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A close-up photograph of a person's hand holding a tall, slender glass filled with a golden beer. The hand is positioned at the top of the glass, with fingers resting on the rim. The background is blurred, suggesting an outdoor setting like a stadium or a public event.

Time for the New Zealand government to ban alcohol advertising and sponsorship in sport

Alcohol sponsorship of a summer of sport: a frequency
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correlates of New Zealanders'
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Demographic and psychological correlates of New Zealanders' support for euthanasia

Carol HJ Lee, Isabelle M Duck, Chris G Sibley

There is strong public support for euthanasia when people are asked whether doctors should be allowed by law to end the life of a patient with a painful incurable disease upon their request. Non-religious, liberal, younger, employed, non-parents and those living in rural areas were more supportive. Those of Pacific or Asian ethnicity, with lower income and higher deprivation, education and socio-economic status were less supportive. Furthermore, those high on the personality traits extraversion (being sociable and assertive), conscientiousness (being diligent and organised) and neuroticism (being anxious and insecure) showed more support, while those high on agreeableness (being tolerant and cooperative) and honesty-humility (being fair and sincere) exhibited less support.

Changes in the age pattern of New Zealand suicide rates

John Snowdon

Age patterns of suicide in both Australia and New Zealand have changed dramatically over the last 50 years. Fluctuations have been attributed to a complexity of factors. Changes within society and in availability of health and community services have doubtless affected suicide rates. The rise in suicide rate of Māori and Australian indigenous younger people has been alarming. There has been a welcome reduction in late life suicide rates, especially notable among New Zealand older men.

Alcohol sponsorship of a summer of sport: a frequency analysis of alcohol marketing during major sports events on New Zealand television

Tim Chambers, Louise Signal, Mary-Ann Carter, Samuel McConville, Rebecca Wong, Wendy Zhu

Alcohol sponsorship of televised sport in New Zealand is prevalent. Sport is used by alcohol companies to bypass regulations on traditional forms of advertising. Viable models of sponsorship replacement are available but require political will from both sports organisations and governments for their implementation.

New Zealand rugby health study: motor cortex excitability in retired elite and community level rugby players

Gwyn N Lewis, Patria A Hume, Verna Stavric, Scott R Brown, Denise Taylor

We examined brain excitability in retired rugby players in comparison to people who had played non-contact sport, to help determine any association between brain injury sustained through rugby and altered corticomotor function (ie, the function of neural pathways from the brain that control movement). There was some evidence of altered corticomotor function in the retired elite rugby players compared to the non-contact sport control group; however, this was not the case for those who had played club-level rugby. Both groups of retired rugby players had experienced more concussions than the non-contact sport players. Given the absence of altered corticomotor function among the community rugby players, there was no evidence that the differences in corticomotor function in the elite rugby players were related to previous concussions.

Stressful events and circumstances reported by patients prior to being prescribed antidepressants

Morgyn Hartdegen, Kerry Gibson, Claire Cartwright, John Read

This large online survey found that over two thirds of New Zealanders who had been prescribed antidepressants reported that they were dealing with at least one and often more than one stressful circumstance in their lives. The most commonly reported stressful circumstances were relationship difficulties, life transitions, losses, work related difficulties as well as stress related to their own or other people's health difficulties. As most antidepressants are prescribed primary care level, it is important for GPs to be aware of the significance of these psychosocial stressors in their patients' lives and recommend treatments that address these directly.

Student-led intervention to inNOvate hand hygiene practice in Auckland Region's medical students (the No HHARMS study)

Nathanael CC Lucas, Carl G Hume, Abdal Al-Chanati, William Diprose, Sally Roberts, Josh Freeman, Vernon Mogol, David Hoskins, Richard Hamblin, Chris Frampton, Warwick Bagg, Alan F Merry

In 2013 national data showed poor compliance with hand hygiene by medical students. A student-led initiative improved compliance, but there is still room for further improvement. Some lessons were also learned about the best way to analyse hand hygiene data.

Should New Zealand introduce nationwide pulse oximetry screening for the detection of critical congenital heart disease in newborn infants?

Elza Cloete, Tom Gentles, Jane Alsweiler, Lesley Dixon, Dianne Webster, Deborah Rowe, Frank Bloomfield

Identifying babies with critical cardiac defects as early as possible is crucial for their survival and long-term wellbeing. A pulse oximeter is a device that can determine the oxygen level in the blood and has been successfully utilised internationally to aid in the early diagnosis of cardiac defects. New Zealand has a largely midwifery-lead model of maternity care and will face unique challenges when implementing a new screening practice. The feasibility of a nationwide screening programme should be investigated prior to adopting this practice at national level.

Time for the New Zealand government to ban alcohol advertising and sponsorship in sport

Kerry S O'Brien, Tanya Chikritzhs

Alcohol is one of the leading causes of death and disability, with around 3.5 million deaths a year due to alcohol, and approximately 25% of all deaths in young adults attributable to alcohol worldwide.¹ A significant burden is also carried by the wider society through collateral damage or harms to others resulting from individuals drinking. Around 40% of those injured in drink driving accidents in New Zealand were not the drinkers, and up to a half of all police reported offences (eg, domestic violence, assaults, vandalism) in New Zealand involve alcohol.² There are three well-established evidence-based approaches for addressing the harms associated with excessive alcohol consumption at a population level; pricing, physical availability and restrictions in alcohol marketing (ie, alcohol advertising and sponsorship).³ The New Zealand government has not effectively implemented any of them. We focus here on the latter of the three approaches to reducing alcohol harms: greater restriction on alcohol marketing.

Stricter independent regulation of, or bans on, alcohol advertising and sponsorship is consistently identified as among the most cost effective and easily implementable means for reducing alcohol-consumption and associated harms at a population level.³ Evidence on the impact of children's exposure to alcohol advertising and sponsorship on subsequent drinking behaviour is clear. Exposure to alcohol advertising early in life is associated with earlier initiation of drinking, and greater drinking in existing drinkers.⁴ It is therefore unsurprising that the New Zealand governments own Ministerial Forum on Alcohol Advertising and Sponsorship⁵ and the New Zealand Law Commission Report (*Alcohol in our lives:*

Curbing the harm)⁶ both called for bans on alcohol advertising and sponsorship, particularly in sport and other cultural events.

