
<td>(60%)</td>
</tr>
<tr>
<td>Optimal (&lt;58mmol/mol or &lt;7.5%)</td>
<td>5</td>
<td>(12%)</td>
</tr>
<tr>
<td><strong>Hospital admissions for diabetes in the past year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>(67%)</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>(26%)</td>
</tr>
<tr>
<td>≥2</td>
<td>3</td>
<td>(7%)</td>
</tr>
</tbody>
</table>

Excluding those diagnosed <6 months, type 2 diabetes, CF-related and associated diagnoses (congenital heart disease, ADHD, CAMHS involvement).

Table 3: Unadjusted quality of life Generic Scaled Scores (out of 100), as assessed by the parent proxy-reports. Data are means ± SD.

<table>
<thead>
<tr>
<th></th>
<th>Type 1 diabetes</th>
<th>Siblings</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>42</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td><strong>Total Generic Scaled Score</strong></td>
<td>75.9 ± 13.4</td>
<td>80.8 ± 14.0</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Physical Scaled Score</strong></td>
<td>80.0 ± 17.9</td>
<td>82.7 ± 14.2</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>Psychosocial Scaled Score</strong></td>
<td>73.7 ± 13.1</td>
<td>79.8 ± 15.0</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 4: Regression analysis on quality of life Generic Scaled Scores comparing patients with type 1 diabetes and siblings (n=77). Statistical analyses have adjusted for age group, gender, ethnicity, and New Zealand Deprivation Index. Model-adjusted mean estimate of difference in Scaled Scores between two groups, standard error of mean (SEM), and 95% confidence interval (CI) are reported with p-value.

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>SEM</th>
<th>95% C.I.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic Scaled Score</strong></td>
<td>-4.37</td>
<td>3.16</td>
<td>-10.67, 1.92</td>
<td>0.17</td>
</tr>
<tr>
<td><strong>Physical Scaled Score</strong></td>
<td>-1.55</td>
<td>3.72</td>
<td>-8.97, 5.87</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Psychosocial Scaled Score</strong></td>
<td>-5.92</td>
<td>3.32</td>
<td>-12.54, 0.69</td>
<td>0.08</td>
</tr>
</tbody>
</table>
The duration of diabetes ranged from 9 months to 13 years, with a mean of 5.1 years (± 3.6SD). One third (n=14/42) had at least one diabetes-related hospital admission within the last year. The mean HbA1c in the past year was 72.5 ± 18.5 mmol/mol (8.8% ± 3.9 DCCT standard). Only 12% of patients (n=5/42) had an average HbA1c in the ‘optimal control’ range, compared with 60% (n=25/42) in the ‘suboptimal control’, and 29% (12/42) in the ‘high risk of metabolic complications’ groups (Table 2).

Comparing parent-proxy and child self-report responses for those children aged 8 years and older showed significant correlations across all PedsQL™ Generic Scaled Scores using the total cohort. The Spearman correlation coefficient for the Physical Scaled Score was 0.55 (p<0.001), and for the Psychosocial Scaled Score 0.48 (p<0.0001) respectively. The Bland-Altman plots indicated good level of agreement on all scores, with only small bias of 1.5 and 0.3 between the child and parent reports respectively. These findings have enabled the parent responses to be used for the entire analysis.

Table 3 shows the unadjusted total Generic Scaled Scores for the sibling and diabetes patient groups, as assessed by the parent proxy reports.

<table>
<thead>
<tr>
<th>Predictors of quality of life scores</th>
<th>Estimate</th>
<th>SEM</th>
<th>95% C.I.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generic Scaled Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c (mean)</td>
<td>-0.32</td>
<td>0.15</td>
<td>-0.63, -0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Diabetes duration</td>
<td>0.78</td>
<td>0.63</td>
<td>-0.51, 2.06</td>
<td>0.23</td>
</tr>
<tr>
<td>Admission for diabetes</td>
<td>14.99</td>
<td>5.61</td>
<td>3.51, 26.5</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Physical Scaled Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c (mean)</td>
<td>-0.61</td>
<td>0.19</td>
<td>-1.01, -0.21</td>
<td>0.004</td>
</tr>
<tr>
<td>Diabetes duration</td>
<td>1.17</td>
<td>0.82</td>
<td>-0.50, 2.84</td>
<td>0.16</td>
</tr>
<tr>
<td>Admission for diabetes</td>
<td>18.62</td>
<td>7.28</td>
<td>3.74, 33.5</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Psychosocial Scaled Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c (mean)</td>
<td>-0.15</td>
<td>0.16</td>
<td>-0.47, 0.17</td>
<td>0.35</td>
</tr>
<tr>
<td>Diabetes duration</td>
<td>0.53</td>
<td>0.66</td>
<td>-0.83, 1.88</td>
<td>0.44</td>
</tr>
<tr>
<td>Admission for diabetes</td>
<td>12.84</td>
<td>5.93</td>
<td>0.72, 25.0</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Table 5: Regression analysis on quality of life Generic Scaled Scores among patients with type 1 diabetes (n=42), with the predictors of interest. Statistical analyses have adjusted for age group, gender, ethnicity, and New Zealand Deprivation Index. Model-adjusted mean estimate of change in Scaled Scores associated with each predictor, standard error of mean (SEM), and 95% confidence interval (CI) are reported with p-value.

Adjusted regression analysis on the total cohort indicated no difference in the Scaled Scores between the siblings and the diabetes groups (Table 4).

For pre-defined confounding variables, the Deprivation Index was a significant confounding factor in all regression models on the total cohort, indicating a strong negative association with the Scaled Scores. That is, children living in more socially deprived areas had poorer HRQOL, regardless of having diabetes or not. The mean Generic Scaled Score was 1.82 lower (95% CI [-3.26, -0.39]; p-value 0.01) with per unit increase in Deprivation Index. Compared with male patients, female patients also had a significantly lower Psychosocial Scaled Score (mean -8.11, 95% CI [-14.47, -1.76]; p-value 0.01) and Generic Scaled Score (mean -6.91, 95% CI [-12.96, -0.86]; p-value 0.03). There was no association on HRQOL found with age group and ethnicity.

For those type 1 diabetes patients, three potential predictors of interest were fitted in the adjusted regression model to see whether they had any predictive effect on the scaled scores. The mean HbA1c had a significant effect on the Physical Scaled Score (mean -0.61, 95% CI [-1.01, -0.21]; p=0.004), and the Generic Scaled Score (mean -0.32, 95% CI [-0.63, -0.01]; p-value...
Any hospital admission for diabetes was a significant predictor of higher HRQOL in all domains (Table 5). Using the HbA1c ranges of control did not show any significant association with the scaled scores. None of the confounding factors were statistically significant in these models.

**Discussion**

This study represents the perceived HRQOL of Taranaki children and young people with diabetes. Overall, there was no difference in HRQOL found between the diabetes group and their siblings. Females however, had lower overall HRQOL and psychosocial quality of life compared to males in both the sibling and diabetes groups. The psychosocial component makes up the majority of the PedsQL™ Generic 4.0 questionnaire, with questions relating to emotions, fears, school and social functioning. The observed poorer HRQOL in females is found in many other studies and may reflect eventual higher rates of psychological diagnoses, such as depression, somatic complaints and anxiety in women.

Higher deprivation scores in the diabetes group compared to sibling group likely reflects the greater number of households sampled in the diabetes group, as those diabetes patients without siblings were still included in the study.

Poorer diabetes control was associated with significantly lower physical quality of life and overall HRQOL with increasing HbA1c. This finding is replicated in other larger studies. Persistently raised blood glucose levels contribute to adverse effects on mood and coordination, and possibly neurocognitive function, but long-term studies are minimal in children and adolescents. A Swiss study did find that in boys with type 1 diabetes, there was a significant decline in verbal intelligence quotient between age 7 and 16 years if diagnosed before age 6, and this was correlated with high long-term HbA1c and degree of metabolic deterioration at diagnosis. These findings were not replicated in girls, or boys diagnosed after 6 years.

An unexpected finding was that a diabetes-related hospital admission was associated with higher HRQOL scores. This finding has not been described elsewhere, and may be due to the small numbers in this study. Information on whether the admission was due to diabetic ketoacidosis, poorly-controlled blood glucose levels, or an episode of hypoglycaemia was outside the scope of the study. It may be that not all admissions for diabetes have equal impact. Intensive education and support gained while on the ward perhaps has a beneficial effect on those patients.

Parent-proxy and child self-report responses were strongly correlated for both the diabetes and sibling groups. Self-reports were not collected on the younger children (2–7 years), but given the correlation found with our older children, it was assumed that parent responses in these cases were a representative reflection of their child’s. Other studies have found that parents tend to report their child’s HRQOL as being poorer and more restricted by the burden of chronic disease than do the children themselves.

The main limitations of this study were the small sample size, and the lack of a population-based control group. The raw scores of our sibling group (Generic Scaled Score mean 80.8 ± 13.97), however, are comparable to a large population study of children using the same PedsQL™ 4.0 instrument (10,241 children aged 2–16 assessed at enrolment in California’s Children’s Health Insurance Program 2001–2003; Generic Scaled Score mean 81.3 ± 15.9). Siblings, with the same family background and living in identical environments, may actually be more closely correlated to our patient group than a group of non-related controls. It is also difficult to take into account the impact on a sibling’s quality of life by having a brother or sister with a chronic illness, such as diabetes, in the family. We were unable to conduct a paired one-to-one comparison with diabetes patients and their siblings, as there were many with no, unwilling or ineligible siblings. Other potential limitations include undertaking the questionnaire before or after the clinic appointment, and the use of parent reports for analysis. With a relatively small regional population, the decision to use parent reports was deemed justified by the authors. However, while there was good correlation between child-parent reports, it is acknowledged these will not be identical.
Diabetes is a life-long illness with potentially major effects on a child's physical and mental health. Impacts on psychological health may be difficult to quantify and HRQOL assessment is one useful tool in the evaluation of a patient's well-being.

Factors such as family dynamics, parental separation, sibling relationships, behavioural problems, and school performance should be explored. It may be a diagnosis of diabetes un-masks or worsens underlying psychological stressors. Early identification of these is important for families to be given support and coping strategies.

In summary, children and adolescents with type 1 diabetes reported a quality of life surprisingly similar to their siblings. While siblings might be adversely affected by having a family member with diabetes, these results were similar to the limited background international population data available. These results are encouraging as type 1 diabetes may not adversely affect quality of life to the degree expected, but need to be interpreted with caution, given the lack of a population-based sample. The current strategies used in paediatric diabetes care may be effective in at least addressing some of the psychological challenges children with diabetes face. It does not minimise, however, the burden of psychological stress experienced in this population, and the need for access to appropriate psychological services. Further study of HRQOL with parent and child reports in a larger cohort of New Zealand children and adolescents with diabetes is warranted.

**REFERENCES:**

7. Kalyva E, Malakonaki E, Mamoulakis D. Health-related quality of life...


Therapeutic hypothermia is independently associated with favourable outcome after resuscitation from out-of-hospital cardiac arrest: a retrospective, observational cohort study
Kerry A Benson-Cooper

AIM: To determine the association between use of therapeutic hypothermia (TH) after resuscitation from out-of-hospital cardiac arrest (OHCA) and neurological outcome.

METHOD: Retrospective observational cohort study in a tertiary university-associated Level III general ICU of 179 ICU patients in three cohorts (‘pre’ hypothermia: 58 patients, ‘post’ hypothermia 69 patients, ‘recent’ 52 patients) admitted between 1 January, 2009, and 15 April, 2011, after resuscitation from OHCA. Interventions: TH to 33°C for 12 hours. Main outcome measures: Favourable neurological outcome (transferred home) at hospital discharge.

RESULTS: The frequency of bystander CPR increased (38/58, 56/69, 47/52, p=0.04), as did the use of TH (0/58, 25/69, 39/52, p<0.00001) and the frequency of favourable neurological outcome between the three cohorts (21/58, 28/69, 32/52, p=0.02). The cohorts were similar in age, gender, shockable rhythm and time to ROSC. In multivariate analysis, favourable neurological outcome was independently associated with younger age (in 5-year intervals, OR 0.78 [0.67–0.90], p=0.001), bystander CPR (OR 4.8 [1.5–15], p=0.007), shockable rhythm (OR 3.5 [1.1–11], p=0.04), time to ROSC (OR 0.90 [0.86–0.94], p<0.0005) and use of TH (OR 2.8 [1.2–6.2], p=0.01).

CONCLUSIONS: The use of TH in patients admitted to ICU after resuscitation following OHCA was independently associated with favourable neurological outcome.

In Australasia, out-of-hospital cardiac arrest (OHCA) has a reported annual incidence of 30–148/100,000,1,2 with 29–42% of patients achieving return of spontaneous circulation (ROSC),3 but only 8–11%,1,2 surviving to hospital discharge. Outcome is better with cardiac aetiology,4 at a younger age, with bystander CPR, shockable rhythm (VT/VF vs PEA/asystole), and with shorter times to defibrillation and to ROSC.3,4 Post-cardiac arrest admissions constituted 2.4% of 1,001,754 admissions to the ICUs reporting to the ANZICS adult database between 2000 and 2011.5 In patients admitted to ICU, death is predominantly due to hypoxic-ischaemic encephalopathy and usually follows withdrawal of therapy because of severe neurological damage; a few patients become brain dead.6 Two studies published in May, 2002, showed a survival benefit of therapeutic hypothermia (TH) post-ROSC. The European study7 used cooling to 32–34°C within 4 hours of ROSC which was maintained for 24 hours, while the Australian study8 cooled to 33°C within 2 hours of ROSC and maintained this
for 12 hours. Both studies showed improved neurological outcome with TH with absolute increases in favourable CNS outcome of 16% and 23% respectively. A meta-analysis of these trials, and a third smaller trial, showed an NNT of 6 (95%CI 4–13) for TH to produce one additional patient with favourable neurological outcome.

We began using TH in 2002; our protocol involved cooling to 33°C for 12 hours, with opioid, sedation and neuromuscular blockade. These agents were continued during rewarming to 36°C to prevent shivering. Sedative-free clinical assessment commenced after normothermia and advanced supportive treatment was withdrawn in accord with the findings of Levy and the recommendations of the American Academy of Neurology.

In order to establish whether the use of TH was associated with improved neurological outcome at hospital discharge, we reviewed three cohorts of patients admitted between 2000 and 2009.

Methods

We identified, from our prospective ICU database (with ethics committee approval and waived consent), all patients admitted to the ICU who had had a primary OCHA in three cohorts: ‘pre’—58 patients between 1 January 2000 and 16 May 2002 (the first patient treated with TH was on 17 May 2002); ‘post’—69 patients between 17 May 2002 and 31 December 2004; and ‘recent’—52 patients from 1 January 2009 to 15 April 2011. The ICU is a nominal 18-bed (14 ICU, 4 HDU), adult-only, general unit in Auckland City Hospital which provides secondary care to the Auckland District Health Board region (population 476,000 in 2014) as well as extensive tertiary (medical, surgical, oncology, trauma, neuroservices) and national (transplant) services. We obtained demographic data from the ICU database and further information (arrest characteristics, whether TH was given or not, and outcome at hospital discharge) from the clinical notes. Arrest characteristics were bystander CPR (received or not/unknown), first monitored rhythm (shockable (VF/VT) vs non-shockable (all others), and time to ROSC (defined as time of ambulance dispatch to ROSC). The treatment data collected were whether the patient received TH or not. One investigator (KBC) assigned a dichotomised Glasgow Outcome Scale (GOS) outcome at hospital discharge of either favourable (good recovery and moderate disability), or unfavourable (severe disability, persistent vegetative state and dead) from information in the clinical notes. Patients who were discharged home (with either no assistance or some assistance) were assigned to good recovery or moderate disability. Patients who were discharged to any other location (rest homes or private hospitals) were assigned to severe disability (there were no patients in persistent vegetative state). We used Stata® software (StataCorp LP, Texas, US) and Chi-squared to compare categorical variables, and Spearman’s rank correlation to compare age and time to ROSC between the three patient groups. As age, bystander CPR, shockable rhythm and time to ROSC are known predictors of better outcome, we performed univariate and multivariate analysis to determine the influence of these factors, as well as therapeutic hypothermia, on dichotomised GOS. Ethical approval was obtained from the Northern X Regional Ethics Committee on 18 August 2011 (NTX/11/EXP/180).