Using sport to promote alcohol

Sport is the primary vehicle for the promotion of alcohol, with the majority of the alcohol industry's advertising and sponsorship budgets spent in and around sport. Chambers and colleagues⁷ new study provides yet more evidence to support recommendations and public calls for stricter and independent regulation or bans of alcohol advertising and sponsorship in sport. Chambers and colleagues examined the extent of alcohol advertising and sponsorship messages in a sample of sporting events televised in New Zealand. For some events they showed that alcohol branding was visible nearly 50% of the broadcast time, and in the Cricket World Cup final between New Zealand and Australia, a Victorian Bitter (VB) beer logo appeared on screen over 500 times.⁷ While we can only guess at the extent of New Zealand children's exposure to these alcohol messages when watching the popular sport events (it depends on audience viewing numbers), other research suggests it is likely to be extensive.

Recent research in Australia,⁸ a similar sporting and drinking culture to New Zealand's, examined the extent of alcohol advertising in sport versus non-sport TV across an entire year, along with calculating children (0–17 years) and young people's (18–29 years) exposure to alcohol advertising when watching sport TV. There were over 6,000 alcohol advertisements in sport TV, with over 85% of all alcohol advertising being placed within sport TV during children's

peak viewing times. The greatest exposure of children to alcohol advertising and sponsorship, regardless of time of day, was when watching sport TV. Across a complete year of sport TV viewing, there were over 60 million potential exposures to alcohol advertising for children. When taking into account programming time for sport versus other TV genres, there were approximately four alcohol advertisements in sport TV for every one advert in non-sport TV.⁸ Although similar research has not been conducted in New Zealand, it's reasonable to assume that New Zealand children's exposure to alcohol advertising and sponsorship messages in sport will be similar.

The study by Chambers and colleagues⁷ is an important addition to the evidence base on alcohol advertising in sport, but there has been good evidence for some time from New Zealand and elsewhere demonstrating the link between alcohol advertising and sponsorship and more problem drinking. For example, Casswell and colleagues⁹ demonstrated longitudinally that exposure to, and liking of, alcohol advertising predicted greater consumption three years later in young New Zealanders, and direct alcohol sponsorship of New Zealand sports teams, clubs and players has been found to be associated with more hazardous drinking in those receiving sponsorship compared to those not sponsored.¹⁰

Policy action is needed

A ban on alcohol advertising and sponsorship, and particularly in sport TV, should be a key policy focus for the New Zealand government. Two thorough, consultative and independent reports have recommended as much, and there is public support for greater restrictions.^{5,6} Around 78% of the nearly 3,000 submissions to the New Zealand Law Commission review mentioned the problem of alcohol advertising and sponsorship, with 86% of those

supportive of a ban or tighter restrictions on all alcohol advertising and sponsorship. We know of no study that shows that the public would miss having alcohol advertising in sport TV, but we do know of studies showing over 75% of the public support bans or tighter restrictions on alcohol advertising and sponsorship, and this support is even greater among parents.¹¹

Governments are fond of blaming and/or calling for changes in drinking culture and associated alcohol-related harm. However, culture is, in effect, what we see around us in the environment. By growing up in New Zealand where alcohol advertising and sponsorship is ubiquitous and paired with the surrogate national identity, sport and sporting prowess, a child will implicitly, if not explicitly, assume that consuming alcohol is part of being a good New Zealander. The New Zealand government has thus far failed to act on repeated expert recommendations that would support a change in the drinking culture, and as such, continues to support a culture where problem drinking behaviour and associated harms will be difficult to address.

With independent review panels recommending bans on alcohol advertising and sponsorship in sport, widespread public support for the same, and evidence to suggest that such initiatives are cost effective and will reduce alcohol-related harms, why has the government not acted? Are vested interests (eg, alcohol industry, advertising industry and sport administrators) preventing the adoption of effect alcohol policy making? There is an increasing evidence base on the influence of vested interest on policy making, and much of the research suggests the influence of vested interest on policy making is not in the interest of public health.^{12,13} Medical and public health organisations along with health advocates need to call on the New Zealand government to explain their inaction in the face of strong evidence-based calls for action.

Competing interests:

Nil.

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Demographic and psychological correlates of New Zealanders' support for euthanasia

Carol HJ Lee, Isabelle M Duck, Chris G Sibley

ABSTRACT

AIMS: To explore the distribution of New Zealanders' support towards the legalisation of euthanasia and examine demographic and psychological factors associated with these attitudes.

METHODS: 15,822 participants responded to the 2014/15 New Zealand Attitudes and Values Study (NZAVS) survey. This survey included an item on people's attitudes towards euthanasia, and information on their demographic and psychological characteristics.

RESULTS: The majority of New Zealanders expressed support for euthanasia, which was assessed by asking "Suppose a person has a painful incurable disease. Do you think that doctors should be allowed by law to end the patient's life if the patient requests it?" Non-religious, liberal, younger, employed, non-parents and those living in rural areas were more supportive. Those of Pacific or Asian ethnicity, with lower income and higher deprivation, education and socio-economic status were less supportive. Furthermore, those high on extraversion, conscientiousness and neuroticism showed more support, while those high on agreeableness and honesty-humility exhibited less support.

CONCLUSION: There is strong public support for euthanasia when people are asked whether doctors should be allowed by law to end the life of a patient with a painful incurable disease upon their request. There are reliable demographic and personality differences in support for euthanasia.

Whether or not doctors should be legally permitted to end the life of a suffering patient remains a controversial issue around the world.^{1,2} Although the practice of euthanasia has been legalised in some countries (eg Belgium and Luxembourg), there is continuing debate regarding the morality and practicality of such legislation.^{3,4} In New Zealand, the "Death with Dignity Bill" was put forward in both 1995 and 2003 but failed to pass.³ The 2012 "End of Life Choice Bill" was also unsuccessful.³ Despite this repeated failure, polls indicate that the majority of New Zealanders tend to support the right of patients to make end-of-life choices.^{3,5} This on-going debate regarding the legalisation of euthanasia suggests that research tracking New Zealanders' attitudes toward euthanasia is essential.

'Euthanasia' refers to the administering of a death-causing or hastening act on a person suffering from an incurable or

painful disease as a means of mercy.⁶ Advocates of euthanasia invoke the argument of human dignity, in that individuals should have the autonomy to make decisions regarding their own death.^{4,7} Conversely, opponents claim that euthanasia is no different to murder, has high potential for abuse and emphasise the sanctity of human life.^{4,7} Nevertheless, support for euthanasia appears to be on the rise in many countries.^{1,8} To illustrate, a Horizon Research study on 2,969 adult New Zealanders in 2012 found that around 63% of respondents supported the right of patients to make end-of-life decisions.⁵ Subsequently, a study by Rae et al on 677 New Zealanders found that 82% of respondents supported the legalisation of euthanasia.³ However, many believed that only patients suffering from severe pain, loss of dignity and with little hope of recovery should be given the choice of hastening death.⁵

Previous studies have also examined links between various demographic and psychological factors with people's attitudes towards euthanasia. In general, individuals who are younger, non-religious, of higher socio-economic status and more educated tend to support euthanasia.^{4,9,10} In terms of personality (see Table 1 for definitions of the core 'Big-Six' personality traits), studies on American and Iranian samples found that individuals high on openness to experience exhibited more support, while those high on honesty-humility and agreeableness exhibited less support for euthanasia.^{11,12}

However, there were some cross-cultural differences in results. For instance, agreeableness was significant in the Iranian but not the American sample.^{11,12} Similarly, a study on European countries found that younger individuals,¹⁰ while a study on a Chinese sample found that older individuals, were more supportive of euthanasia.⁹ This suggests that culture or national history may have important influences on people's perceptions of euthanasia.