Results

The demographic characteristics of each of the three cohorts of patients are shown in Table 1, along with the incidence of bystander CPR, shockable first rhythm, time to ROSC and use of therapeutic hypothermia. The cohorts were similar in age, gender, shockable rhythm and time to ROSC. The frequency of bystander CPR increased (38/58, 56/69, 47/52, p=0.04), as did the use of TH (0/58, 25/69, 39/52, p<0.00001) between the three cohorts.

Table 2 shows outcome at hospital discharge for the three cohorts of patients. The frequency of favourable neurological outcome significantly increased between the three cohorts (21/58, 28/69, 32/52, p=0.02).

Table 3 shows the odds ratios for favourable neurological outcome of age, gender, bystander CPR, shockable rhythm, time to ROSC and use of therapeutic hypothermia in a univariate and multivariate analysis. In multivariate analysis, favourable neurological outcome was independently associated with a younger age (in 5-year
intervals, OR 0.78 [0.67–0.90], p=0.001), bystander CPR (OR 4.8 [1.5–15], p=0.007), shockable rhythm (OR 3.5 [1.1–11], p=0.04), time to ROSC (OR 0.90 [0.86–0.94], p<0.0005) and use of TH (OR 2.8 [1.2–6.2], p=0.01).

Discussion

The median age of the three cohorts of patients were similar, and similar to the patients in the two sentinel trials of TH. but included a few younger patients. The gender of the patients was similar between the three cohorts and reflected the male predominance found in all studies of OCHA. The time to ROSC was similar between the three cohorts, somewhat longer than in the Australian TH trial and shorter than in the European trial.  The incidence of shockable rhythm was high, similar between the cohorts, and in keeping with the more recent targeted temperature management (TTM) trial.  The incidence of bystander CPR was high (~79% overall, with a significant increase between the cohorts), similar to that found in the TTM trial and higher than in the earlier Australian and European trials.

Therapeutic hypothermia was not used prior to the publication of the NEJM trials, and increased between the cohorts.

### Table 1: Cohort characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Recent</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>58</td>
<td>69</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>39 (67%)</td>
<td>48 (70%)</td>
<td>34 (65%)</td>
<td>N.S.</td>
</tr>
<tr>
<td>Median Age–Years (Range)</td>
<td>61 (16–82)</td>
<td>58 (21–82)</td>
<td>60 (20–81)</td>
<td>N.S.</td>
</tr>
<tr>
<td>Bystander CPR</td>
<td>38 (66%)</td>
<td>56 (81%)</td>
<td>47 (90%)</td>
<td>p=0.04</td>
</tr>
<tr>
<td>Shockable First Rhythm</td>
<td>46 (80%)</td>
<td>56 (81%)</td>
<td>48 (92%)</td>
<td>p=0.21</td>
</tr>
<tr>
<td>Median Time To Rosc (Mins)</td>
<td>20</td>
<td>18</td>
<td>17</td>
<td>N.S.</td>
</tr>
<tr>
<td>Use Of TH</td>
<td>0</td>
<td>25 (36%)</td>
<td>39 (75%)</td>
<td>P&lt;0.0001 (post vs recent)</td>
</tr>
</tbody>
</table>

### Table 2: Outcome at hospital discharge.

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Recent</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfavourable</td>
<td>37</td>
<td>41</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Favourable</td>
<td>21 (36%)</td>
<td>28 (41%)</td>
<td>32 (62%)</td>
<td>p=0.02</td>
</tr>
</tbody>
</table>

### Table 3: Effects of variables on favourable outcome.

<table>
<thead>
<tr>
<th></th>
<th>Univariable</th>
<th>Multivariable Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OOR</td>
<td>95% CI OR</td>
</tr>
<tr>
<td>Age*</td>
<td>0.81</td>
<td>0.72-0.91</td>
</tr>
<tr>
<td>Male</td>
<td>1.2</td>
<td>0.63-2.3</td>
</tr>
<tr>
<td>Bystander CPR</td>
<td>4.2</td>
<td>1.6-11</td>
</tr>
<tr>
<td>Shockable Rhythm</td>
<td>3.8</td>
<td>1.4-9.9</td>
</tr>
<tr>
<td>Time To ROSO</td>
<td>0.91</td>
<td>0.88-0.95</td>
</tr>
<tr>
<td>Use Of TH</td>
<td>3.4</td>
<td>1.8-6.5</td>
</tr>
</tbody>
</table>

* Age difference from median (59.5 years) in increments of 5 years
We decided to confine the use of TH to patients who had been resuscitated from a shockable rhythm, (although 4 patients in the ‘post’ cohort who had non-shockable rhythms were cooled). In the ‘recent’ cohort, 38/48 (79%) patients with shockable rhythms and none with non-shockable rhythms were cooled.

There has been a significant increase in the proportion of patients with a favourable outcome over the three study periods of a similar nature to the original studies. This finding is also consistent with registry data in Australasia, and has also shown a progressive improvement in outcome over the period 2000–2011 for post-arrest patients.

This study confirmed that favourable neurological outcome was not associated with gender, but was more common in younger patients, when there had been bystander CPR and with a shorter time to ROSC. Therapeutic hypothermia was also associated with favourable outcome, including independently by multivariate analysis.

We wrote our TH protocol and treated the first patient in May 2002, three months after the publication of the two sentinel papers. Initially we used TH selectively for patients meeting our protocol, largely out of concern for the development of cardiogenic shock in an elderly comorbid population with a high incidence of myocardial ischaemia. Although heart rate and cardiac index were significantly lower in the hypothermic group in the Australian trial of TH, these haemodynamic consequences did not translate into higher mortality. With experience, our concerns lessened and we increased our use of TH.

We assigned outcome (favourable vs unfavourable) on the basis of review of clinical notes by a single assessor, based on both neurological performance and placement after hospital discharge. Since all patients who were discharged home were assigned good recovery or moderate disability and all patients discharged to other places (or who died in hospital) were assigned to unfavourable outcome and the discharge location was clearly documented and was unalterable by the assessor, there is no possibility of bias in our determination of outcome.

There has been further development of this topic since this study was undertaken. The TTM trial showed that hypothermia (33°C) did not confer a survival or neurological benefit compared with temperature control at 36°C in unconscious survivors of OCHA. Although apparently compelling (we are in the process of developing an in-house protocol for TTM, including explicit guidelines for prognostication), we have some reservations about changing from a practice (TH) which, in our experience, is associated with improved outcomes.

We conclude that the use of TH in patients admitted to ICU after resuscitation following OHCA was independently associated with favourable neurological outcome.

**Competing interests:** Nil
**Acknowledgements:**
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**URL:**
REFERENCES:

A cost effectiveness analysis of community water fluoridation in New Zealand

Caroline Fyfe, Barry Borman, Guy Scott, Stuart Birks

ABSTRACT

AIM: The aim of the study was to use recent data to determine whether Community Water Fluoridation (CWF) remains a cost effective public health intervention in New Zealand, given a reduction in dental caries in all communities over time.

METHOD: Local authorities that fluoridated their water supplies were asked to complete a questionnaire regarding fixed and variable costs incurred from CWF. Cost savings were calculated using data from the 2009 New Zealand Oral Health Survey. The cost effectiveness of CWF in conjunction with treatment per dmft/DMFT averted was compared to an alternative of treatment alone. Calculations were made for communities with populations of less than 5,000, 5,000 to 10,000, 10,001 to 50,000 and greater than 50,000.

RESULTS: CWF was cost effective in all communities at base case. CWF remained cost effective for communities over 5,000 under all scenarios when sensitivity analysis was conducted. For communities under 5,000 the there was a positive net cost for CWF under certain scenarios.

CONCLUSION: In this study, CWF was a cost effective public health intervention in New Zealand. For smaller communities cost effectiveness would be more dependent upon the population risk profile of the community.

The World Health Organization (WHO) recommends a water fluoride concentration of 1–1.5mg per litre, depending on local climatic conditions. This level has been set in order to maximise the caries preventative benefit of Community Water Fluoridation (CWF) while minimising the degree and prevalence of dental fluorosis (which causes stained, mottled teeth). New Zealand was one of the first countries to adopt CWF as a public health intervention to lower rates of dental cavities. Results from early trials found that children born and brought up in fluoridated areas had, on average, 50% fewer cavities compared to children from non-fluoridated areas.

Approximately 56% of New Zealander’s have access to fluoridated water. The Ministry of Health recommends a water fluoride concentration of 0.7–1.0mg/l to improve oral health; however, responsibility for implementing CWF has remained with local authorities since the 1950s.

The last economic analysis of CWF in New Zealand, by Wright et al (2001), found it was a cost effective intervention in communities of over 1,000 people. It has been noted that prevalence of dental caries has decreased over time, both in fluoridated and non-fluoridated communities. The aim of the current study was to use more recent data to determine whether community water fluoridation remained a cost effective public health intervention in New Zealand.

Method

A cost effectiveness analysis (CEA) was conducted from a societal perspective. CWF at a level of 0.7–1.0mg/l with treatment was evaluated against a treatment only option for the prevention of dental caries. The CEA measured the cost of preventing one newly decayed tooth, rather than a tooth surface, as the effectiveness data for teeth had greater statistical significance than that for tooth surfaces.

In line with Wright et al, the CEA examined the relationship between cost effectiveness and community size. Four
communities sizes (minor, medium, large 1 and large 2) were identified based on three Register of Drinking Water Suppliers for New Zealand derived groupings. The large group was split into two, due to a wide variation in the size of communities included.

CEA was conducted separately for children and total population. Fluoride was considered to be effective for all adults that were dentate. Recent evidence suggests the effectiveness of fluoride is both systemic and topical, resulting in a protective effect continuing after teeth have erupted.7

Data collection
Fluoridation status of water supplies was identified using data from the National Fluoridation Information Service (NFIS), Environmental Scan for 2011–2012.8 Local authorities supplying fluoridated water were contacted to identify the correct person and organisation to direct questions regarding CWF. A questionnaire was emailed to the organisations identified. If replies were not received within two weeks, a follow-up phone call was made and a second email sent. This process was repeated if there was no response after six weeks. After this point, a non-response outcome was assumed and no further contact made.

Fixed capital costs, lifespan of plant and machinery, salvage value, and ongoing costs (purchase of chemical, labour from administration and maintenance of CWF and water testing) were requested in the questionnaire. Population which received a fluoridated water supply were cross referenced against the Register of Drinking Water Suppliers for New Zealand.6

Cost of adverse side effects (dental fluorosis) was assumed to be negligible and not attributed a value. This was in line with previous studies undertaken.5,10 In addition, the most recent New Zealand Oral Health Survey found no statistically significant difference in prevalence of dental fluorosis between 8–30-year-olds living in areas with CWF compared to those in areas without CWF.7

Data on mean difference in decayed, missing and filled teeth (dmft: deciduous teeth; DMFT: permanent teeth) between fluoridated and non-fluoridated communities were taken from the New Zealand Oral Health Survey.7 These data represented a mean for the total New Zealand population and were adjusted for age, gender, ethnicity and socioeconomic deprivation. Dental costs averted were identified for total population, and children. The proportion of dentate people within the population was calculated using data from the same source.7

Consistent with previous studies, the following assumptions were made:

• All carious surfaces would be treated and treatment would comprise of a two surface dental restoration per dmft/DMFT.10-12 Wright et al based their analysis on a dental restoration.
• Cost was based on the reimbursement rate under the CDA base agreement for the treatment of children and adolescents,13 adjusted to the 2011/2012 financial year using the consumer price index.14 This cost may be conservative for total population as adults visiting a private dental practice may be charged at a higher rate.
• There would be a one hour loss of productivity to attend a dental appointment.9 Indirect costs arising from loss of productivity were based on the average hourly wage rate in 2011.15
• The population profile reflects that of the New Zealand population, described in the New Zealand Oral Health Survey,7 from which effectiveness data for CWF was based. Level of effectiveness had already been adjusted for ethnicity, age and gender.

Data Analysis
Data on costs of CWF received from local authorities supplying fluoridated water was adjusted to the 2011/2012 financial year using the New Zealand Consumer Price Index.14 Average annual equivalised costs were calculated at a base discount rate of 3.5% (as recommended by PHARMAC),16 and a base life span for capital equipment of 15 years—based on questionnaire responses and in line with other analyses conducted in Australasia.5,10 The salvage value of plant and machinery (FV) was set at zero in line with questionnaire responses.

The Annual Equivalised Cost of capital equipment was calculated and added to the annual costs for the chemical, mainte-
nance and testing. The sum was divided by the population of the community served, to gain an Annual Equivalised Cost per person (AEC per capita).

Average AEC per capita was determined for communities with populations of: <5,000 (small); 5,000–10,000 (medium); 10,001–50,000 (large 1) and > 50,000 (large 2).

Present value of cost averted resulting from CWF was calculated for the mean difference in dmft/DMFT between communities with CWF and those without. The cost of treatment was divided by the lifespan of the treatment (12.8 years), to determine annual cost averted at a discount rate of 3.5%. Annual cost averted was divided by the percentage of the population who were dentate to give an annual equivalised per person cost averted (AES per capita).

Cost effectiveness was calculated using net cost per DMFT averted, by subtracting AES per capita from AEC per capita, (see Appendix 1 for formulae used in the data analysis).

Sensitivity Analysis

A univariant sensitivity analysis was conducted. Univariant analysis was used as (with the exception of the discount rate) inputs were prone to parameter uncertainty rather than causing uncertainty to the cost effectiveness ratio as a whole.

Sensitivity analysis was conducted on:

- Discount rates: 0%, 5% recommended for sensitivity analysis by PHARMAC, and 6.4%, the nominal rate recommended by the New Zealand Treasury.
- Number of years of life for fluoridation equipment, 8–30 years based on the shortest and longest replacement periods reported for parts in the questionnaire.
- Number of years of life for a dental restoration, 8–15 years based on protocol from previous studies.

Results

Fluoridation Costs Questionnaire

Twenty-eight communities (total population 2,110,778) were identified as receiving fluoridated water from 20 suppliers in 2011/2012. All 20 suppliers were contacted and asked to complete the questionnaire. Sixteen responded, of whom two suppliers refused to answer the questions for commercial reasons, two sets of costs were incomplete and one set of costs was found to be anomalous. The final inclusion rate of 55% covered 11 of the 20 suppliers of fluoridated water, 12 out of 28 fluoridated communities (43%) and a population of 420,616, (20% of those receiving fluoridated water). Responses were evenly distributed geographically and between sizes of community, with two exceptions. Water providers for four out of the five small fluoridated communities responded to the survey. The provider for Auckland, the largest community receiving fluoridated water (population 1,249,858), did not complete the questionnaire.

At base rate, the total annual equivalised per capita cost of community water fluoridation ranged from $0.37 to $5.63; mean: $1.95; median: $1.32. Full cost details used in the calculation of AEC per capita can be found in Appendix 2. A strong relationship was evident between community size and cost (Table 1).

Costs Averted from Community Water Fluoridation

The difference in mean dmft/DMFT between communities with and without CWF was 1.0 dmft/DMFT (p<0.05) for

Table 1: AEC per capita of CWF at base rate (3.5% discount rate, 15 year lifespan of plant and machinery).

<table>
<thead>
<tr>
<th>Size of community served</th>
<th>Mean annual equivalised cost (AEC) per capita of CWF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small (&lt;5000)</td>
<td>$4.38</td>
</tr>
<tr>
<td>Range: 744–3,240</td>
<td>$5.63–$0.94</td>
</tr>
<tr>
<td>Medium (5–10,000)</td>
<td>$1.23</td>
</tr>
<tr>
<td>Range: 7,542–9,710</td>
<td>$0.71–$1.75</td>
</tr>
<tr>
<td>Large 1 (10–50,000)</td>
<td>$0.66</td>
</tr>
<tr>
<td>Range: 19,000–34,300</td>
<td>$0.68–$0.63</td>
</tr>
<tr>
<td>Large 2 (&gt;50,000)</td>
<td>$0.53</td>
</tr>
<tr>
<td>Range: 74,953–343,900</td>
<td>$0.88–$0.37</td>
</tr>
</tbody>
</table>
children (<18 years) and 0.8 dmft/DMFT (p<0.05), for total population, see Table 2.7

Costs averted, adjusted to 2011 prices, were $82.33 for a two surface dental restoration and $20.64 for one hour’s loss of productivity to attend the dental appointment, based on the average wage in 2011.

The annual equivalent per capita costs averted resulting from CWF was $4.82 for total population and $5.21 for children.

Cost effectiveness of CWF
CWF represented a negative net cost (cost saving) at base rate per dmft/DMFT averted for total population and children in all four communities. This indicated that CWF with treatment was a more cost effective oral health intervention than treatment alone for those groups (Table 3).