In the context of New Zealand, Horizon Research found that support for euthanasia was highest among European and Māori individuals, and those aged 45–54.³ Contrastingly, Rae et al reported that younger Māori individuals and those indicating an "other" ethnicity (not European, Pacific, Māori or Asian) were less supportive of euthanasia.³ Further, religious people showed less support.³ Given these mixed findings, the demographic factors associated with support for euthanasia in New Zealand remain unclear. Extending on these studies, we use a large nationally representative probability sample of New Zealanders to assess the distribution of support for euthanasia, and more importantly, explore how these attitudes are associated with a broad range of demographic and psychological factors. These include gender, age, household income, deprivation, education, employment status, the Big-Six personality traits and political orientation. This provides an important cross-sectional 'snapshot' on the level of support for euthanasia in the New Zealand adult population in 2014/15.

Table 1: Interpretation of each Mini-IPIP6 factor, including example traits, and likely adaptive benefit and costs resulting from high levels of each personality dimension (adapted from Sibley et al,¹³ p. 144, which was in turn adapted from Ashton and Lee¹⁴ p. 156).

Factor	Interpretation	Example traits	Likely adaptive benefits of high levels (in evolutionary history)	Likely costs of high level (in evolutionary history)
Extraversion	Engagement in social endeavours	Sociability, leadership, exhibition	Social gains (friends, mates, allies)	Energy and time; risks from social environment
Agreeableness	Ingroup co-operation and tolerance; reciprocal altruism in HEXACO model	Tolerance, forgiveness, (low) quarrelsomeness	Gains from cooperation, primarily with ingroup (mutual help and nonaggression)	Losses due to increased risk of exploitation in short-term exchanges
Conscientiousness	Engagement in task-related endeavours	Diligence, organisation, attention to detail	Material gains (improved use of resources), reduced risk	Energy and time; risks from social environment
Neuroticism (low emotional stability)	Monitoring of inclusionary status and attachment relations; kin altruism in HEXACO model	Anxiety, insecurity, (low) calmness	Maintenance of attachment relations; survival of kin in HEXACO model	Loss of potential gains associated with risks to attachment relations.
Openness to experience	Engagement in ideas-related endeavours	Curiosity, imaginative-ness, (low) need for cognitive closure and (low) need for certainty	Material and social gains (resulting from discovery)	Energy and time; risks from social and natural environment
Honesty-humility	Reciprocal altruism (fairness)	Fairness, sincerity, (low) entitlement and (low) narcissism	Gains from co-operation, (mutual help and non-aggression)	Loss of potential gains that would result from the exploitation of others (and in particular outgroup members)

Method

Sampling procedure

We used the sixth wave of the (2014/15) NZAVS, which contained responses from 15,822 participants (15,740 retained from one or more previous waves, and 82 unmatched participants or unsolicited opt-ins). The initial Time 1 (2009) NZAVS recruited participants by randomly selecting samples from the New Zealand electoral roll (a national registry of registered voters). A booster sample was later recruited at Time 3 (2011) through an unrelated survey posted on the website of a major New Zealand newspaper. Further booster samples were recruited from the 2012 and 2014 Electoral Roll in subsequent time periods (see online technical document for more details).¹⁵

Participants

Fifteen thousand eight hundred and twenty-two participants (10,002 female, 5,800 male) completed the NZAVS Time 6 questionnaire. Participants had a mean household income of NZ \$108,277 ($SD = 119,918.47$; 1,143 missing cases). Participants had a mean age of 49.34 years ($SD = 14.04$, range 18–95; nine missing cases). With regard to other demographics, 39.8% (674 missing cases) were religious, 74.6% (259 missing cases) were parents, 74.7% (640 missing cases) were in a committed romantic relationship, 77% (188 missing cases) were employed and 67% (209 missing cases) lived in an urban area (as opposed to a rural area of New Zealand). Education (1,114 missing cases) was coded as a 10-point ordinal variable ranging from 0 (none) to 10 (PhD/ equivalent degree) following the standard New Zealand Qualifications Authority (2012) framework for coding ($M = 5.05$, $SD = 2.85$).

Measures

Support for the legalisation of euthanasia in New Zealand were measured using the item:

“Suppose a person has a painful incurable disease. Do you think that doctors should be allowed by law to end the patient’s life if the patient requests it” rated on a Likert scale from 1 (definitely no) to 7 (definitely yes). This item was modelled on the British Social Attitudes Survey, which included this item with a yes/no response option.¹⁶ We used this single item as an indicator of a continuous latent attitude trait (sample weighted $M = 5.51$, $SD = 1.91$, unweighted $M = 5.61$, $SD = 1.85$).

As presented in Table 2, for descriptive purposes, the following scale ranges were used to describe pro-euthanasia (ratings of 6–7; weighted 66% of sample, unweighted 68.3% of sample), neutral/unsure (ratings of 3–5; weighted 21.7% of sample, unweighted 20.6% of sample) and anti-euthanasia (ratings of 1–2; weighted 12.3% of sample, unweighted 11.1% of sample) in this study. The weighting procedure weighted men and women from each of the four primary ethnic groups separately as well as region of residence based on data from the 2013 New Zealand Census (See technical document for further details).¹⁷

Big-Six Personality traits were measured using the Mini-IPIP6.¹⁸ Deprivation was measured using the 2013 New Zealand Deprivation Index.¹⁹ Political orientation was measured on a 7 point Likert scale (1 = extremely liberal; 7 = extremely conservative).²⁰ Socio-economic status was measured using the measure of socio-economic status based on occupation developed by Milne, Byun and Lee.²¹

Table 2: Definitions of groups by support for euthanasia and operationalisation in this study.