Sensitivity Analysis
A negative net cost (cost saving) per dmft/DMFT averted remained for CWF for total population and children in all communities with populations of over 5,000 when the variables were adjusted for sensitivity analysis, (Table 4).

Positive values for communities under 5,000 at the ‘low’ end of the value range indicate that CWF with treatment was less cost effective than treatment alone under certain scenarios: when the discount rate was increased above 3.5%, the lifespan of plant was reduced from 15 to 8 years; when the lifespan of a dental restoration was increased from 12.8 to 15 years; and when only direct costs (cost of treatment but not loss of productivity) were included.

CWF with treatment was less cost effective than treatment alone, for total population in small communities (<5,000) at all discount rates when lifespan of plant and machinery was <8 years and when only direct costs were included. When the base discount rate (3.5%) was used, CWF with treatment was less cost effective than treatment alone when only direct costs were included. When the discount rate was increased to 5% and above, CWF had a positive cost effectiveness ratio when all other variables were at base case.

In small communities (<5,000), CWF with treatment was less cost effective than treatment alone, for children at the base discount rate when a dental restoration was assumed to last >15 years. At a discount rate of 6.4% CWF with treatment was less cost effective than treatment alone for children when all other variables were at base case.

Table 2: Difference in mean dmft/DMFT between fluoridated and non-fluoridated communities

<table>
<thead>
<tr>
<th>Population</th>
<th>Mean dmft/DMFT non-fluoridated area (95% Cl)</th>
<th>Mean dmft/DMFT fluoridated area (95% Cl)</th>
<th>Ratio of means</th>
<th>Difference in mean dmft/DMFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children (2–17 years)</td>
<td>2.4 (2.0–2.6)</td>
<td>1.5 (1.1–1.9)</td>
<td>1.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Total (&gt; 2 years)</td>
<td>12.1 (11.5–12.7)</td>
<td>9.6 (9.1–10.1)</td>
<td>1.1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table 3: Average annual per capita net cost of CWF per dmft/DMFT averted.

<table>
<thead>
<tr>
<th>Population</th>
<th>Cost Effectiveness by Community Size ($ per dmft/DMFT averted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small: (&lt;5000)</td>
</tr>
<tr>
<td>Child</td>
<td>-$2.23</td>
</tr>
<tr>
<td>Total</td>
<td>-$0.55</td>
</tr>
</tbody>
</table>

Table 4: Sensitivity Analysis Range for CWF (net cost per dmft/DMFT averted).

<table>
<thead>
<tr>
<th>Population</th>
<th>Value Range</th>
<th>Cost Effectiveness Range by Community Size ($ per dmft/DMFT averted)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small (&lt;5,000)</td>
<td>Medium (5,000–10,000)</td>
</tr>
<tr>
<td>Child</td>
<td>Low: $2.5</td>
<td>-$1.71</td>
</tr>
<tr>
<td>Total</td>
<td>Low: $4.24</td>
<td>-$1.03</td>
</tr>
<tr>
<td></td>
<td>High: -$7.78</td>
<td>-$10.79</td>
</tr>
</tbody>
</table>
Discussion

The baseline results, which show a negative net cost per dmft/DMFT averted for CWF with treatment when compared to treatment alone, were consistent with Wright et al, and a number of other economic analyses undertaken since.5,9-12,20-25 Cost effectiveness remained, despite an overall reduction in dental caries in the population. In other studies, levels of effectiveness for CWF have varied between 50–60%,11 30%,26 25%22 and 15%.23 Even where gains in effectiveness were modest, savings in dental treatment mean that CWF could still provide a net saving to society both in monetary and oral health terms.

Community size and cost effectiveness of CWF

Due to higher per capita costs for implementation and maintenance, CWF with treatment was less cost effective than treatment alone when lifespan of a filling was reduced to eight years (in line with Wright et al) in small communities. CWF with treatment was also less cost effective than treatment alone for these communities where the lifespan of plant and machinery were reduced and the discount rate increased. These findings were similar to those of previous studies.5,22 Wright et al identified a ‘break-even’ community size for CWF of 700–900 people.5 The four communities making up the ‘small’ classification in this study ranged from 744 to 3,240 people.

Effectiveness of CWF

The levels of effectiveness used in this study were based on adjusted mean differences in dmft/DMFT between fluoridated and non-fluoridated communities, reported by the 2009 New Zealand Oral Health Survey.7 The unadjusted differences represented a 20.7% reduction in dmft/DMFT for the total population and a 47.5% reduction in dmft/DMFT for children. The figure for total population demonstrates a lower level of effectiveness for CWF than found in most previous studies.11,22,26 Despite lower levels of effectiveness, CWF remained cost effective. This finding was supported by Tchouaket et al, who found that cost savings could be achieved even at an effectiveness level of 1%.26

In addition to differences in effectiveness between age groups and over time, some populations are more at risk of caries than others.25,27 The analysis undertaken in this study was based on the New Zealand population as a whole. Communities that have a higher risk of dental caries would show greater cost-effectiveness. This might make small rural communities, where the population has a greater proportion of Māori and/or low-income families, more appropriate candidates for CWF than communities with larger but more affluent populations. Wright et al identified that cost effectiveness increased in areas where the proportion of the population that were Māori was above the national rate.5 Lopez25 identified higher levels of cost savings from CWF amongst (low income) medicaid recipients in Texas. Differences of this sort were also demonstrated by Birch using a hypothetical model of the UK.27

Limitations

This cost effective analysis has a number of limitations. Costs which were not included, for example adverse effects and ‘selling’ CWF to the community, may have led to an over-estimation of the cost effectiveness of CWF. Likewise, cost savings which were not included, such as pain and suffering averted and dental treatments beyond a two surface dental restoration, may have led to an under-estimation of the cost-effectiveness of CWF.

Three limitations arose from the data collection.

Firstly, not all providers responded to the questionnaire.

Secondly, of those providers that did reply, data for five providers was excluded. Data suitable for use in this study equated to around 20% of people who received fluoridated water in New Zealand in 2011/2012.

Thirdly, the open nature of the questions gave a wide scope for attributing costs. While this allowed local authorities to attribute the costs of CWF as they perceived them, it did lead to a lack of consistency between local authorities.

The data for the effectiveness of CWF was taken from the 2009 New Zealand Oral Health Survey. Fluoridation status was determined by where the respondent lived at the time of the survey. Movement
of individuals between communities, resulting in different levels of exposure, and length of time the community had received fluoridated water was not taken into account. The lack of information on lifetime exposure particularly limits the reliability of the data for adults. In addition, confounding factors, such as oral hygiene habits, exposure to other fluoride sources and diet, were not controlled for. It was also assumed that for adults, over 45 years of age, missing teeth had been extracted solely for pathological reasons.  

### Conclusion

The cost effectiveness analysis supports the findings of an earlier economic analysis of water fluoridation in New Zealand by Wright et al. CWF is a cost effective public health intervention in New Zealand for all populations. For smaller communities cost effectiveness is more marginal and dependent on the population profile of the community.

### REFERENCES:

ARTICLE


27. Birch S. The relative cost effectiveness of water fluoridation across communities: analysis of variations according to underlying caries levels. Community Dental Health. 1990:7(1);3-10.
Appendix 1:
Equations used in the cost effectiveness calculation:

1. Annual equivalent cost of capital for CWF:

   \[ PMTc = PV \times DR / (1 - (1 + DR)^{-T}) \]

   Where:
   - \( PMTc \) = Annual equivalent cost of capital equipment (fluoridation equipment)
   - \( PV \) = Present value (purchased cost of the asset)
   - \( FV \) = Future value (salvage cost (if any) of the asset when it is replaced)
   - \( DR \) = Discount rate
   - \( T \) = lifespan of the asset

2. Annual equivalised cost per capita of CWF:

   \[ AEC \text{ per capita} = \frac{(PMT+c+m+t)}{n} \]

   Where:
   - \( PMT \) = Annual equivalent cost of capital equipment
   - \( C \) = annual cost of chemical
   - \( m \) = cost of maintenance, labour and administration
   - \( t \) = cost of independent testing of water fluoride concentration

3. Costs averted resulting from CWF:

   \[ PV = (dc+ic) \times dif(\mu DMFT) \]

   Where:
   - \( PV \) = present value of dental treatment
   - \( dc \) = direct cost (of a two surface amalgam filling)
   - \( ic \) = indirect cost (productivity loss to seek treatment)
   - \( dif(\mu DMFT) \) = the difference in mean DMFT (for the relevant population) resulting from CWF

4. Annual costs averted resulting from CWF:

   \[ PMTs = PV \times DR / (1 - (1 + DR)^{-T}) \]

   Where:
   - \( PMTs \) = Annual equivalent costs averted
   - \( PV \) = Present value (reimbursement rate for treatment)
   - \( DR \) = Discount rate (3.5%)
   - \( T \) = lifespan of the treatment (12.8 years)

5. Annual equivalised per capita costs averted:

   \[ AES \text{ per capita} = \frac{PMTs}{(dentate \ population)} \]

6. Cost effectiveness per dmft/DMFT averted:

   \[ CE = \frac{(AEC-AES)}{dif(\mu DMFT)} \]

   Where:
   - \( AEC-AES \) = net cost of CWF
   - \( dif(\mu DMFT) \) = difference in mean DMFT resulting from CWF
## Appendix 2:
Cost components of CWF by community

<table>
<thead>
<tr>
<th>Plant</th>
<th>Size of community served</th>
<th>Acquisition Costs* ($)</th>
<th>Annual equivalent cost ($)</th>
<th>Chemical** ($)</th>
<th>Maintenance and testing*** ($)</th>
<th>Per capita capital cost ($)</th>
<th>Year</th>
<th>Per Capita Cost of Maintenance and testing ($)</th>
<th>Per Capita Cost of Chemical ($)</th>
<th>Total Annual Costs ($)</th>
<th>Per Capita Annual Costs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>large 2 (&gt;50,000)</td>
<td>114,330</td>
<td>9,926.71</td>
<td>35,700</td>
<td>1,200</td>
<td>101,354</td>
<td>0.1</td>
<td>2011</td>
<td>0.01</td>
<td>36,826.71</td>
<td>0.46</td>
</tr>
<tr>
<td>2</td>
<td>small (&lt;5,000)</td>
<td>22,500</td>
<td>1,953.56</td>
<td>4,624</td>
<td>500</td>
<td>2,040</td>
<td>0.96</td>
<td>2011</td>
<td>0.25</td>
<td>7,077.56</td>
<td>3.47</td>
</tr>
<tr>
<td>3</td>
<td>small (&lt;5,000)</td>
<td>27,500</td>
<td>2,387.69</td>
<td>1,950</td>
<td>500</td>
<td>860</td>
<td>2.78</td>
<td>2011</td>
<td>0.58</td>
<td>4,837.69</td>
<td>5.63</td>
</tr>
<tr>
<td>4</td>
<td>small (&lt;5,000)</td>
<td>22,950</td>
<td>1,950.00</td>
<td>1,687</td>
<td>500</td>
<td>744</td>
<td>2.68</td>
<td>2011</td>
<td>0.67</td>
<td>4,179.64</td>
<td>5.62</td>
</tr>
<tr>
<td>5</td>
<td>large 2 (&gt;50,000)</td>
<td>240,000</td>
<td>2,083.80</td>
<td>22,000</td>
<td>23,432</td>
<td>74,953</td>
<td>0.28</td>
<td>2011</td>
<td>0.31</td>
<td>66,270.02</td>
<td>0.88</td>
</tr>
<tr>
<td>6</td>
<td>medium (5,000-10,000)</td>
<td>30,000</td>
<td>2,604.75</td>
<td>720</td>
<td>7,542</td>
<td>0.35</td>
<td>2011</td>
<td>0.10</td>
<td>0.27</td>
<td>5,324.75</td>
<td>0.71</td>
</tr>
<tr>
<td>7</td>
<td>large 2 (&gt;50,000)</td>
<td>78,749</td>
<td>6,813.94</td>
<td>2,3412</td>
<td>26,500</td>
<td>132,471</td>
<td>0.05</td>
<td>2009</td>
<td>0.20</td>
<td>55,313.94</td>
<td>0.42</td>
</tr>
<tr>
<td>8</td>
<td>medium (50,00-10,000)</td>
<td>85,134</td>
<td>7,391.77</td>
<td>5,410</td>
<td>4,160</td>
<td>9,710</td>
<td>0.76</td>
<td>2009</td>
<td>0.43</td>
<td>16,951.77</td>
<td>1.75</td>
</tr>
<tr>
<td>9</td>
<td>large 1 (10,000-50,000)</td>
<td>27,500</td>
<td>2,387.69</td>
<td>10,000</td>
<td>4,160</td>
<td>19,000</td>
<td>0.13</td>
<td>2011</td>
<td>0.03</td>
<td>12,887.69</td>
<td>0.68</td>
</tr>
<tr>
<td>10</td>
<td>small (&lt;5,000)</td>
<td>22,000</td>
<td>1,910.15</td>
<td>3,048</td>
<td>4,140</td>
<td>3,240</td>
<td>0.59</td>
<td>2011</td>
<td>1.28</td>
<td>9,098.15</td>
<td>2.81</td>
</tr>
<tr>
<td>11</td>
<td>large 1 (10,000-50,000)</td>
<td>55,000</td>
<td>4,775.38</td>
<td>12,670</td>
<td>4,140</td>
<td>34,300</td>
<td>0.14</td>
<td>2011</td>
<td>0.12</td>
<td>21,585.38</td>
<td>0.63</td>
</tr>
<tr>
<td>12</td>
<td>large 2 (&gt;50,000)</td>
<td>66,294.49</td>
<td>5,752.12</td>
<td>89,052</td>
<td>30,674</td>
<td>343,900</td>
<td>0.02</td>
<td>2012</td>
<td>0.09</td>
<td>126,426.12</td>
<td>0.37</td>
</tr>
</tbody>
</table>

* Tank (30 years+), Dosing Pump (8 years), Pipework, Day Tank
**10/12 use hydrofluorosicic acid: two use sodium silico powder no significant difference was found in the costs of these two chemicals
*** Costs vary from purely external testing ($500 p.a.) to including maintenance and calibration, consumables (parts), safety and administration ($22,000 p.a.)
Care, compassion and charity: do they have a place in modern medicine?

Ron Paterson, Ombudsman
The Inaugural Ron Ball Memorial Lecture
1 October 2015, St Andrew’s College, Christchurch

It’s a pleasure and a privilege to be invited to deliver the inaugural Ron Ball Memorial Lecture here in Christchurch. I’ve set what I hope is a rhetorical question, as the topic for my lecture: do care, compassion and charity still have a place in modern medicine?

Addis Ababa Fistula Hospital

Last month, I visited the Addis Ababa Fistula Hospital, which I learnt of some years ago, when I read Catherine Hamlin’s *The Hospital by the River*.¹

The book tells the story of how obstetricians and gynaecologists, Reg Hamlin (a New Zealander) and Catherine Hamlin (an Australian), arrived in Addis Ababa in 1959 to establish a midwifery school, and stayed for the rest of their lives. They founded a charitable fistula hospital that opened in 1975—a hospital dedicated to the surgical treatment and rehabilitation of Ethiopian women suffering from obstetric fistulas, caused by obstructed labour, often in very young women whose untreated condition causes them to become outcasts in their communities. At 91, Catherine Hamlin is still working at the hospital, which has become a major teaching institution for surgeons from all over Ethiopia, Africa and the developing world.

The story has a Christchurch connection. Reg Hamlin was a choral scholar in the Christchurch Cathedral choir, educated at the Cathedral Grammar School. He qualified as a teacher at Christchurch Teachers Training College and obtained a BA and MA from Canterbury University. He was a friend and fellow chorister of my school music master, Lin Saunders, whose wife Helen told me this story.

One day in their 20s, Lin and Reg, newly qualified teachers, played a round of golf here in Christchurch, and discussed how they were both thinking of studying medicine. They decided to ask their respective GPs for advice. Lin’s GP told him to stick with music—which he did, becoming a music teacher at King’s College, and reviewer for the *New Zealand Herald* for 53 years. Reg’s GP thought he would make a good doctor, and so Reg headed off to Otago to study medicine and graduated in 1941.

The Addis Ababa Fistula Hospital also has another New Zealand connection. The initial funding for the hospital came from a £10,000 donation from the head of CORSO, the New Zealand Council of Organisations for Relief Service Overseas.²

Today, the fistula hospital relies on charitable donations from all over the world.