Euthanasia attitudes	Definition	Operationalisation
<i>Pro-euthanasia</i>	Those who express support for the legalisation of euthanasia in New Zealand, usually paired with values of human dignity	Ratings of 6 or 7 on a 7-point scale assessing agreement that doctors should be allowed by law to end the life of a patient suffering from a painful and incurable disease upon their request
<i>Neutral/unsure</i>	Neutral or undecided attitudes toward the legislation of euthanasia	Ratings of 3 to 5 on the same scale as above
<i>Anti-euthanasia</i>	Strong opposition towards the legislation of euthanasia, usually paired with negative views regarding the morality and practicality of euthanasia	Ratings of 1 or 2 on the same scale as above

Statistical analyses

We conducted a multiple regression examining the concurrent association between various demographic and psychological variables with New Zealanders' support for the legalisation of euthanasia. We estimated the model-implied difference in levels of support for euthanasia associated with a one-unit increase in each demographic or personality variable, holding all other covariates constant.

Missing data for exogenous variables were estimated using Rubin's procedure for multiple imputation procedure with parameter estimates averaged over 10,000

datasets (thinned using every 200th iteration).²³ Our model explained 17% of the variance in attitudes towards euthanasia ($p < .001$).

Results

Regression model predicting support for euthanasia

Demographic factors. As shown in Table 3, compared to those who were non-religious, religious people showed less support for the legalisation of euthanasia ($b = -1.158$). Age showed a negative curvilinear effect ($b = -.0034$, $b^2 = .00014$). That is, support for euthanasia decreased as age increased,

Table 3: Regression coefficients, Standard Errors (SE) and t-values for demographic and psychological predictors of support for the legalisation of euthanasia in New Zealand.

	b	SE	Lower 95% CI	Upper 95% CI	Beta	t
Constant	7.177	.240	6.706	7.649		
Gender (0 women, 1 men)	-.026	.031	-.086	.035	-.007	-.829
Age	-.003	.001	-.006	-.001	-.025	-2.737**
Age squared	.00014	.000	.000	.000	-.020	-2.292*
Māori (0 no, 1 yes)	-.038	.045	-.127	.051	-.007	-.831
Pacific (0 no, 1 yes)	-.575	.099	-.769	-.380	-.055	-5.799**
Asian (0 no, 1 yes)	-.313	.077	-.463	-.163	-.034	-4.092**
Income (log)	.030	.015	.001	.058	.018	2.030*
NZ deprivation (0–10)	-.020	.006	-.031	-.010	-.030	-3.686**
Education (0 low to 10 high)	-.026	.006	-.039	-.014	-.040	-4.084**
Socio-economic status	-.006	.001	-.008	-.003	-.047	-4.931**
Employed (0 no, 1 yes)	.078	.040	.000	.157	.018	1.958*
Partnered (0 no, 1 yes)	.034	.036	-.037	.104	.008	.931
Parent (0 no, 1 yes)	-.106	.036	-.177	-.036	-.025	-2.961**
Religion (0 no, 1 yes)	-1.158	.032	-1.221	-1.095	-.306	-36.087**
Urban area (0 rural, 1 urban)	-.102	.031	-.163	-.042	-.026	-3.324**
Political orientation	-.235	.013	-.260	-.210	-.166	-18.319**
Extraversion	.035	.013	.010	.061	.022	2.702**
Agreeableness	-.043	.017	-.075	-.010	-.022	-2.566**
Conscientiousness	.096	.014	.068	.123	.052	6.768**
Neuroticism	.055	.013	.029	.081	.033	4.164**
Openness	.001	.014	-.027	.029	.000	.043
Honesty-humility	-.067	.013	-.092	-.043	-.044	-5.354**

Note: * $p < .05$, ** $p < .01$. Model fit statistics: $R^2 = .171$, AIC = 59414.27, BIC = 59597.51

with a decelerating decrease among those of older age. In comparison to Europeans (the reference group), Pacific ($b=-.575$) and Asian peoples ($b=-.313$) were less supportive of euthanasia. Being of Māori ethnicity was not significantly associated with attitudes toward euthanasia. People with a higher (log) household income ($b=.030$) tended to be more supportive, while those with higher deprivation ($b=-.020$) showed decreased support for euthanasia.

Those with a higher level of education ($b=-.026$) and socio-economic status ($b=-.006$) were significantly less supportive of euthanasia. Compared to those who were unemployed, employed individuals exhibited increased support for euthanasia ($b=.078$). Parents relative to non-parents ($b=-.106$), and those residing in urban areas, relative to those in rural areas ($b=-.102$) showed less support for euthanasia. Gender and whether or not one had a partner were not significantly associated with support for euthanasia. Among all demographic variables, religion exhibited the strongest association with people's attitudes towards euthanasia.

Psychological factors. With regard to political orientation (1 = liberal to 7 = conservative), those who were more conservative exhibited less support for euthanasia ($b=-.235$). Extraversion ($b=.035$), conscientiousness ($b=.096$) and neuroticism ($b=.055$) were all positively associated with support for euthanasia. Conversely, agreeableness ($b=-.043$) and honesty-humility ($b=-.067$) were negatively associated with support for euthanasia. Openness to experience was the only personality trait with no significant relationship with attitudes towards euthanasia. Of the psychological factors, political orientation showed the strongest association with support for euthanasia. However, overall, religion had the strongest association with people's attitudes toward euthanasia.

Discussion

The present study investigated attitudes about the legalisation of euthanasia using a large national probability sample of more than 15,000 New Zealand adults. We

assessed the distribution of New Zealanders' attitudes towards euthanasia, along with its association with a broad range of demographic and psychological factors. The 'snapshot' of attitudes in 2014/15 provided by this study is an important addition to the body of polling data on support for euthanasia in New Zealand.

Overview of key findings

Our results reveal that the majority of New Zealanders expressed support the legalisation of euthanasia (66%), which was assessed by asking "Suppose a person has a painful incurable disease. Do you think that doctors should be allowed by law to end the patient's life if the patient requests it?" Regarding those who did not support euthanasia, 21.7% indicated they were neutral/unsure and 12.3% indicated they were strongly opposed. Our findings provided tentative evidence for a slight increase in support for euthanasia since the 2012 Horizon Research study, in which 62.9% supported, 24.8% were neutral/unsure and 12.3% opposed euthanasia.⁶ Malpas et al suggest that the rise in international media coverage about practices and legislation of euthanasia may have contributed to a more positive climate regarding euthanasia.⁸ However, we need to be cautious when making comparisons to previous studies, as many used different methods and attitude measures to our study.