Care and compassion lay at the heart of the vision of Reg and Catherine Hamlin. Reg described their patients:³

> Mourning the stillbirth of their only child, incontinent of urine, ashamed of their offensiveness, often spurned by their husbands, homeless, unemployed, except in the fields, they endure, they exist, without friends and hope. They bear their sorrows in silent shame. Their miseries, untreated, are utter, lonely and lifelong.

Catherine describes what the charity hospital can offer:⁴

> Somehow she hears about the hospital. Somehow she begs the fare or persuades a relative to take her on the long, frightening journey to the unimaginable confusion of
the capital. The hospital is quiet and clean, set amongst flowers. People treat her with kindness. She is bathed and experiences the strange luxury of a soft bed with clean sheets. And the miracle she has hardly dared to believe, happens. After a time she returns home, cured, to begin life anew.

Visiting last month was a moving experience.

Charity
The derivation of charity is from the Latin word *caritas*, sometimes described as altruistic love. Paul’s 1st letter to the Corinthians, chapter 13, verse 13, in the King James version, reads: “And now abideth faith, hope, charity, these three: but the greatest of these is charity.” Some of you will also be familiar with the well-known Latin text, often set to music: “*Ubi caritas et amor, Deus ibi est*”—where love and charity are, God is there.

The modern notion of charity is of the voluntary giving of help, often in the form of money or services, to those in need. The Canterbury Charity Hospital states in its ‘Enduring Vision’ that its single purpose is to “serve the unmet health care needs of the community”, by providing “specialist health care services to as many people in Canterbury as possible”.

The wording of duty in the latest version of the AMA Code (dating from 1994) is less clear-cut, but it still specifies an obligation on physicians to care for the poor:

> Each physician has an obligation to share in providing care to the indigent. ... All physicians should work to ensure that the needs of the poor in their communities are met. Caring for the poor should be a regular part of the physician’s practice schedule.

I have no doubt that many individual doctors quietly and routinely provide free care to patients who cannot afford to pay. That is certainly true in New Zealand.

A few come to public notice. One whom I know personally, is Dr Sharad Paul, a GP specialising in skin cancer surgery from a clinic in Blockhouse Bay in Auckland. Dr Paul provides around 7,000 free skin check consultations each year, and has provided this service since 1996.

He has been honoured with several public awards, including last week from APAC (the Asian Pacific Healthcare Forum), for ‘Leading Health Improvement on a Global Scale’, for his role in improving skin care management, education and patient-centred care internationally. But Dr Paul has also faced fierce resistance from some surgeons and dermatologists. Doctors who provide high quality, charitable services may be ostracised by colleagues who have different motivations in the practice of medicine.

Critics say that the charity care provision of the AMA Code is an empty platitude, and argue that instead of reliance on the altruism of some individual doctors, a community...
obligation would make more sense. That is precisely the direction of Obamacare, or the Affordable Care Act in the US.

In New Zealand, of course, we have our own form of socialised medicine. Arnold Nordmeyer was the architect of the Social Security Act 1938, passed under the first Labour Government, headed by Prime Minister Michael Joseph Savage. The so-called ‘cradle-to-grave’ welfare system made comprehensive provision for health, for security of income, and for the general welfare. It paved the way for free hospital care and access to a wide range of health benefits, many of which were rolled out while Nordmeyer was Minister of Health from 1941 to 1947, and which endure today.

Interestingly, one of the concerns expressed in Parliament in 1938 was that social security could embarrass the professional commitment of doctors. There was certainly professional resistance. The attempt to introduce free primary medical care was fiercely resisted by the New Zealand branch of the British Medical Association. A contemporary cartoon shows a jar with the tag “General Practitioner Service” with the BMA inside it, and the text has Minister of Health Walter Nash, saying “Snappy work Nordmeyer, Are you sure he can’t bite?” The BMA could bite, and it did. It ran a very effective public relations campaign, and demonised Nordmeyer and his reforms. Debate about free primary medical care and fees surcharges continues to this day.

In the decades since, the publicly funded health system has struggled to meet patients’ needs in both primary and secondary care. Last year, Robin Gauld and colleagues published an article in the New Zealand Medical Journal, entitled “The importance of measuring unmet healthcare needs”. They propose regular, objective and comprehensive measurement of unmet health care needs, by formal interviews of representative samples of the community. A pilot survey is planned for later this year.

In the meantime, health officials, policymakers, politicians, funders and health practitioners grapple with growing demands for health care, in the face of the inability of the system to cope, even at a government spend of 6% of GDP on health care and a total spend of 10% of GDP on health care, slightly above the OECD average. One finds little discussion of the role of charitable funding and provision in official documents.

Looking back in time, I was intrigued by some of the references to charitable provision of health care in the 1975 White Paper, A Health Service for New Zealand, presented during the term of the third Labour Government, by Minister of Health Tom McGuigan, MP for Lyttelton and a former Christchurch Hospital manager. It traces the history of public health provision in New Zealand. A key figure in the late 19th century was Dr D Macgregor, Inspector of Lunatic Asylums and Hospitals, who pressed for radical reorganisation in the number of hospital and charitable aid authorities, to “about twenty strong boards”. Macgregor played a key role in preparation of the Public Health Act 1900. He apparently tended to the view that “State sponsored charity should be given more in the spirit of Blake's usurious hand than St Paul's charity [that] suffereth long, and is kind.”

In later years, the role of charitable funding of health care seems to have dropped off the political and legislative radar. In official documents, such as the report of the Royal Commission on Social Security in 1972, the issue of concern was the growth of private health insurance and private provision of health care. Interestingly, the report of the National Health Insurance Investigation Committee of 1937 (at the end of the depression) had stated: “Self-respecting, freedom-loving New Zealanders will never … tolerate … one type of service to the poor and another type to the well-to-do.”

It seems that we have become a more tolerant society.

Access
As an Ombudsman, an appointed, not an elected officer of Parliament, it is not my role to comment on the inability of the publicly funded health system to meet the needs of patients. But as a former Health and Disability Commissioner, and as author of a chapter on “access to health care” in the newly published Health Law in New Zealand, I am well aware of the problems
of access to specialist assessment and treatment, and of the need for good information for patients left waiting while they seek to access care.

Many patients, in Canterbury and beyond, are unable to access charitably-funded health care, yet will not meet the threshold (so-called clinical priority access criteria) for specialist assessment and treatment in the public system. Many will lack the resources (including private health insurance) to access private care. Do they have any rights under the Code of Patients’ Rights, which articulates rights when receiving health services, but not an actual right to access care in the first place?

I considered this situation in a decision issued on my final day as Health and Disability Commissioner, in March 2010. I stated:

It is well recognised that there is insufficient public funding to meet the immediate health needs of all New Zealanders, and that some patients who require elective services are unable to access them through the public system. Public hospitals are expected to treat those with the greatest need first. In this environment, it is essential that patients are treated fairly, consistently, and to an appropriate standard within the resources available.

In that case, a young woman in her mid 20s, with hearing loss and worsening neurological symptoms, was referred three times over 30 months to the Nelson Marlborough District Health Board, before she finally had an MRI that revealed a tumour requiring urgent surgery. I found the DHB in breach of its duty of care to “appropriately assess and prioritise” the patient’s level of need for an MRI scan, and to operate a fair and consistent process for managing the care of referred patients; and of its duty to provide timely information about the outcome of the referral, whether the patient was likely receive an MRI, the option of a private scan, what the symptoms meant, and the risks of delay in being seen.

My Nelson Marlborough ruling built on my earlier decision in 2006 about a Southland freezing worker, Jim Logan. After a very high PSA test result and urinary symptoms, he was referred by his GP to the Southern DHB, which classified him as ‘urgent’ on a waiting list for a first specialist assessment. Mr Logan waited 18 months without being seen and finally sought treatment from a private specialist, who diagnosed prostate cancer. In my opinion, he had the right to be told by his GP ‘what other options were available to him’, including the right to seek private assessment and treatment, if publicly funded services were not available (www.hdc.org.nz Opinion 04HDC13909).

We need to be careful about assumptions about what means a patient can draw on to access necessary care.

Care

Let me turn from problems of access, to questions of care. As patients, whether we access care in the public, private or charity system, we have the same legal right to receive services of an appropriate standard. I note that the Canterbury Charity Hospital states on its website that “the standard of health care will, in all instances, equal or exceed that expected of the public health system”.

Survey research by the Picker Institute in England in 2006 found that 78% members of the public rated whether the doctor makes the care of the patient his or her first concern as the most important duty of a doctor. Patients want their interests to come first—and this is true both in relation to health practitioners and systems of care.

Luke Fildes’ iconic painting of The Doctor, commissioned by Henry Tate for an exhibition in 1891, is an evocative portrayal of the caring, attentive physician making a house call and watching over a sick child at night. It evokes a sense of care.

As we know, patients do not always receive good quality care from attentive health practitioners and alert systems. Mistakes happen, sometimes from a lack of care. In my time as Health and Disability Commissioner, I spoke out about cases where patients had received poor care in private hospitals, an environment where members of the public sometimes assume that they will receive superior care. It is equally important that care in a charity hospital is of a high standard.

The duty of care owed by a surgeon, an anaesthetist, a nurse, a dentist or a counsellor,
or indeed by the hospital where they work, cannot be diluted based on the means of financing or the location of service provision. There can be no sliding scale of care. As a patient, I am entitled to expect that health services, wherever provided and however financed, will meet the legal test, affirmed in Right 4 of the Code of Patients’ Rights, of being provided with reasonable care and skill, in accordance with professional standards, in a manner that minimises potential harm, and well coordinated.

Quality assurance and improvement activities within a charity hospital should be as rigorous as we expect in the public system, with robust systems of incident reporting and peer review. Grateful patients who receive charitable services must feel no moral pressure not to ask questions, raise concerns or complain if they are unhappy about their care. They have the legal right to complain, and to receive a prompt, reasoned response. All service providers should welcome complaints as valuable feedback that can help improve the quality of care, and respond to the concerns of an unhappy patient.

In a national study of a decade of complaints about doctors to Australian healthcare complaint commissions, Bismark and colleagues found that 61% related to clinical care. It is interesting to speculate how many complaints about care were precipitated by a failure in communication.

The verb, to care, has its roots in the Old English word *carian*, meaning to “be anxious, grieve; to feel concern or interest”. This sense was captured by Boston physician, Francis Peabody, when he wrote (in JAMA in 1927) that “the secret of the care of the patient is in caring for the patient”. A patient who does not feel cared for, is more likely to complain when things go wrong.

This leads me naturally to compassion, and its role in health care.

**Compassion**

“Compassion” can be traced to its Latin roots: *cum* (with) and *patrior* (to suffer); note that this is also the root of the word ‘patient’. This meaning is well captured in the Oxford English Dictionary, which defines compassion as “suffering together with another” or “fellow-feeling”.

The absence of compassion in health care is increasingly remarked upon. In 2009, there was a national campaign by some health practitioners to have ‘the right to be treated with compassion’ added to the Code of Patients’ Rights. As Commissioner, I did not support the change. I thought then (and still do) that compassion cannot be mandated by law, and needs to come from the heart of the healthcare provider.

That is not to say that compassion is unimportant. It should be at the heart of health care provision. But compassionate behaviour is a gift from the caring practitioner. Anatole Broyard, the American literary critic, wanted his doctor to “give me his whole mind just once”. As he faced metastatic prostate cancer, he wrote: “I’d like my doctor to scan me, to grope for my spirit as well as my prostate. Without some recognition, I am nothing but my illness.”

Palliative care physician, Harvey Chochinov, argues that compassion may be cultivated by exposure to the medical humanities and the arts. Martha Nussbaum believes that to develop compassion in public life, we must give the humanities and the arts a large place in education. She says that the imagination of poets is required, and cites Walt Whitman.

This brings to mind some Whitman lines from *Leaves of Grass*, which are inscribed above the entrance to the cavernous Dupont Circle underground Metro station in Washington DC. Whitman recalls his experience as a wound dresser, tending to Civil War soldiers in hospital. His words, carved in stone, are a subtle but eloquent reference to an epidemic that reminded us of the importance of care in the absence of cure:

> Thus in silence in dreams' projections, Returning, resuming, I thread my way through the hospitals, The hurt and wounded I pacify with soothing hand, I sit by the restless all dark night, some are so young, Some suffer so much, I recall the experience sweet and sad …

Sadly, many cases where compassion was notably absent crossed my desk as Health and Disability Commissioner. One that I remember well involved the neglectful
care of a 50-year-old man who struggled for breath as he lay dying at Wellington Hospital in 2004. In my decision, finding Capital and Coast DHB in breach of the Code, I stated:

*Patients who have been admitted to hospital because they are acutely unwell are especially in need of care, comfort and compassion. As well as suffering from their present illness, they are likely to be frightened by the unfamiliar hospital environment and fearful for the future.*

In closing, let me tell you a personal story of the care for a patient, a former colleague and close friend. I do so to remind us all why care and compassion must still have central place in health care in New Zealand.

**Judi Strid**

The patient was my friend, Judi Strid, who died in February. Judi will be known to some in this room through her health advocacy work.

For 10 years, until a few months before her death, Judi was Director of Advocacy for the Health and Disability Commissioner. She was a leader in the home birth and midwifery movements in the 1980s, and in the 1990s worked in women’s health to implement the recommendations of the Cartwright Report. Judi was a tireless champion of health and disability consumer advocacy and of consumers’ rights—especially for vulnerable consumers, including mental health consumers, deaf consumers, and residents of aged care facilities. She also cared deeply about informed choice, independent ethics committees, consumer engagement and evidence-based health care.

Judi was diagnosed with a brain tumour, a glioblastoma of the left frontal lobe, in November 2010. And with lymphoma, causing tumours in her face and bladder. That month, Judi appointed me her enduring power of attorney and made me promise to tell her story of care publicly.

Judi kept a 60,000 word health diary for four years, until the final months of her life. The family gave it to me shortly after her death, to use in telling her story. Judi never told the people treating her that she worked at HDC. She wanted to be a mystery shopper in the health system.

What Judi experienced wasn’t pretty. It certainly wasn’t patient-centred care. I will give you two examples, from her diary.

Time after time, Judi didn’t get the information she wanted and needed. Her brain tumour was diagnosed on November 7 2010, after an ED admission. Unsurprisingly, Judi wanted information about her tumour and prognosis. Yet, despite calls by her and her GP, Judi waited over 6 weeks for the first contact from neurosurgery, a phone call from the booking clerk on December 23, to tell her she was booked for surgery on December 29. During this time, Judi had several appointments with haematology. She writes in mid-December:

*Once again at the Haematology appointment I explain that the most important matter I wish to deal with relates to the brain tumour and the rest is just background. ... All my questions relate to the brain tumour yet I have not had an opportunity to ask them and get the answers I need.*

Judi never got told about her tumour before surgery. She saw the anaesthetist the morning of surgery, and learnt for the first time that she was to have a craniotomy with resection of the left frontal tumour.

The coordination of Judi’s care was also woeful. It’s hard to imagine having a brain tumour and lymphoma and going through months and months of debilitating treatment. To be sent from pillar to post every time you’re referred for a CT scan or an MRI or more radiation, and to wait for hours to be seen by consultants, is a cruel waste of the patient’s time and energy.

I am following up these concerns with Auckland DHB, and am heartened by their willingness to learn from Judi’s experience and to improve care and coordination for future cancer patients.

The second example from Judi’s diary highlights a lack of care and compassion. In 2011, Judi was admitted to her local hospital with pneumonia and very low haemoglobin, and received blood transfusions and intravenous antibiotics. Judi woke in the middle of the night to hear another patient being put in the other bed in her room and helped to use the bathroom. She overheard the woman tell the nurse she had ESBL, a readily transmissible infection, whereupon
the woman was moved to another room. Judi asked the nurse if the bathroom could be cleaned, given her own compromised immune system. The nurse told Judi off for listening to a personal conversation in breach of privacy! Soon after, the nurse arrived back with a rectal swab, “to check my infection status”. Judi recorded that it felt “humiliating and like a punishment.”

This happened at the same public hospital where a national Centre for Compassion in Healthcare had been launched in 2007. Again, I have followed up these issues, with Waitemata DHB. They wrote to the family, through me, in August, saying:

Judi’s case reminds us that every encounter matters and can have a significant impact on a patient. It also reminds us of the need to demonstrate respect, kindness and compassion as essential elements of our care.

Judi’s experience is sad and painful to relate—but I am confident it will lead to change.