In line with previous studies,^{3,9,10} those who were religious, have low household income and high deprivation were found to be less supportive of euthanasia. The effect of religion appears to be associated with their strong belief in the sanctity of life and damnation of suicide.²³ Similar to findings from Horizon Research,⁵ Pacific and Asian peoples tended to be less supportive of euthanasia. Unexpectedly, those with higher education and higher social status were significantly less supportive of euthanasia. Furthermore, age had a negative relationship with support for euthanasia, with older people generally being less supportive and this effect tending to plateau among the elderly. This finding is likely to represent a cohort effect, as younger generations tend to exhibit more permissive and liberal attitudes than older generations.^{24,25}

Our study also found that more liberal individuals, as opposed to conservative individuals, showed increased support for euthanasia. Previously, Horizon Research found that support for euthanasia was highest among National (70%) and Labour party (67.7%) voters, but lowest among Conservative party voters (over 45% opposed).⁵ Although additional research is needed, such strong opposition among Conservative party supporters may be an important contributor to the effect of political orientation. In regard to personality, those high on extraversion, conscientiousness and neuroticism were more supportive of euthanasia, while those high on agreeableness and honesty-humility were more opposed. The effect of honesty-humility is not surprising, as this trait is characterised by morals linked to concern for the wellbeing of others,²⁶ and has already been associated with decreased support for euthanasia in previous international studies.^{11,12} However, the effects of the other five personality traits are novel and appear to be unique to the context of New Zealand. Further research on these effects is needed to increase understanding of the underlying drives behind New Zealanders attitudes towards euthanasia.

Caveats

One major limitation is the cross-sectional nature of our study. Our analyses thus do not imply causal effects. Furthermore, it is important to recognise that we measured support for euthanasia using the single item “Suppose a person has a painful incurable disease. Do you think that doctors should be allowed by law to end the patient’s life if the patient requests it?” This item has been used previously in the British Social Attitudes Survey¹⁶ and assesses levels of support versus opposition to euthanasia as a general concept only. As such, our results do not provide information about potentially more nuanced differences in support for euthanasia in different contexts and for different types of illnesses. For example, previous studies using vignettes have found that people tend to exhibit differing levels of support depending on the subject, type of illness and voluntariness of euthanasia.^{3,4}

Euthanasia is an emotionally laden issue and thus, it is important to recognise that

the way in which the question is asked could affect how people respond. Because of this, we opted to assess support for euthanasia as a general concept, rather than asking about people’s views of euthanasia in specific scenarios or with regard to specific types of illness. For example, a study by Parkinson et al on cancer patients found that more people indicated they agreed with/supported the concept of euthanasia when questions mentioned patients’ suffering, the incurable nature of the disease and the role of doctors in ‘assisting’ or acting upon the patient’s request (68%–75%), compared to when questions included the term ‘kill’ or emphasised the doctors role in ‘deliberately bringing about a patient’s death’ (14% and 31% respectively).²⁷ The item in our study included the terms ‘painful,’ ‘incurable disease’ and ‘request’, which may have influenced participants to express increased support for euthanasia.

It is also important to note that, due to the improvement in palliative care and pain-management in Western countries,²⁸ most patients today should die without physical pain. Hence, the avoidance of physical pain may no longer be the central motivation for desiring euthanasia.²⁹ Dees et al suggest that patients’ definition of ‘unbearable suffering’ and reasons for requesting euthanasia now revolve around psycho-emotional and existential factors such as feelings of meaninglessness, loss of self and being a burden on others.²⁹ The question used in our study included the term ‘painful’ but did not mention any psychological factors associated with desires for euthanasia. This raises the possibility that our findings do not represent peoples’ support for the concept of euthanasia per se, but instead, support for assisted death in the face of severe physical pain.

Concluding comments

The present study used a nationally representative sample of New Zealand adults to assess the distribution, demographic and psychological correlates of people’s attitudes towards the practice of euthanasia. The majority of New Zealanders were supportive of euthanasia, which was framed in terms of doctors being allowed to end a patient’s life, under the

condition that the patient has a painful incurable disease and requests that their life be ended. Those who were of Pacific or Asian ethnicity, had lower income, higher deprivation, higher education or socio-economic status were less supportive of euthanasia framed in these terms. Conversely, those who were non-religious, younger, employed, non-parents and live in rural areas exhibited increased support. In regard to personality traits, those high

on extraversion, conscientiousness and neuroticism showed increased support for euthanasia, while those high on agreeableness and honesty-humility exhibited decreased support. Lastly, those who were more liberal were more supportive of euthanasia. Our findings build on previous New Zealand studies and provide a framework for future research in understanding the origins of people's attitudes towards euthanasia.

Table 4: Bivariate correlations between all demographic and psychological variables with attitudes towards euthanasia (ATE).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
1. ATE																						
2. Gender	.01																					
3. Age	-.09	.12																				
4. Māori	-.01	-.03	-.05																			
5. Pacific	-.09	-.02	-.08	.03																		
6. Asian	-.06	-.01	-.12	-.06	.01																	
7. Income	.03	.06	-.05	-.05	-.02	-.01																
8. Deprivation	-.04	-.03	-.03	.19	.15	.01	-.20															
9. Education	-.02	-.06	-.18	-.12	-.02	.11	.18	-.16														
10. SES	-.04	-.06	-.04	-.10	-.04	.04	.18	-.18	.57													
11. Employed	.06	.05	-.27	-.02	-.00	-.00	.16	-.08	.17	.11												
12. Partnered	.01	.07	.06	-.06	-.05	-.02	.19	-.19	.05	.08	.08											
13. Parent	-.07	.01	.43	.02	-.03	-.08	.03	-.05	-.12	-.00	-.08	.29										
14. Religion	-.36	-.05	.13	.04	.10	.07	-.03	.06	-.01	-.00	-.07	-.01	.09									
15. Urban	-.01	-.00	-.10	-.07	.07	.11	.09	-.13	.12	.14	.04	-.06	-.12	-.02								
16. Political	-.22	.04	.13	-.02	.02	.03	-.03	-.01	-.21	-.14	-.06	.06	.13	.24	-.09							
17. Extraversion	.02	-.06	-.03	.04	.02	-.02	.06	-.04	.03	.05	.06	.06	.07	.02	.02	-.06						
18. Agreeable	-.03	-.29	.00	-.04	-.03	-.02	.01	-.05	.10	.11	-.02	.02	.03	.07	.03	-.09	.12					
19. Conscience	.01	-.08	.07	.01	.01	.01	.05	-.06	.00	.02	.01	.08	.09	.04	-.01	.12	.06	.14				
20. Neuroticism	.04	-.13	-.18	.00	.01	.02	-.04	.05	-.01	-.04	-.01	-.04	-.09	-.01	.03	-.02	-.14	-.04	-.17			
21. Openness	.05	.05	-.12	-.01	-.01	-.01	.04	-.04	.24	.15	.07	-.03	-.09	-.06	.08	-.27	.19	.29	-.01	-.04		
22. Honesty-H	-.05	-.12	.18	-.07	-.05	-.09	-.02	-.04	.07	.06	-.06	.04	.06	.02	-.04	-.07	-.07	.22	.09	-.17	.06	
Mean	5.61	.37	49.34	.13	.03	.04	1082.77	4.71	5.05	53.2	.77	.75	.75	.40	.67	3.59	3.93	5.35	5.07	3.43	4.90	5.28
SD	1.85	.48	14.04	.33	.18	.20	1199.18	2.76	2.85	15.8	.42	.44	.44	.49	.47	1.31	1.16	.94	1.02	1.10	1.09	1.21

Competing interests:

Nil.