Joy

Let me express again my admiration for the vision that underpins the Canterbury Charity Hospital, and for everyone whose charitable efforts support the endeavor. Having visited the hospital on Harewood Road, I have a sense of the joy and fulfillment that you find in your work.

I leave you with a blessing from the Irish philosopher and priest, John O’Donohue:

May the sacredness of your work bring healing, light and renewal to those who work with you and to those who see and receive your work.

May your work never weary you.

May it release within you wellsprings of refreshment, inspiration and excitement.

Competing interests: Nil

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Targets and actions for non-communicable disease prevention and control in New Zealand

Chris Bullen, Robert Beaglehole, Mike Daube AO, Gerry Devlin, Sally Hughes, Boyd Swinburn

ABSTRACT

AIM: To propose non-communicable diseases (NCD) prevention and control targets for New Zealand, where NCDs are the leading causes of death and health inequalities in men and women.

METHOD: We adapted NCD global targets for New Zealand in the light of local progress, priorities and feasibility.

RESULTS: National NCD targets relevant to New Zealand, yet congruent with global targets, together with inclusive, collaborative and feasible actions to achieve them are outlined.

CONCLUSION: A national commitment to collaborative and pragmatic action is needed to capitalise on opportunities for further progress in the prevention and control of NCDs in New Zealand.

Non-communicable diseases (NCDs), principally cardiovascular diseases, cancer, diabetes and chronic respiratory diseases, are the leading causes of death in men and women in New Zealand: 89% of all deaths each year are caused by NCDs. In 2012, an estimated 7,000 New Zealanders died prematurely (under the age of 70) from these conditions. NCDs are also the leading causes of preventable ethnic and socioeconomic health inequalities in New Zealand. However, a large proportion of the burden of death and disability caused by NCDs is potentially avoidable though cost-effective, evidence-based preventive and treatment interventions. Some of these interventions, such as tobacco control, are also cost saving.

In this paper, we propose a practical set of priority national targets in keeping with the globally agreed set of targets. We argue for a national commitment to inclusive, collaborative and pragmatic action to capitalise on opportunities for further progress.

Global commitments

At the United Nations (UN) High-Level meeting on NCDs in September 2011, New Zealand committed to a full range of NCD prevention and treatment policies. In 2013, all World Health Organization (WHO) Member States agreed to a NCD Global Action Plan and a Monitoring Framework that includes a NCD premature mortality reduction target (25% by 2025) and a set of voluntary targets—six for risk factors and two treatment targets—to be reached by 2025 (Table 1).

In July 2014, a UN NCD Review Meeting noted that while considerable progress has occurred, it had been uneven and much more needed to be done. Member States agreed to report on actions to be completed by 2015 or 2016—to consider the development of a multi-sectoral NCD strategy, and a set of national targets, including an overall premature NCD mortality reduction goal for 2025. The outcome document of this meeting also reaffirmed that governments have a primary role and responsibility to respond to the challenge of NCDs, including through engaging non-governmental organisations, the private sector and other sectors of society, to generate effective responses for the prevention and control of NCDs at the global, national and local levels.
Table 1: Global NCD global mortality reduction target and agreed voluntary risk factor and health system targets for 2025 (with a baseline of 2010).

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature mortality reduction from NCDs</td>
<td>25% relative reduction</td>
</tr>
<tr>
<td>Harmful use of alcohol</td>
<td>10% relative reduction</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>10% relative reduction</td>
</tr>
<tr>
<td>Salt/sodium intake</td>
<td>30% relative reduction</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>30% relative reduction</td>
</tr>
<tr>
<td>Raised blood pressure</td>
<td>25% reduction reduction</td>
</tr>
<tr>
<td>Diabetes and obesity</td>
<td>0% increase</td>
</tr>
<tr>
<td>Drug therapy and counseling</td>
<td>50% coverage</td>
</tr>
<tr>
<td>Essential medicines and technologies</td>
<td>80% coverage</td>
</tr>
</tbody>
</table>


Box 1: Proposed criteria for selecting NCD targets for New Zealand.

<table>
<thead>
<tr>
<th>Criteria</th>
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<tr>
<td>Importance of risk factor—prevalence and associated NCD burden</td>
</tr>
<tr>
<td>Likely contribution to the overall NCD mortality target</td>
</tr>
<tr>
<td>Impact of achieving the target on ethnic inequalities in NCD mortality</td>
</tr>
<tr>
<td>Availability of cost-effective and affordable interventions</td>
</tr>
<tr>
<td>Successful national and international experiences</td>
</tr>
<tr>
<td>Ability to measure progress in a timely manner</td>
</tr>
<tr>
<td>Political feasibility of the target</td>
</tr>
<tr>
<td>Programmatic feasibility of the target</td>
</tr>
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</table>

NCDs in New Zealand: successes, challenges and threats

NCD death rates have declined in Māori and Pākehā men and women from their peak in the late 1960s. Cardiovascular (CVD) death rates have fallen by approximately 75%. Lung cancer death rates in men have also declined, but not in women. Preventive and treatment strategies have contributed to the dramatic decline in NCD death rates, especially heart disease and stroke. This decline has been responsible for much of the recent increase in life expectancy in New Zealand.

One of the great recent NCD successes hitherto has been the Government's tobacco control leadership. The Smokefree 2025 goal of reducing smoking prevalence to 5% or lower was established in 2011. Although there has been steady progress, modeling suggests much more action will be needed, including a comprehensive government plan of action, if the target is to be met. In contrast, death rates from diabetes have not declined over the past decade, but have been sustained by the increase in obesity levels (31% of New Zealand adults are now obese).

New Zealand NCD targets

New Zealand should be developing its own NCD targets in line with its international obligations. National health system targets have already been established for smoking cessation advice in hospital and primary care settings, checks for diabetes, cardiovascular risk assessments and several aspects of cancer services. Two WHO health system targets (Essential NCD medicines: 80% coverage; Drug therapy and counseling: 50% coverage) are no longer so relevant to New Zealand and most other high-income countries. This is because, although inequalities in access still exist, for the most part high levels of access have already been achieved. Nevertheless, it is still appropriate to include a target for health systems in relation to risk management for CVD and diabetes.

The Government has yet to set a target for NCD mortality. The New Zealand mortality target should include two elements: an overall premature mortality reduction component, for example a reduction to an agreed level by 2025, and an inequality component, such as an ambitious, yet
feasible, reduction in the Māori/European premature mortality ratio. Such a target would address the continuing burden of NCDs and their risk factors (smoking, high blood pressure and cholesterol levels, unhealthy diets, physical inactivity and harmful alcohol use), the marked ethnic inequalities in the burden of NCDs and their risk factors, and the impact of high rates of obesity and diabetes, including on the health system.

The global mortality target of a 25% relative reduction in premature mortality from NCDs was based on the achievement of the best performing countries since the 1990s, including New Zealand. Indeed, New Zealand’s record in tobacco control and treatment for people at high risk of cardiovascular disease is good so is likely to meet the WHO target.

Targets for the other risk factors will be much more challenging to meet. The establishment of a national, multi-sectoral action plan and strategy will provide the context for the achievement of New Zealand NCD targets. Box 1 shows criteria we consider relevant for selecting targets.

Political feasibility is challenging because while this can change quite rapidly—and the presence of targets may aid this shift—the most important actions for childhood obesity, alcohol and fat intake—such as taxation and regulating marketing—are currently not politically palatable. Programmatic feasibility hinges on high-level political support, sufficient to make available the required financial resources, but also people and organisational capacity and capability to implement interventions, wider societal support, effective partnerships with a range of sectors, ongoing monitoring of performance indicators, together with strategic oversight and technical guidance.

Table 2 shows proposed NCD targets and actions for New Zealand. Alongside each is the WHO Global target, where relevant, justification for the New Zealand target’s inclusion, and proposed actions. We did not include the WHO target of no increase in adult obesity and diabetes by 2025 because we considered it unrealistic that it will be met, given the absence of a clear strategy with good evidence of effectiveness, and lack of international exemplars from countries where this has yet been achieved. However, a childhood overweight and obesity target is included.

To attain these targets, it will be vital to have collaboration among all interested parties: iwi; Government, government ministries and agencies; local authorities; civil society; academia; and in some cases the private sector (excluding the tobacco and alcohol industries and those associated with them, and other ‘unhealthy commodity’ industries, who, evidence suggests, should have no role in formulating national or international NCD policy).

A wide range of groups is ready and willing to be actively engaged: already, NGOs that focus on NCDs are in discussion about establishing a New Zealand NCD Alliance to speak with one voice on issues of common concern, and affiliate with the Global NCD Alliance.

Agencies involved in working towards the targets must keep focused on a limited set of priorities and gradually expand their ambitions as experience accumulates and progress is made. It is important to keep in mind the political realities, but also be in a position to build on opportunities that might arise.

Accountability will also be of critical importance. Accountability includes monitoring and reviewing progress and acting to ensure that New Zealand is on track to achieve the agreed targets. Monitoring should include key indicators for each target and incorporate both interim and the 2025 targets. The indicators should be easily and reliably measured and reported on publicly and regularly, such as every five years. For example, for salt intake, urinary spot sodium measurements should be added to current health and nutrition surveys and salt content of packaged and processed foods monitored. Finally, a multi-sectoral NCD planning committee, including independent members, should be established with responsibility for setting up and maintaining accountability mechanisms.

Discussion

We have outlined a sector-initiated set of national targets and actions that align with global targets and actions, but are specific to New Zealand. The NCD mortality target should include an overall premature
mortality reduction component and an inequality component. The involvement of many groups in health and other sectors provides a solid platform for future action. However, there are formidable barriers to progress, including the approaches of large and well-funded commercial interests, industry groups and those directly and indirectly associated with them. Government leadership and collaboration between government and all other sectors, together with clear monitoring and accountability arrangements, will be vital to success. The Government has an opportunity through the National Health Strategy to incorporate population targets for NCDs and support actions such as we have proposed. Urgent action is now needed.

Table 2: Proposed NCD targets and actions for New Zealand.

<table>
<thead>
<tr>
<th>Factor</th>
<th>NZ Target</th>
<th>WHO Target</th>
<th>Justification</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>Reduction of daily smoking prevalence from current daily smoking prevalence to 25% by 2025, and reductions in the ethnic and socioeconomic gradients in prevalence.</td>
<td>A 30% relative reduction in prevalence of current tobacco use in persons aged 15+ years.</td>
<td>This target meets all the criteria and is a reinforcement of the Government’s commitment to this goal. A business as usual will not achieve the Smokefree 2025 goal. Achieving an overall adult prevalence of smoking of &lt;5% (for all ethnic groups, and in men and women) will require halving the uptake of smoking and doubling the current quit rate.</td>
<td>Develop a strategic plan for reaching the 2025 Goal that could include: 1. Continued and increased tobacco taxation 2. Passage of the standardised tobacco packaging (‘plain packaging’) legislation 3. Increasing funding for sustained, research-based mass media campaigns 4. A register of retailers with strong enforcement and penalties for those selling to minors 5. Research informing new approaches to support smokers to quit 6. Smokefree cars where children are passengers.</td>
</tr>
<tr>
<td>Childhood overweight and obesity</td>
<td>Reduction of childhood overweight and obesity prevalence from 33% to 25% by 2025, and reductions in the ethnic and socioeconomic gradients in prevalence.</td>
<td>0% increase in children and adolescents.</td>
<td>Childhood obesity has increased by almost 30% in 6 years, from 8% in 2006/07 to 11% in 2012/13. One-third of New Zealand children are obese or overweight and significant ethnic and socioeconomic differences exist: 41% of Māori children and 62% of Pacific children are overweight or obese; children living in the most deprived areas are 10 times as likely to be obese as those in the least deprived areas. The target of 25% is the current level of childhood obesity in Australia. These reductions in prevalence and inequalities are ambitious targets. Improved physical activity levels in children are important for a range of reasons but will make only a small contribution to achieving the obesity target. The focus must be primarily on food and nutrition.</td>
<td>Focus on the following areas for action: 1. ‘Bottom up’ community-based interventions that prioritise at-risk populations 2. ‘Top down’ regulatory approaches that include: Restricting exposure of children to marketing and promotion of unhealthy food and beverages; developing a comprehensive food and nutrition plan for children including food standards for early childhood services and schools; improving nutrition labeling to enable individuals to make healthier choices about food purchases for their families; taxing or introducing other regulatory measures for sugar-sweetened drinks.</td>
</tr>
<tr>
<td>Salt intake</td>
<td>A 30% relative reduction in mean daily salt intake from current 9g to 6g per day by 2025.</td>
<td>A 30% relative reduction in mean population intake of salty sodium.</td>
<td>New Zealand’s salt intake has not declined over the last four decades. New Zealanders are currently estimated to consume at least twice the recommended intake of salt. A 30% reduction will mean that the salt consumed per person per day in NZ would fall from 9 grams to 6 grams, still higher than WHO recommendations (5 grams per day per person) but realistic given the challenges and timeframes. Achieving this target will have a major impact on population blood pressure levels, heart disease and stroke rates, and possibly also stomach cancer. This target meets all the criteria although accurate monitoring of population salt intakes is a challenge.</td>
<td>Develop a national salt reduction strategic plan for reaching the 2025 goal that could include: 1. Setting up an action group with strong Government leadership and scientific credibility 2. Setting progressively lower salt targets for a comprehensive range of food categories, with a clear time frame for achievement 3. Initiating a consumer awareness campaign 4. Undertaking independent monitoring of progress at 3-5 year intervals.</td>
</tr>
<tr>
<td>Factor</td>
<td>NZ Target</td>
<td>WHO Target</td>
<td>Justification</td>
<td>Action</td>
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<tr>
<td>Saturated fat intake</td>
<td>Reduction of total energy intake from saturated fat for adults from current 13% to 11% by 2025.</td>
<td>Not included as a WHO target</td>
<td>Saturated fat intake is the key underlying cause of much of the coronary heart disease burden in New Zealand and contributes to the cancer burden. Despite declines since the 1960s, saturated fat intake is still excessive, and is one of the highest globally. In the most recent National Nutrition Survey (2008/09) self-reported saturated fat intake was 13% of total energy for adult New Zealanders (14% for Māori), far higher than the Australasian nutrient reference value of 8 to 10% of total energy intake, including trans fats. Trans fat intakes in NZ are on average below the 1% of total energy intake recommended by WHO but they should be monitored at regular intervals to ensure they remain so.</td>
<td>Develop a strategic approach to saturated fat reduction that should include: 1. Reducing the saturated fat content of processed foods and commercially deep fried foods such as many takeaways. 2. A public education campaign that informs and reduces confusion about the difference between low fat diets, and diets where saturated fat is replaced with healthy fats (the latter being the best approach for reducing risk of coronary heart disease).</td>
</tr>
<tr>
<td>Harmful use of alcohol</td>
<td>A 10% relative reduction in the harmful use of alcohol from the current 16% to 14.5% by 2025.</td>
<td>At least 10% relative reduction in the harmful use of alcohol by 2025.</td>
<td>Alcohol is a major and preventable cause of NCD burden in New Zealand and contributes to a wide range of social disorders. A full range of cost-effective interventions is available. This issue has limited political feasibility at present, but public acceptance of the recently reduced drink driving limits appears high.</td>
<td>Commit to a comprehensive, evidence-based approach (as recommended in the Law Commission's 2010 report “Alcohol in our lives: curbing the harm”) that should include: 1. Restricting access via price and other levers. 2. Restricting advertising and promotion. 3. Educating the public about the harms of alcohol misuse. 4. Enacting appropriate legislation with effective enforcement.</td>
</tr>
<tr>
<td>Physical activity</td>
<td>A 10% relative reduction in physical inactivity from 49% to 44% in adults, and from 33% to 30% of children by 2025.</td>
<td>A 10% relative reduction in prevalence of insufficient physical activity by 2025.</td>
<td>Physical inactivity is a major and preventable cause of NCD burden in New Zealand. Only 54% of New Zealand adults currently meet the guidelines for achieving at least 30 minutes moderate-to-vigorous physical activity on most days of the week. Only two-thirds of New Zealand children currently meet the guidelines for achieving at least 60 minutes of daily moderate-to-vigorous physical activity on most days of the week.</td>
<td>Develop a set of priority actions consistent with WHO recommendations that should include: 1. Promoting physical activity through public awareness campaigns and policies that improve access, acceptability and safety of walking and cycling (such as those that encourage active transport, recreation, leisure and sport and better urban planning). 2. Provide well-resourced high quality Health and Physical Education in pre-schools, schools and tertiary institutions, including opportunities for physical activity before, during and after the school day.</td>
</tr>
<tr>
<td>Health systems</td>
<td>Increased uptake of evidence-based medications and behavioural interventions following an NCD event or diagnosis.</td>
<td>At least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes.</td>
<td>Only 60% of people having had a heart attack take the recommended medications that can halve the risk of another heart attack. Adherence to prescribed medication and lifestyle interventions (such as quitting smoking) is important for effective management of diabetes, CVD, respiratory conditions and some cancers. Targets for CVD risk assessment are in place but there are currently no targets for CVD risk management.</td>
<td>Develop a strategic approach that could include: 1. Agreement on national targets for the management of CVD and Diabetes. 2. Equipping health professionals with relevant skills (e.g. risk communication, motivational interviewing, shared decision making, goal setting, and health literacy) to support people to take their prescribed medications and make lifestyle changes. 3. Making available fixed-dose combination CVD medication (polypills) for people with high CVD risk and low adherence to prescribed CVD medications.</td>
</tr>
</tbody>
</table>
VIEWPOINT

Competing interests:
Chris Bullen reports grants from PHARMAC NZ (NZ Government Pharmaceuticals Agency) during the conduct of the study, grants from Health Research Council of New Zealand, personal fees and non-financial support from University of Malaya, grants from Ministry of Health (New Zealand), and grants from Virginia Commonwealth University outside the submitted work.