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Changes in the age pattern of New Zealand suicide rates

John Snowdon

ABSTRACT

AIMS: It is timely to examine changes in male and female suicide rates across the age range in New Zealand, comparing them to some of the changes recorded in Australia.

METHOD: Data regarding suicide and population figures in New Zealand and Australia were obtained. The suicide rates of different age-groups in the two countries were calculated and compared. Data concerning 'open verdicts' were also obtained.

RESULTS: The age patterns of suicide rates in New Zealand and Australia have changed markedly and similarly. Suicide rates of New Zealand males in their twenties increased threefold between the 1960s and 1990s, with a fall since then. Nevertheless, the 2009–13 youth suicide rates in New Zealand were double the corresponding rates in Australia. Since 1979–88 a decrease in suicide rates of men and women aged 60–79 has been even greater than in Australia. The Māori suicide rate is high in young men but almost zero in old age.

CONCLUSIONS: The persistently high suicide rate of New Zealand youths (Māori much more than non-Māori) remains of concern. The rate is equally high among indigenous young Australians. There has been a welcome decrease in late-life suicide rates in New Zealand and Australia.

During the last 65 years, over 28,000 deaths in New Zealand (population currently 4.57 million) have been recorded as suicides.

An extraordinary change in the age pattern of suicides over recent decades has been reported from New Zealand,¹ Australia² and other countries, though not always in the same direction.³ Socio-cultural variation may largely explain differences in age and gender patterns of suicide between countries, such as those between New Zealand and China.⁴ New Zealand and Australia have much in common: there is good reason to examine whether changes in New Zealand suicide rates in recent years have been similar to those observed in Australia, and to discuss possible explanations for changes found in suicide rates of particular socio-cultural or age groups. Variations in age patterns of suicide may help identify factors that influence suicidal behaviour.

Method

Statistics regarding deaths recorded as suicides in New Zealand and Australia, together with population figures, were made available, respectively, by the New Zealand Health Information Services (Ministry

of Health) and the Australian Bureau of Statistics (ABS). Data for a series of 10-year periods extending from 1949 to 2008, and for 2009–2013, were provided in relation to five-year age groups of males and females (15–19 years up to 80–84 years, and then 85 years or more). Rates of suicide were calculated from five-yearly national census data. New Zealand's 2013 suicide statistics were provided by the New Zealand Ministry of Health in July 2016. For earlier years, information regarding deaths where findings did not allow a verdict of suicide, and that were classified as deaths due to injury but "undetermined whether accidentally or personally inflicted", was also obtained.

Graphical representations of differences in suicide rate were prepared in order to facilitate comparisons across the age-range, between genders, over time and between New Zealand and Australia.

Results

Prior to 1988, comparatively few people in New Zealand were aged over 85 years. The number of suicides by males in this age-group ranged from four to eleven per five-year period, and female numbers

ranged from one to five (average 2.5). Therefore, in Table 1, data for those aged 80 years or more were amalgamated. In the five-year periods between 1989 and 2013, the suicide rate per 100,000 of New Zealand males aged 85 years or more was (successively) 31.5, 30.4, 28.4, 36.3 and 28.2.

Examination of Figure 1 and of the fluctuations in rate shown in Table 1 reveal remarkable changes in the age patterns of male and female suicide in New Zealand. Comparable changes have occurred in Australia.

In both New Zealand and Australia in the 1950s and 1960s, the suicide rate of *males* was low in their teenage years, but was progressively higher across the age-range to reach a peak in old age. During the following three decades, the suicide rate of New Zealand males in their late teens and early twenties rose progressively and substantially, reaching a peak in the 1990s three times higher than it had been two decades earlier (Table 1, Figure 2). There was a comparable but smaller increase in suicide rates of young Australian males (see Figure 3). Meanwhile, the suicide rate of New Zealand men in their early thirties

increased twofold (Table 1). Since the 1980s the suicide rate of older males has fallen more than twofold. The lowest rates among adult New Zealand males in the new century have been in those aged 60 to 79 years (Figures 4 and 5, Table 1). In Australia the lowest adult male rates have been in the 60 to 74 years age group (Figures 4 and 5). Tables showing Australian rates during 2004–13 have been published.⁵

The suicide rate of young New Zealand *females* increased during the last half-century, while suicide rates at age 40–49 years remained fairly steady (Table 1, Figures 1 and 3–5). However, suicide rates of all five-year age groups of women aged 50–54 to 75–79 years have fallen considerably over recent decades, the drop since the 1950s being threefold or more. The suicide rate of women aged over 80 years has changed little across the decades (Table 1); it has been lower than the rate among young women for over twenty years.

The suicide rate among the Māori population, male and female, has remained at about 1.6 times the rate in the non-Māori population over recent years. The mean suicide rates per 100,000 among Māori aged

Table 1: A comparison of suicide rates of five-year age-groups of males and females in New Zealand, in six decades and in 2009–13.

Five-year age-groups	1949–1958		1959–1968		1969–1978		1979–1988		1989–1998		1999–2008		2009–2013	
	Male	Female												
10–14	0.6	0	0.4	0.2	1	0.3	1.7	0.6	3.3	1.3	1.3	1.2	2.5	2.5
15–19	5.5	0.7	3.6	1.7	8.6	3.1	15.4	4.2	30.3	9.2	21.8	10.1	24.8	12.6
20–24	9.3	2.2	10.7	4.3	16.1	5.8	28.3	7.7	50.7	9.4	34.2	9.3	29.7	10.2
25–29	12	5.1	11.8	3.7	13.6	7.2	23.4	7.7	41.1	8.1	33.6	8.7	21.4	8.0
30–34	14.4	4.3	14.5	4.7	13.7	6.3	19.8	7.1	30.4	7.5	30.4	7.1	22.9	7.5
35–39	14.4	4.5	18.1	6.1	16	7.2	20.6	6	27.1	5.1	27.4	9.3	24.0	6.8
40–44	16.5	9	22.4	8.7	20.7	9.1	20.5	7	23	8.5	23.1	7.7	25.2	6.2
45–49	22.3	7.8	26.9	12	23.5	11	23	7.5	25.5	7.8	21.6	6.5	26.5	7.6
50–54	30.4	14	24.5	14.1	21.4	13.5	21.8	11.2	21	9.1	20.4	7.1	22.1	8.7
55–59	33.2	14.8	27.4	17.5	24.5	16.7	25.9	12.2	23.2	6.3	22.5	6.3	20.9	6.7
60–64	26.6	16	28.4	16.1	24.9	16.3	25	9.9	23.8	6.5	16.8	4.7	16.0	5.3
65–69	37.5	11.7	24.2	12.2	24.6	13.8	27.6	8.8	24.6	4.6	14.2	4.7	8.8	3.2
70–74	36.9	11.3	34.3	16.7	31.6	13.5	32.4	11.1	25.8	8.4	16.4	4.9	14.7	1.6
75–79	39.6	8.5	34	8.1	34.1	8.1	38.9	12.8	24.8	5.7	18.8	3.4	16.2	3.9
80+	45.1	5.7	28.3	6.6	34.4	6	41.9	9.5	37	4.4	26.8	6.2	23.7	6.4