Acknowledgements:
We acknowledge the many people from a range of organisations who participated in the workshop facilitated by the Heart Foundation on November 7 2014, ‘Addressing NCDs in Aotearoa/New Zealand’ and to other colleagues who contributed to the subsequent development of this article, in particular Professor Cliona Ni Mhurchu and Associate Professor Ralph Maddison of the National Institute for Health Innovation, University of Auckland.

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REFERENCES:
Cystic adventitial disease of the external iliac artery: a rare cause of claudication

S Al Shaqsi, S Lesche, I Thomson

A 40-year-old, healthy female presented complaining of intermittent right calf claudication that occurred after minimal exercise. The symptoms were getting progressively worse over 4 weeks. She denied any rest pain or non-healing wounds. She was unable to do her work as a farm manager due to her troublesome symptoms.

Her past medical history was unremarkable with no previous surgery or trauma.

On examination, her femoral pulse on the right was weak and reduced to 1/3 compared to 2/3 on the left. No bruits were heard. Popliteal, dorsalis pedis and posterior tibial pulses were easily palpable and 2/2 bilaterally. Her resting ankle brachial indices (ABI) were normal at 1.0 bilaterally. This remained normal on the left, but dropped to 0.6 on the right with exercise, using treadmill exercise protocol with speed of 3.2 km/hr and incline of 10 degrees for 5 minutes. Ultrasound duplex scan showed a cyst measuring 3x3x2cm externally compressing the right external iliac artery. Computer Tomography Arteriogram (CTA) showed a non-vascular homogenous cyst compressing the right external iliac artery as shown in Figure 1. The cyst did not have any joint connection.

The patient underwent surgical exploration by a retroperitoneal approach. Intraoperative findings were consistent with a mucinous-filled cyst adjacent to the anterior aspect of the right external iliac artery, as shown in Figure 2. No connection to a joint could be identified intraoperatively. The cyst was resected and the adjacent arterial wall opened, the residual stenosis dealt with by a bovine pericardial patch. Postoperative ABIs returned to 1.0 at rest and post-exercise. The patient recovered well and was discharged home after two days with no residual symptoms. She returned to full-time work after two weeks post-operatively. She remains clinically asymptomatic. Using our standardised follow-up protocol, the patient underwent duplex scanning 3 months after the procedure, showing no signs of recur-
**Figure 2:** Intra-operative view showing a cyst narrowing the external iliac artery.

**Figure 3:** Cystic wall surrounding gelatinous material which forms the stroma of the resected cyst. X40 magnification.
The histology of the cyst was consistent with cystic adventitial disease.

Cystic adventitial disease (CAD) causes arterial insufficiency. Atkins and Key reported the first case of CAD in 1947. CAD is defined as a collection of gelatinous material within an aberrant synovial-type cyst in the sub-adventitial plane of a blood vessel which results in external compression. Symptoms of CAD depend on the location of the affected blood vessel. In 85% of reports, CAD affects the popliteal artery. Claudication of a sudden-onset is the most common complaint. The age group affected by CAD is usually 40–60 years old. Nevertheless, CAD has been reported in children.

The pathophysiology of CAD is not well understood. Repeated stretching causes adventitial degeneration and cyst formation, particularly in the popliteal artery. The misplacement of mucin-secreting cells in the adventitial layer of blood vessels during fetal development is thought to cause cyst formation later in life.

Desy et al reported cases in which CAD was caused by a cystic lesion with a direct joint connection, often via small branches of the affected artery. In our case, no joint connection could be identified, nor any arterial side branches in that area.

Macroscopically cysts are often described as “gelatinous, jelly-like material”. Microscopically, cysts contain variable amounts of fibrinogen, hydroxyproline, hyaluronic acid and mucin. This explains the differing echogenicity of CAD cysts.

Diagnosis of CAD requires a high index of suspicion. Clinicians should be vigilant of the history, age of the patient and site of the lesion. For popliteal CAD, distal pulses may disappear with maximal flexion of knees due to compression of the artery by the cystic structure. The ankle-brachial index at rest and exercise is useful, however, a drop in pressure post-exercise is not always present.

Imaging is essential in the diagnosis of CAD. Historically, arteriography was used to investigate CAD. The classic appearance of the blood vessel effected by CAD has been described as the ‘Scimitar sign’, a curvilinear narrowing of the vessel. If the cyst itself is concentric, the appearance is more hourglass-like.

Considering the invasiveness of arteriography, imaging modalities such as ultrasound, CTA and MRA are more frequently used. Duplex ultrasound can quantify the stenosis of the blood vessel and identify the cyst.

MRI may provide additional information regarding possible joint connections, but is not as readily available as alternative imaging modalities.

The management of CAD is dependent on the severity of the symptoms. If symptoms are minimal, then conservative management is justified. Surgery is the mainstay of treatment for severe CAD cases. Resection of the cyst and adjacent vessel with a bypass graft, or excision of the cyst with patch repair, are the recommended techniques. Complete resection and bypass/graft interposition is the surgical technique used if the cyst causes occlusion of the blood vessel. The preservation of the native arterial wall with patch repair, rather than excision of arterial wall adjacent to the cyst, is recommended. If joint connection is identified then ligation of such connections in combination with cyst resection is recommended as a treatment strategy.

Percutaneous and endovascular aspiration and angioplasty of CAD have high recurrence rate and are usually not recommended.

As the cyst in our case only affected the anterior aspect of the external iliac artery, a cyst excision and bovine pericardium patch repair was done rather than resection of the whole segment and vein graft interposition, thus saving the patient the risk of vein harvesting morbidities. Potential joint connections were not identified in this case.

Recurrence is low and estimated to be 1 in 40 surgically treated cases. No specific long-term follow up is routinely required other than the usual graft follow-up if the patient remains asymptomatic.

In summary, CAD is a rare cause of arterial insufficiency in otherwise healthy adults. A high index of suspicion combined with clinical examination and US imaging is critical in CAD diagnosis. Surgery is recommended in symptomatic patients.
Competing interests: Nil
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REFERENCES:
Missing in action: an antimicrobial resistance strategy for New Zealand

Deborah Williamson, Michael Baker, Nigel French, Mark Thomas

A recent report from China showing the rapid emergence of antimicrobial resistance (AMR) to colistin (the ‘drug of last resort’) in *Escherichia coli* and *Klebsiella pneumoniae* isolated from chicken and pork meat, and from patients, has prompted a sharp intake of breath from the medical community and provided a timely and worrisome reminder of the inexorable spread of AMR. AMR is recognised as a grave threat to public health, summed up recently in the World Health Organization Global Action Plan on AMR: *Without harmonized and immediate action on a global scale, the world is heading towards a post-antibiotic era in which common infections could once again kill.*

In order to respond to and contain the threat of AMR, many countries, including the UK, the US and Canada, have developed cohesive action plans, with a series of ‘forward-looking’ objectives, and the recognition that AMR is a One Health issue, covering both human and animal populations. Most recently, in June 2015, the Australian Government released Australia’s first National Antimicrobial Resistance Strategy, incorporating the collective views of stakeholders from human and animal health, academia, and food and agricultural sectors. One of the common features of overseas AMR strategies is endorsement by and commitment from Government, with demonstrable leadership and accountability frameworks.

New Zealand, like other countries, has suffered the consequences of the emergence of AMR. Indeed, over the past decade, a number of concerning AMR threats have emerged in New Zealand. For example, as the result of very high levels of use of topical antibiotic preparations (Bactroban© and Foban©) in New Zealand, the rates of resistance to mupirocin and fusidic acid in *Staphylococcus aureus* are amongst the highest in the developed world. Moreover, the prevalence of resistance to commonly used antibiotics in gram-negative pathogens, such as *E. coli* and *K. pneumoniae*, continues to increase, and recent reports of the transmission of carbapenem-resistant Enterobacteriaceae within New Zealand healthcare facilities are also of significant concern. In addition, the emergence of livestock-associated methicillin-resistant *S. aureus* (MRSA) in humans, and the detection of resistant *Campylobacter jejuni* in poultry and in human populations raises concerns about potential animal reservoirs of AMR in New Zealand. Finally, New Zealand has high rates of human antimicrobial consumption compared with most other developed countries, exacerbating the problem of AMR, and prompting calls for improved medical and public awareness around the judicious use of antibiotics. Importantly, the effectiveness of antimicrobials is integral to almost all areas of human and animal health, and has an impact on all of society.

Laudable efforts have already been made by several organisations in New Zealand to monitor and respond to the threat of AMR. For example, the Health Quality and Safety Commission’s Infection Prevention and Control (IPC) programme has successfully implemented initiatives designed to improve IPC practices and reduce the spread of AMR in healthcare facilities, and the Best Practice Advocacy Centre (BPAC) provides advice to healthcare professionals on the appropriate use of antimicrobials. In addition, the Institute of Environmental Science and Research (ESR)...
provides surveillance data on AMR to the New Zealand Ministry of Health, with the capacity to monitor emerging and existing resistance patterns. Particularly admirable is a recent statement from the New Zealand Veterinary Association,\(^\text{10}\) stating, “By 2030 New Zealand Inc. will not need antibiotics for the maintenance of animal health and wellness.” It is important to recognise however, that no single individual, organisation or action will provide an effective and successful response to AMR, and that continuing to document the problem is no replacement for devising a solution.

Responding to AMR is also a key component of the global health security agenda.\(^\text{11}\) This framework is increasingly being used internationally to promote a more systematic and proactive response to emerging microbial and related threats to public health. This approach has been motivated by the realisation that, while recognising and responding rapidly to pandemics and emerging problems is vital, it is also necessary to use our knowledge to prevent problems emerging in the first place. This additional focus includes strategies to reduce the overuse of antibiotics, work with animal health agencies to reduce the prevalence of and human exposure to zoonotic diseases, and increase population resilience through immunisation and other approaches. A strong motivation is the observation that our current public and private sector organisations generally appear poorly adapted to combat complex, long-term, global health problems.

While there have been other major public health responses over the past few years, most notably addressing extremely high rates of rheumatic fever, and ensuring national preparedness for the distant threat of Ebola virus infection, there has been no visible and coordinated strategy around AMR in New Zealand. Importantly, the WHO has called for all member states, including New Zealand, to have a multisectoral national action plan on AMR in place by the 2017 World Assembly.\(^\text{2}\) Given the emergence and spread of AMR globally and in New Zealand, it is critical that efforts are made to promptly develop and implement a cohesive and coordinated national AMR strategy, rather than suffer a slow ‘death by committee.’ This strategy should have clear objectives, include a governance framework, and identify priority areas for New Zealand. Most importantly however, there should be active participation from all relevant stakeholders, with clear and credible leadership from Government. Failure to act now will impact on the health and wellbeing of New Zealanders for generations to come.

**Competing interests:** Nil

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LETTER
REFERENCES:


Incidence of malignant mesothelioma in New Zealand and Australia: a global snapshot
Matthew J Soebeg, Nico van Zandwijk

There has been recent, and increasing, interest in the human health effects of occupational and non-occupational exposure to airborne asbestos fibres, including the potential risk of malignant mesothelioma occurrence in New Zealand and Australia.\(^1,2\) Despite New Zealand and Australia having among the highest age-standardised incidence rates globally, there are few contemporary reports comparing malignant mesothelioma in New Zealand and Australia with data from other countries. For example, the most recent published literature on the epidemiology of malignant mesothelioma in New Zealand was published in 2004.\(^3\)

High-quality global cancer incidence rate data published in 2013 by the International Agency for Research on Cancer (IARC)\(^4\) can help determine where New Zealand and Australia are placed in terms of the global incidence of malignant mesothelioma. The IARC global cancer incidence data are reported as male and female populations separately. For the purpose of this short communication, we have focused on male age-standardised malignant mesothelioma incidence rates, as men are the population group most affected by malignant mesothelioma due to the primary mode of asbestos exposure being in occupational settings. However, non-occupational asbestos exposures for both men and women are of increasing concern, particularly in Australia.\(^5,6\)

Methods
We extracted data from the 10th volume of the Cancer Incidence in Five Continents report published by IARC.\(^7\) We extracted age-standardised incidence rates per 100,000 during 2003–2007, along with their standard errors, for malignant mesothelioma using the code C45 from the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10). Rates were standardised using the Segi World Population age group distribution. Malignant mesothelioma is a relatively rare malignancy with age-standardised incidence rates in many countries, often not exceeding 1.0 per 100,000 person-years. We focused on geographic regions where malignant mesothelioma incidence rates were reported by IARC to be 1.0 per 100,000 or above. These regions were North America, Europe, and Oceania—including Australia and New Zealand. A national incidence rate estimate was provided for New Zealand. Age-standardised incidence rate estimates for Australia were presented for each of the 8 population-based cancer registries. However, a national figure was not provided.

Results
Countries where the male age-standardised malignant mesothelioma incidence rate during 2003–2007 was 2.0 per 100,000 or above were Australia (all jurisdictions), Belgium, England, France (1 out of 11 jurisdictions reported), Germany (4 out of 9 jurisdictions reported), Italy (8 out of 33 jurisdictions reported), New Zealand, The Netherlands, Northern Ireland, Scotland, Switzerland (3 out of 9 jurisdictions reported), and Wales (Figure 1). New Zealand’s age-standardised malignant mesothelioma incidence rate during 2003–2007 was 2.6 per 100,000 (95% CI 2.3, 2.9). A median average calculation of Australia’s sub-national male age-standardised malignant mesothelioma incidence rate during 2003–2007 was 2.3 per 100,000 (95% CI 2.0, 2.6).
lioma incidence rates during 2003–2007 equates to 2.8 per 100,000. These values for New Zealand and Australia are below the age-standardised incidence rates for Scotland (4.0 per 100,000), England (3.6 per 100,000) and The Netherlands and Northern Ireland (both at 3.0 per 100,000).

We calculated the highest 25 male age-standardised malignant mesothelioma incidence rates reported by IARC during 2003–2007 (Table 1). Incidence in Western Australia (4.5 per 100,000) is third in this ranked listed. However, the next highest Australian jurisdiction is Queensland (3.1 per 100,000)—tenth in the ranking. New Zealand was ranked in 21st place. From these data, we can confidently conclude that there is large international variation in malignant mesothelioma rates.

Discussion
New Zealand and Australia are one of a number of high-income countries with elevated incidence of malignant mesothelioma. This is a direct result from exposure to airborne asbestos fibres in occupational settings. It is difficult to determine the total

<table>
<thead>
<tr>
<th>Geographic region</th>
<th>Region, country and cancer registry name</th>
<th>Age-standardised incidence rate per 100,000</th>
<th>Lower and upper 95% confidence limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>Germany, Bremen</td>
<td>6.0</td>
<td>(5.1, 6.8)</td>
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<td>Switzerland, Graubunden and Glarus</td>
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<td>(2.7, 5.3)</td>
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<tr>
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<td>(3.3, 4.1)</td>
</tr>
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<td>European</td>
<td>Scotland (national registry)</td>
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<td>Switzerland, St Gall-Appenzell</td>
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<td>(2.0, 3.4)</td>
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<td>(1.7, 3.1)</td>
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</table>
Figure 1: Male age-standardised malignant mesothelioma incidence rates per 100,000 using the Segi world standard population with 95% confidence limits, 2003–2007, for countries in the North American (clear bars), European (dotted bars), and Oceanic regions (striped bars) where the incidence rate is above 1.0 per 100,000 or more. Data excludes the following countries where incidence was below 1.0 per 100,000: Austria, Belarus, Bulgaria, Czech Republic, Estonia, Iceland, Latvia, Lithuania, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Ukraine, USA (Hawaii). Data extracted from the IARC report Cancer Incidence in Five Continents, Vol X, Forman et al, 2013.
asbestos consumed in New Zealand over time, including both the import of raw asbestos, as well as the import and use of asbestos-containing products. Kjellstrom and Smartt have reported that the import of crude (raw) asbestos into New Zealand peaked in 1974 at 12,500 tonnes (4 kg per capita), followed by a steep decline. No crude asbestos was imported into New Zealand after 1991.8 The use of materials containing chrysotile asbestos is not yet banned in New Zealand, and import of such material is not strictly regulated.2 Australia’s asbestos consumption peaked during 1970–1979 at around 700,000 metric tonnes9 with a complete asbestos ban in place by 2003. Australia’s malignant mesothelioma peak incidence is estimated around 2010.10 Little is understood about the peak of malignant mesothelioma in New Zealand; further research is warranted in this area. In both New Zealand and Australia, occupational and non-occupational exposure to airborne asbestos fibres will continue to pose challenges to the public health community both in terms of undertaking epidemiological research to understand who is most at risk of asbestos exposure, as well as the communication of health risks associated with asbestos exposure in the built environment.

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REFERENCES:
Obituary

David Anthony Waite
24 October 1946–22 November 2014

MB ChB (Otago), FRACP, FRNZCGP, DIH (Otago), Dip Av Med (Otago), FFOM (RCP)

David died on 22 November 2014, 14 months after he was diagnosed with a brain tumour. He knew and accepted his prognosis, but his competitive spirit came out when he was able say he had lived longer than the average mortality statistics with this condition would suggest. His funeral was held at the Catholic Cathedral, Wellington, and was attended by 1,000 friends, family and colleagues—a very real tribute to someone who was known and respected by many and who had such a multiplicity of professional interests. He was gregarious and supportive of others, both colleagues and patients. He was a great communicator and managed his diverse life with verve, focus and positivity.

David was born in Wellington, the third child of Captain William Waite RNZN and Teresa Waite. His father was a naval officer and the family had to travel often. As a result, his education was in both New Zealand and in the UK; however his secondary schooling was at St Patricks College, Silverstream. His first year at university was at Victoria, where he sat medical intermediate and was accepted into Otago Medical School the following year. During that first university year, his father was diagnosed with a terminal malignancy and died during David’s final exams. It was a tribute to his determination that he was able to focus and succeed during that stressful time.

After graduation from Otago in 1970, David spent 2 years as a house surgeon at Wellington hospital and then embarked on a career in pathology at Case Western Hospital; however he quickly found that the lack of live patient contact was not for him and he returned to New Zealand. He took up a registrar post at Palmerston North Hospital and in his typically determined way, studied for and passed his FRACP examinations in a record time. He subsequently spent 7 years as a registrar at Wellington Hospital while undertaking research with Professors Ian Prior and Tom O’Donnell. He was able...
to put his name to some 11 major research publications relating to his interest in respiratory medicine.

In 1978, David made a major career decision and took up solo general practice in Wadestown. At the same time he maintained a teaching post at the Wellington Clinical School, as well as developing his lifelong interest in occupational medicine.

He was well known and very well respected in the occupational medicine community, both in New Zealand and overseas. David brought his humanity, his internal medicine expertise, common sense and practicality, and his socialism to bear on a worker-centric practice of occupational health in New Zealand. He entered occupational medicine when it was still emerging as a specialty and went on to gain the Fellowship of the Faculty of Occupational Medicine from the Royal College of Physicians of Ireland. He completed the Diploma of Industrial Health in 2000 and the Diploma in Aviation Medicine 2 years later. He was awarded the John Stoke Medal for Service to Occupational Medicine, and was president of the Australian and New Zealand Society of Occupational Medicine and the Occupational Health Education Trust. He ran occupational medicine services for TranzRail, InterIsland Line, Hutt Valley Health, and BP. He was awarded the BP Chairman’s prize for his groundbreaking work for the global company; notably tanker driver fatigue and innovative, ergonomically sound BP petrol stations. He was an inspiration to many younger aspiring occupational health practitioners, to whom he gave his time and energy, as always, fully and generously.

In addition to general practice and occupational medicine, he worked as a MOSS in the Neurology Department at Wellington Hospital, Occupational Physician at Hutt Hospital, was an advisor to PHARMAC on the Exceptional Circumstances Panel, a quality assurance assessor to the Medical Council and travelled extensively as an ACC reviewer.

Outside of medicine, David had a multitude of interests. He was an ardent conservationist and took great pride in developing the family retreat in Miro Bay, Pelorus Sound (without power and only reachable by water) where he and his children destroyed legions of opossums and pine trees. He planted over 2,000 Australian Blackwoods and was able to mill the first of these before he died.

He was passionate about rugby and did not pass opportunities to watch when his third son played rugby for Otago University, Sydney University, the Turbos and in Japan. He was also able to enjoy watching his grandson playing for Grammar Juniors in Auckland.

He loved classical music and never missed chamber music concerts or the International Festival of the Arts in Wellington.

He took a keen interest in politics and was a staunch supporter of the Labour Party. He made his political views known on a number of occasions, including successfully resigning from the Otago University Medical Corps as a protest against the Vietnam War. He marched against the Springbok rugby tour in 1981 and was part of a group of prominent academics who carried out a silent protest in Parliament against one of the more egregious activities of Robert Muldoon (he and the other protesters were banned from parliament grounds for a year by the Speaker of the House for this).

David was an enthusiastic sportsman and had a real love for animals, Labradors in particular.

David had an encyclopaedic memory and was a master of esoteric information. As a schoolboy he could name the capital of every country in the world and was a key player in any general knowledge quiz.

He was a member of the Wellington Club and facilitated the College of Physicians social functions for registrars from Wellington Hospital who had passed the examinations.

Upon the diagnosis of his brain tumour, he approached his final months with an extraordinary inquisitiveness and courage. He enjoyed life to the end and filled the house with visitors. As the tumour progressed, he would explain in detached clinical detail what new neurological deficit was occurring. Notwithstanding, he made the most of his time, travelling round the country sightseeing and saying farewell to friends. He even travelled to Australia (at the cost of a deep vein thrombosis and a pulmonary embolus) to see a grandchild for one last time.
David was very brave during his last illness and made great use of his time, but this could only have occurred because of the selfless care and nursing by his wife, Janet and his children.

David is survived by his wife Janet and his four children, William (Auckland), James (Washington DC), Alex (Auckland) and Julia (Auckland).

Author information:
Peter Moodie, Geoff Robinson, Rob Griffiths

URL:
Robin Mackenzie Norris died peacefully on 20 September 2015 at his home on the North Shore, Auckland, after a short illness. Robin was an outstanding doctor, researcher, teacher, and mentor.

Robin was born in Newcastle, UK, on 9 March 1931. His father, Alan John Norris, was a Commander in the Royal Navy and was stationed overseas for long periods, including Gibraltar for 3 years. There, Robin had a pet donkey called Betsy, and when they returned to the UK sadly, Betsy was left behind. After many tears and much fretting, the officers of the battleship H.M.S. Rodney transported Betsy to England. This occurred with much fanfare with articles and pictures in the UK newspapers.

Robin arrived in New Zealand at the age of 6 when his father was transferred on H.M.S. Leander. His mother, Molly, got a position as Matron at Queenswood School in Hastings and Robin went to school at Hereworth boarding school in Havelock North.

At the age of 10, Robin suffered a ruptured appendix followed by peritonitis. Despite treatment with sulphanilamide—the only antibiotic available—the infection spread and he developed sepsis of both hips and knees associated with severe pain and muscle spasms. Gradually the joints stiffened. Almost 2 years after hospitalisation he returned to Auckland where he continued his correspondence lessons which he had started in hospital. Seven years after the onset of his acute appendicitis, assisted with funding by the Crippled Children's Society and the Government, he had three operations at Massachusetts General Hospital, Boston, Massachusetts, to free up movement in his hips. He stayed in Boston for 5 months while he underwent convalescence and rehabilitation. He subsequently required two walking sticks to help him walk.

On return from Boston, he went to Takapuna Grammar School and then Dunedin School of Medicine, University of Otago, Dunedin, where he graduated in 1955. After house surgeon appointments at Auckland and Middlemore Hospital and medical registrar attachments at Auckland Hospital, he travelled to London. He married Iris, a casualty department staff nurse in 1963. He was awarded an MD from Birmingham University in 1965 on the subject of ‘the relative distribution of air and blood flow in the lungs’. He then returned to New Zealand as a junior medical specialist at Green Lane hospital and was subsequently
appointed director of research programmes by the Medical Research Council.

Robin was appointed physician in charge of the Coronary Care Unit at Green Lane Hospital from 1967 and Honorary Professor of Cardiovascular Therapeutics at the Auckland University School of Medicine (1980) until 1992, when he returned to the UK asHonorary Consultant Cardiologist at the Royal Sussex County Hospital, Brighton where he worked on the UK Myocardial Infarction National Audit Programme (MINAP) for 11 years.

Robin was the New Zealand representative on the Board of the Cardiac Society of Australia and New Zealand from 1990–92 and was made a life member in 2002. He became a fellow of the Society in 2004.

Robin’s contributions to medicine and to patient care were enormous. He helped set up the first coronary care unit (CCU) in New Zealand at Green Lane Hospital with Dr Laurie Reynolds in 1967 at the time the coronary epidemic was at its height. The unit had four beds with monitoring and a waiting room for relatives. At the time, many colleagues thought it was better to treat heart attack patients at home and “the psychological trauma of uprooting cardiac patients from their home surroundings and setting them in the midst of frightening electrical gadgets and any amount of scientific care would not be able to match the results of treating patients in their homes”. Robin rounded every day in the CCU and came into hospital whenever a cardiac arrest occurred after hours in the CCU, general medical or surgical wards. He carefully followed patients for over 10 years after a heart attack, and developed what became known as the Norris index for predicting outcomes after heart attacks. He led several important studies at Green Lane with cardiology and cardiothoracic colleagues comparing patient outcomes with heart surgery and medical treatments. He was also a world leader in research, testing a number of approaches to reduce the size of heart attacks—particularly with beta blockers. His original insights and inspiration were pivotal to the work of colleagues at Oxford University, with the first International Study of Infarct Survival (ISIS) on the effects of the beta blocker atenolol on mortality.

He wrote over 200 original scientific papers, including anonymous editorials in the Lancet, predicting the future of coronary angioplasty. He also wrote an important book called Myocardial Infarction: its presentation, pathogenesis and treatment. It was really a book describing a personal odyssey of looking after heart attack patients with critical observations from his vast experience. The book was a notable contribution to our scientific knowledge about heart attacks, and over his career the mortality from heart attacks decreased 50%.

Robin was a great mentor and trained a number of registrars, funded by the New Zealand Medical Research Council (who work throughout the world), continuing Robin’s legacy, providing excellent care to patients, as well as teaching and undertaking research. On hearing of his death, they all mentioned the fond memories they had of working with Robin, and how much they had learnt from him and the lessons that had stuck with them for the rest of their careers. Robin taught them to question and to challenge many of the so called truisms we have in medicine.

He also had much joy in teaching nurses and ran, along with others at Green Lane, a course for coronary care nurses for many years. Nurses often commented that “Dr Norris had taught them everything they knew about caring for heart patients.”

Robin always had a patient-centred approach before it became an ‘in-vogue term’ and stated that “patients must never be made to feel guilty if they present as a false alarm when they come to hospital thinking they have had a heart attack”.

Robin was very determined in everything he did, including always taking the stairs and not driving an automatic car. The experience of being a passenger with Robin was quite exhilarating, breath-taking, and something to behold. Robin had a strong Christian faith, and regularly attended St. Paul’s by-the-Sea Anglican Church in Milford. He set up a trust to encourage an exchange program for young people to travel between St. Pauls and St. Mary the Virgin in Ringmer, East Sussex. He loved swimming, body surfing and playing with his grandchildren. All of whom have very
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special memories of him. At his funeral one grandchild said, “I will never be able to play cricket as well without ‘Grand Pere’ supporting me.”

Robin and Iris returned to New Zealand to retire in 2003; however, he always had a project he was undertaking. He did not stop contributing, writing to The New Zealand Medical Journal several times, and recently wrote a letter to the Lancet, about an issue that he has been passionate about, people dying with heart attacks in the community. He pointed out that too many patients die needlessly in the community from heart attacks before getting to hospital. And he made a plea for more research, for treatments to be directed to these patients, and noted that three-quarters of people who die from heart attacks under the age of 75 do so in the community.

Robin felt privileged being part of the Green Lane team. He recently instigated a museum project telling the story of Green Lane Hospital. This will begin at the Museum Of Transport and Technology (MOTAT) and it will tell the story of the people of Green Lane and the innovations and patient experiences. Many of the exhibits will be interactive with the aim to teach the public about heart disease and its prevention.

The picture of Robin sitting in his office wearing a white coat (which he always wore), his locator in his pocket, beside him a bookshelf with his book and his beloved journals, the Lancet and Circulation, is a true likeness.

Robin was a visionary, an inspiration to many, a motivator, an outstanding researcher, a wonderful compassionate doctor, and a lovely man.

He has enhanced and enriched many lives and his legacy will live on.

Robin and Iris were a devoted couple. Robin nursed Iris during her long illness until her death in 2009.

Robin is survived by his sons Andrew and Richard, their wives Dianne and Jolanda, and beloved grandchildren Cordelia, Honor, Callum, Danielle and Vivien.

‘To travel hopefully is a better thing than to arrive’ Robert Louis Stevenson from Virginibus Puerisque, 1881

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Comparative effectiveness of treatments for *Helicobacter pylori*

Hitherto, the most widely used treatment to eradicate *h. pylori* has utilised 7 days of standard triple treatment (a proton pump inhibitor plus clarithromycin, with amoxicillin or metronidazole). However, with the development of antibiotic resistance, particularly to clarithromycin, the standard triple treatment is now challenged by several new treatments.

This review and meta-analysis has examined evidence from 143 studies emulating 14 different regimens. The conclusions reached were that the standard triple treatment was inferior to the other regimens. It resulted in a 73% eradication rate compared with 94% for a 7-day course of a proton pump inhibitor with 3 antibodies (often amoxicillin, clarithromycin and 5-nitroimidazole).

BMJ 2015;351:h4052

Neuraminidase inhibitors for influenza

As winter approaches in the UK, the debate is renewed as to whether the benefit of routine use is outweighed by the adverse effects, such as nausea and vomiting. Some light has been thrown on this as the Academy of Medical Sciences and the Wellcome Trust (AMS/WT) has recently published a report on the neuraminidase inhibitor (NAI) antiviral drugs in seasonal and pandemic influenza treatment and prophylaxis.

The most significant recommendation is that routine use of antivirals is not supported in patients with seasonal influenza unless the individual is seriously ill or the strain is very severe. The report also calls for high quality, adequately-powered randomised trials in hospitalised and high-risk patients (pregnant women and children) in a pandemic.

Lancet 2015;386:1510

A randomised, controlled trial of total knee replacement

Total knee replacement is a well-established procedure. However, high-quality evidence to support the effectiveness of the procedure, as compared with nonsurgical interventions, is lacking. Hence this trial, which involved 100 patients with moderate-to-severe knee osteoarthritis who were eligible for unilateral total knee replacement.

Patients were randomly assigned to undergo total knee replacement followed by 12 weeks of nonsurgical treatment (total-knee-replacement group), which was delivered by physiotherapists and dietitians and consisted of exercise, education, dietary advice, use of insoles, and pain medication.

The surgical treatment resulted in greater pain relief and functional improvement after 12 months follow-up. However, the surgical treatment was associated with a four-fold increase in serious adverse events. The commonest were deep venous thrombosis and severe stiffness in the operated knee.

N Eng Med J 2015;373:1579-606

URL:

In the October number of The New Zealand Medical Journal, there is an article on the use of pituitrin in labour. The opinions expressed in that article agree with those which have appeared in other publications, but I regret that my own experience has not been so fortunate. I quite admit that in pituitrin we have a very valuable weapon, but I believe that its limits are more restricted than some writers claim. General surgery has gained as much as, if not more than, obstetrics by the introduction of pituitrin.