Figure 1: New Zealand male and female suicide rates in five-year age-groups, 1949–58 and 1998–2008.

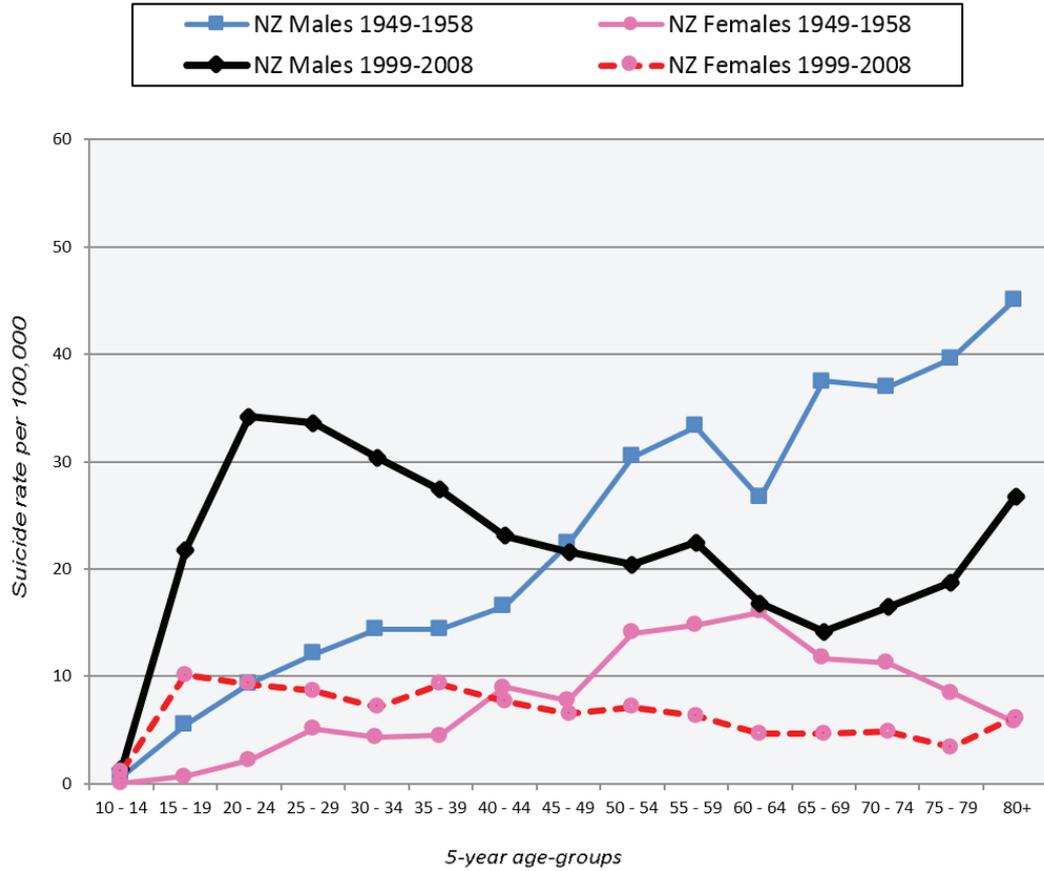


Figure 2: Suicide rates of New Zealand males in five-year age-groups, in the 1950s, 1970s, 1980s and 1990s.

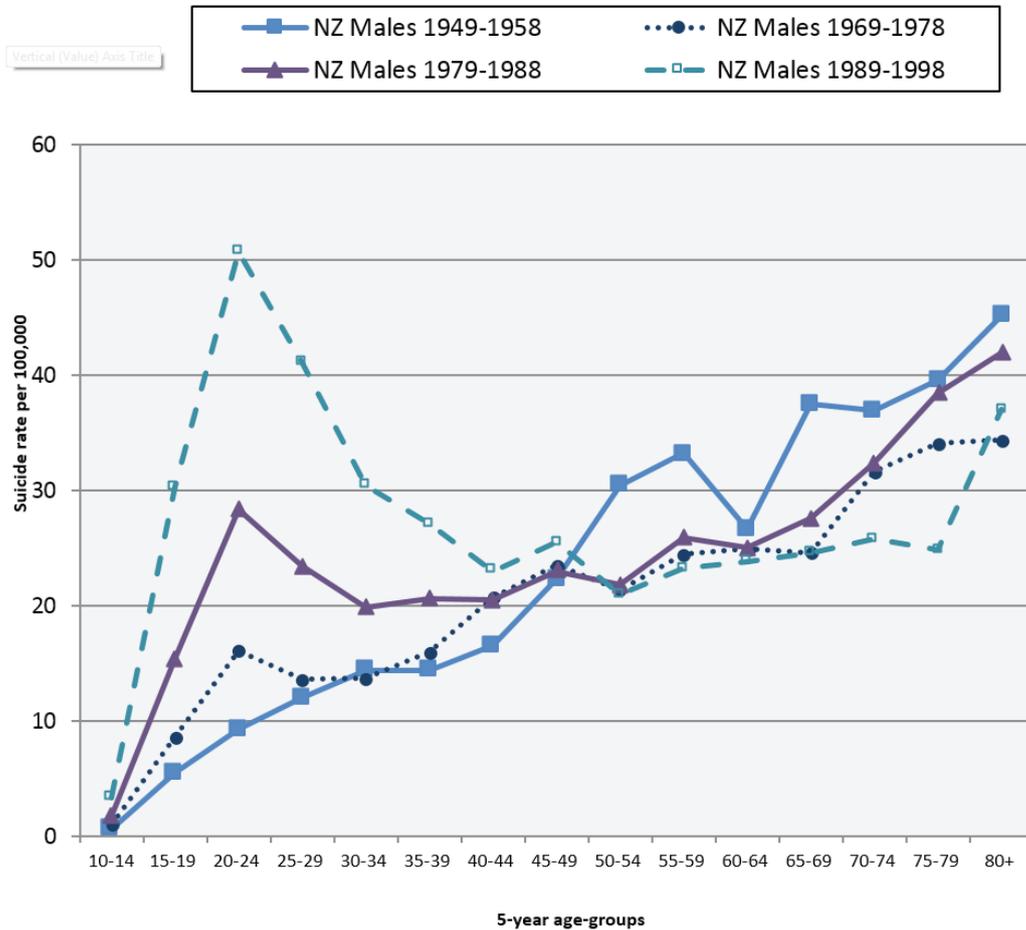


Figure 3: New Zealand and Australian suicide rates per 100,000 in 1989–1998.