To my mind the greatest objection is the difficulty of judging what its action will be in any particular case. Given intra-muscularly, the maximum effect is obtained in a very short time, and, once it is given, there are no means of controlling its action. Perhaps a concrete example may explain my meaning.

Mrs. W., ætat 25 years, primipara. Labour was proceeding slowly with moderate pains. As conditions were unfavourable for the application of forceps, at the stage of full dilatation I injected 1 c.c. of pituitrin. The pains were soon increased in strength and in frequency. Progress was now rapid, and when the head was on the perineum, the pains were almost continuous. The result was a bad tear of the perineum and a stillborn child, both of which I attribute to the use of pituitrin in that particular case.

In another case, no appreciable effect was produced, though all the indications pointed to the administration of pituitrin.

Mrs. H., multipara. The pains were infrequent and inefficient. Dilatation proceeded very slowly, and the injection of 1 c.c. of pituitrin on three separate occasions produced nothing but the most transient effect. Delivery was finally completed with forceps.

It is stated that the use of pituitrin hastens the third stage. This is certainly true, but in two cases of mine the rapid detachment of the placenta resulted in small pieces of placental tissue being retained.

As regards the occurrence of post-partum haemorrhage, this seems to depend on the time at which the pituitrin is administered. As the effect of pituitrin wears off in about one hour, unless delivery is completed within one hour after the exhibition of the pituitrin, there may be considerable uterine relaxation with more or less haemorrhage. I have noticed this tendency in several cases. Of course, a second injection quickly remedies this.

Another advantage claimed for pituitrin is that the number of forceps cases is reduced, but in many instances I believe that the use of forceps is a distinct advantage. In primiparous cases especially the application of forceps helps to stretch the perineum, and while exercising traction with the right hand, one can stretch the perineum with two fingers of the left hand. When the head is brought down to the perineum it is advisable to push the anaesthesia and so abolish all straining on the part of the patient. Then it is a simple matter to deliver the head gradually, at the same time working the perineum backwards over the sinciput. In this way it is possible to deliver a primipara with only the smallest tear of the fourchette.

If the labour is proceeding slowly and the patient shows signs of becoming exhausted, I prefer to give ¼-gr. of morphia. This, while not abolishing uterine action, greatly lessens the sufferings of the patient, and even permits of a few hours’ sleep in some cases. Later pituitrin or forceps can be used as is thought fit.

Personally, I am inclined to restrict the use of pituitrin to a multipara whose perineum has lost its rigidity, and after the third stage to those cases which show a tendency to haemorrhage.
The in situ configuration of bilateral and unilateral thoracic type II meningeal cysts

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Spinal meningeal cysts a source of back pain and are classified into three types. Type II meningeal cysts are distinguished from other spinal cysts by the presence of nerve fibres. Surgical strategies to manage symptomatic Type II meningeal cysts depend upon our understanding of their anatomy. Knowledge thus far is incomplete and has relied upon imaging, surgical observation and histopathology of resected cysts. Using a modern anatomical technology – epoxy sheet plastination – the current study is the first cadaveric in situ macro/microscopic configuration analysis of Type II cysts and their anatomic relationship with surrounding structures since Tarlov’s study in 1938 in which only sacral type II cysts were analysed.

Three Type II cysts were incidentally found in one (female; 89 years old) of 16 epoxy sheet plastinated spines. The spine was plastinated as a set of 164 serial transverse sections with a thickness of 2.5 mm. The sections were examined under a stereomicroscope.

Three spinal cysts were found at the levels of T11 (bilateral) and T10 (unilateral) vertebrae.

They were type II meningeal cysts with necks connecting cyst bodies to the meningeal ostia. The dorsal roots of the spinal nerves were centred at the meningeal ostia, and then splayed over the cyst bodies or traversed the cyst cavities. The cyst necks pressed against the inferior border of the vertebral pedicle as they sharply turned inferolaterally into the intervertebral foramina, where the cyst bodies were halted laterally by the spinal ganglia.

This study, for the first time, reports the in situ macro/microscopic configuration of Type II cysts and their relationship with the thecal sac, spinal nerve roots and ganglia, vertebral pedicles and intervertebral foramina. These findings suggest a neck-linked valvular mechanism and indicate the necessity of localising and ligating the cyst neck for surgical management of symptomatic Type II cysts.

Exploring the influence of patient covariates on the dose-response of vitamin D supplementation in pregnant women and their infants.

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Vitamin D deficiency during pregnancy is associated with an increased risk of pre-eclampsia and gestational diabetes in the mother and an increased risk of rickets in the infant. Supplementation of vitamin D during pregnancy is advocated but the recommended doses of existing regimens vary four-fold and are not individualised. This can potentially result in treatment failure or hypervitaminosis D. Therefore, this study aimed to explore the influence of patient covariates (e.g. age, sex, size, season, and ethnicity) on the dose-response of vitamin D supplementation.

Data were obtained from a published clinical trial of pregnant women (n = 260) and their infants (n = 260). Mother-infant pairs were randomised to either placebo (0 IU, 0 IU), low-dose (1000 IU, 400 IU), or high-dose (2000 IU, 800 IU) oral vitamin D3. Serum concentrations of 25-hydroxyvitamin D were obtained from mothers in two occasions and from infants in five occasions. Several pharmacokinetic (PK) models were fitted to the concentration data using nonlinear mixed effects modelling. The influence of covariates was explored using plots of posthoc estimates of the parameters versus the covariates and covariate modelling. Selection of the best model was evaluated using the likelihood ratio test and goodness-of-fit plots.

PK models for vitamin D supplementation in pregnant women and their infants were developed. A one-compartment model with first-order elimination was found to provide the best fit for both the pregnant women’s data and the infants’ data. No covariates were found to have a significant effect on the PK parameters of either model.

It is uncertain whether this lack of covariate effect on the disposition of vitamin D
is real or whether the design (models and data) was inadequate to detect any covariate effect. However, based on this study, there is no evidence to support dose-individualisation of vitamin D3 based on the covariates tested here.

**Ablation of hypothalamic RF-amide related peptide neurons with diphtheria toxin: effects on anxiety behaviours and reproductive hormone secretion.**

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RF-amide related peptide (RFRP) 3 is a neuropeptide that inhibits central regulation of fertility. RFRP-3 infusions stimulate stress hormone secretion and anxiety-related behaviours. It is unknown if these findings reflect endogenous RFRP-3 fluctuations. This study aims to demonstrate a role for endogenous RFRP-3 in such responses by characterising the resulting behavioural phenotype in RFRP ablated mice using a novel transgenic technique to specifically ablate RFRP neurons.

A new transgenic mouse line in which the Rfrp gene also products Cre recombinase was crossed with a line that enables Cre-dependent expression of the diphtheria toxin receptor. Consequently, injecting the offspring with diphtheria toxin resulted in apoptosis of cells expressing Rfrp.

RFRP neuron ablated female mice were compared against non-Cre expressing controls (n = 10/group) for anxiety behaviour (elevated plus maze (EPM) and light/dark box tests), obsessive-compulsive behaviour (marble-burying test), depression (forced swim test) and stress axis activity (acute restraint). 4 weeks post-diphtheria toxin treatment. Additionally, the effect of RFRP ablation on the secretion of the reproductive gonadotrophic hormone luteinizing hormone (LH) was measured.

RFRP ablation had no effect on time spent in aversive areas of the EPM (P = 0.43, Mann Whitney-U test) and light/dark box (P = 0.13), marble-burying (P = 0.97) and active swimming duration (P = 0.48). Restraint caused an increase in circulating stress hormone (corticosterone) in both groups (basal: 47.5 ± 39.0, restrained: 214.0 ± 111.1 ng/mL, P < 0.05 two-way ANOVA) however the response did not differ between groups. In contrast, circulating LH concentrations were elevated in ablated mice compared to controls (0.79±0.27 vs. 0.51 ± 0.24 ng/mL respectively, P < 0.05; unpaired t-test), and the suppressive effect of acute restraint stress on LH in controls (0.45 ± 0.19, P < 0.001 vs. basal levels; unpaired t-test) was not seen in ablated mice.

These data show that RFRP neurons suppress LH secretion and mediate stress induced LH suppression. They were not required for behavioural or stress steroid responses modelled here, although may still be involved in chronic affective disorders.

**The overlap of hyperventilation syndrome with asthma and anxiety.**

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Hyperventilation Syndrome (HVS) is a functional breathing disorder that causes recurrent or chronic respiratory and non-respiratory symptoms which cannot be attributed to a specific medical diagnosis. It is thought to be common yet often recognised or misdiagnosed as asthma. Asthma and HVS can co-exist and there are also similarities between HVS and anxiety disorders leading to diagnostic uncertainty. HVS is usually diagnosed by the Nijmegen questionnaire (NQ), a self-administered 16-item checklist for HVS symptoms. However, the NQ includes several symptoms that are also associated with asthma and anxiety disorders. The aim was to examine the poorly understood overlap of HVS with asthma and anxiety in a general population sample.

The prevalence of HVS and its association with various asthma measures and anxiety diagnosis at age 38 years were explored in the Dunedin Multidisciplinary Health and Development Study (‘Dunedin Study’). According to NQ in the Dunedin Study, HVS was more common in women (12.1%) than men (6.5%, P = 0.003). There was substantial overlap between HVS and asthma, with up to one-third of female asthmatics (35.4%) reporting symptoms suggestive of HVS. However, there were different patterns of symptoms in the NQ found between people in HVS-only and asthma-only groups. Conversely, there were no significant difference in asthma measures including lung function (FEV1/FVC ratio), bronchodilator responsiveness, and developmental asthma phenotypes between those with asthma only and those with both asthma and HVS. Further, approximately half of the HVS-only group were also diagnosed with anxiety, especially panic disorder. However, there remained a group of people whose high NQ score could not be explained by co-morbid anxiety disorder.

Taken together, HVS is a distinguishable clinical entity using the NQ that is common in the general population of young adults, and unlikely to be merely undiagnosed asthma or panic disorder.

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**Energy expenditure associated with prolonged sitting, regular activity breaks, and physical activity**

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Sedentary behaviour induces unique physiological mechanisms associated with an increased risk of cardio-metabolic diseases independent to those related with a lack of physical activity (PA). Regular activity breaks (RAB) from sedentary behaviour impart acute metabolic benefits in terms of postprandial glycaemia and insulinemia. It is unknown whether RAB elicit a cumulative effect on energy expenditure (EE) compared to a single bout of exercise. Therefore, the aim of this study was to compare EE profiles of prolonged sitting, RAB, and currently recommended levels of PA.

Six male and 18 female (n = 24) participants, aged 18-34 years, completed a randomised-controlled crossover study with four separate 7 hr interventions: (1) Prolonged sitting; (2) Sitting with RAB (2 min of walking every 30 min); (3) Prolonged sitting with 30 min of walking at the end of the day; (4) Sitting with both RAB and 30 min of walking at the end of the day. All walking was undertaken on a treadmill at a speed and incline to elicit 60% VO2max. Indirect calorimetry was used to estimate EE. Participants consumed standardised meals during the intervention.

Preliminary results of the mixed-model regression showed that compared to prolonged sitting EE was 724 kJ (95% CI 441 to 1007 kJ; P < 0.001) greater for the PA, 896 kJ (95% CI 613 to 1179 kJ; P <0.001) greater for RAB, and 2432 kJ (95% CI 2150 to 2716 kJ; P <0.001) greater for the combined interventions.

There was no difference (P = 0.23) in total EE between RAB and PA. The EE associated with excess post-exercise oxygen consumption was 500 kJ (95% CI 372 to 627 kJ; P <0.001) greater for RAB compared to PA. The EE associated with RAB can match that of recommended levels of PA. This may elicit important effects on cumulative daily EE and be beneficial to energy balance and overall health.

Leptin receptor signalling in Agouti-related peptide (AgRP) neurons modulates puberty.

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The adipose-derived hormone leptin is required to communicate metabolic information to hypothalamic gonadotropin-releasing hormone (GnRH) neurons, the central drivers of reproduction. Metabolic signals provided by leptin are integrated with the reproductive system so that fertility can be closely linked with metabolic status. GnRH neurons do not possess leptin receptors (LepR), indicating that leptin acts through intermediate leptin-responsive neurons to exert effects. Neurons which are critical for leptin-to-GnRH signalling are GABAergic, which narrows the pool of candidate populations involved in this transfer of information. Agouti-related-peptide (AgRP) neurons in the arcuate nucleus of the hypothalamus are an attractive candidate population as they are GABAergic and possess LepR. This study aimed to investigate whether leptin actions on AgRP neurons are required for normal fertility.

Transgenic mice were generated using Cre-Lox technology where targeted expression of the Cre recombinase enzyme allowed specific removal of LepR from AgRP neurons. Puberty onset and fecundity of AgRP-LepR knockout male (n = 9) and female (n = 10) mice were compared to that of male (n = 10) and female (n = 10) control littersmates. AgRP-LepR knockout female mice exhibited a significant delay in the onset of reproductive cycles, which began on day 37.5 ± 1.0 compared to day 34.1 ± 0.85 in controls (P < 0.05, Mann-Whitney U test), however no deficits were observed in adult fecundity. No significant differences in puberty onset or fecundity were observed between male control and AgRP-LepR knockout mice (P > 0.05, Mann-Whitney U test).

This study provides evidence that leptin signalling in AgRP neurons is involved in the development of reproductive function in female mice but is not required for adult fertility. A follow-up experiment using LepR-null mice in which the receptor is ‘rescued’ only in AgRP neurons to determine whether leptin signalling in this neuronal population is sufficient for fertility is currently underway.

Does Denovilliers’ fascia exist in the female?

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Of all cancer deaths in New Zealand, 15% are attributed to colorectal cancer. Treatment may involve excision of the rectum and surrounding tissues. The prerectal surgical plane is demarcated by Denovilliers’ fascia (DVF). Recognition of DVF is important to define the extent of direct rectal cancer spread when interpreting preoperative imaging. DVF was first described in the male as a “distinct membranous layer”, giving no account to presence in the female thus existence of this structure in the female is controversial. This study aimed to map the configuration of DVF in adult female cadavers. Three sets of serial sections (two transverse and one sagittal) were collected from three adult female cadavers. Two sets were collected individually from two cadavers and plastinated using novel Epoxy-12 plastination technology, and examined under a dissection microscope.

The upper border of the external anal sphincter was
found to be a crucial landmark in the pre-rectal surgical plane. The area superior to the border was filled with adipose tissue. Inferiorly, the fibres of the rectal and vaginal walls intermingled and no fascial septum was identifiable. Fragmented membrane-like structures in the plane included (1) the peritoneal extension on the posterior vaginal fornix, (2) vascular fascial sheets and (3) tendinous fibres of the longitudinal rectal muscles.

These results indicate that there was no evidence of DVF in the female. Surgeons may misidentify the fragmented membrane-like structures as DVF.

Mapping perspectives on an ethically challenging paediatric case

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Neonatal care of infants with life limiting conditions provides ethical challenges for all involved including their whānau. Care of these infants often involves a large multi-disciplinary team (MDT), with each individual of this team bringing different perspectives and views to the care of these infants. Previous research in the field of paediatric bioethics tends to be theoretical and focus on “grey-zones” in decision making, particularly concerning when and if a parent’s decision can be overridden. However, little is known about how a multidisciplinary team actually navigates complex ethical decisions in the clinical setting, in affiliation with the family. This study aims to contribute to this gap in the literature.

This project was designed around a single ethically challenging neonatal case and employed qualitative interviews with both the family and a range of health professionals to explore the personal perspectives regarding ethical issues navigated through this single case.

Data was collected in the form of semi-structured, qualitative interviews and then analysed using grounded theory-lite methodology. One interview was conducted with the family, and seven interviews with members of the MDT (neonatologist, paediatrician, charge nurse, transport nurse, midwife, clinical geneticist and social worker).

A key theme from the data was the importance of communication in ethically complex cases. This theme arose from subthemes extracted from the interview data, including: 1) the role of information; 2) processes and procedures and 3) building a relationship. Subtle differences in the way in that different team members talked about these three sub-themes are described and interpreted.

Developing a nuanced understanding of the ethical aspects of such cases, from a multidisciplinary perspective, may help to optimise clinical care and could contribute to the development of inter-disciplinary education resources for health professionals.

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