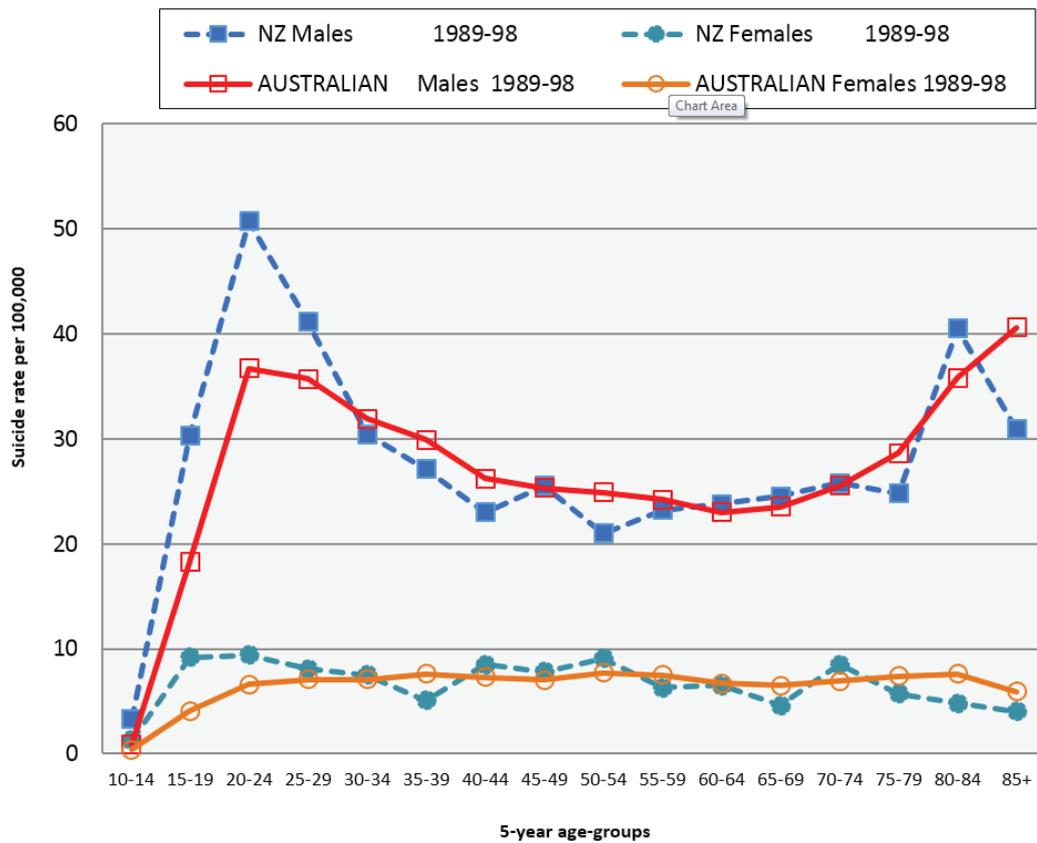


Figure 4: New Zealand and Australian suicide rates per 100,000 in 1999–2008.

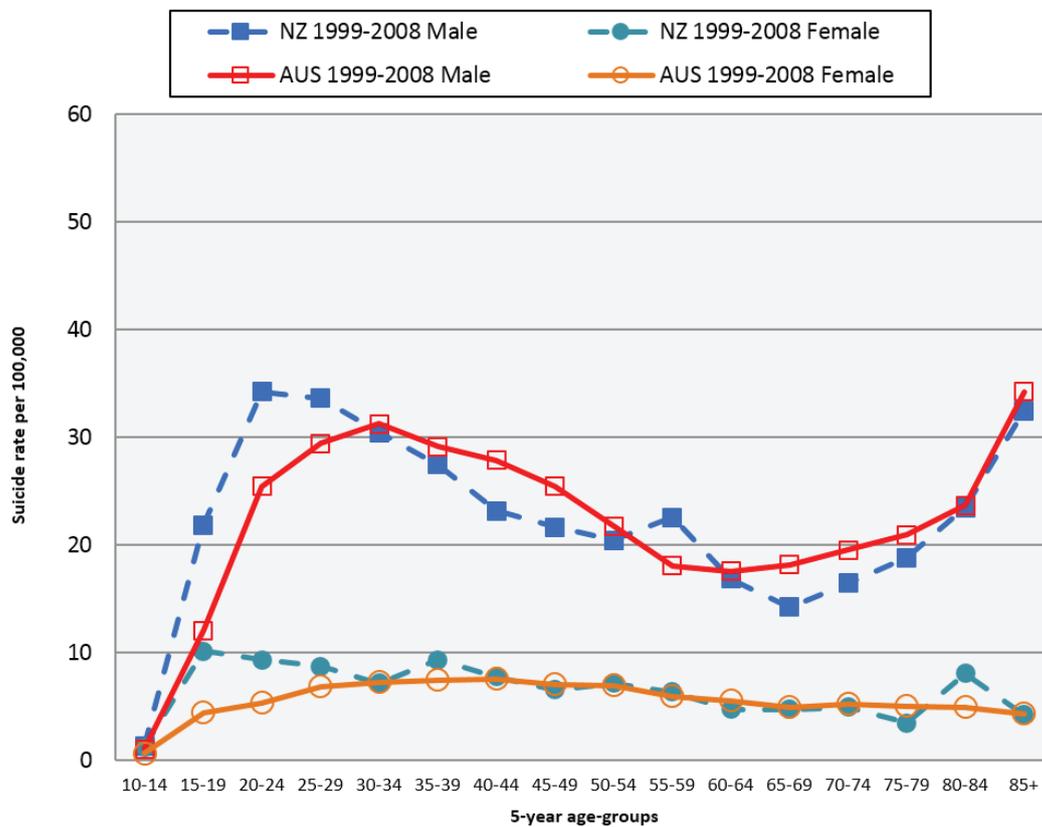
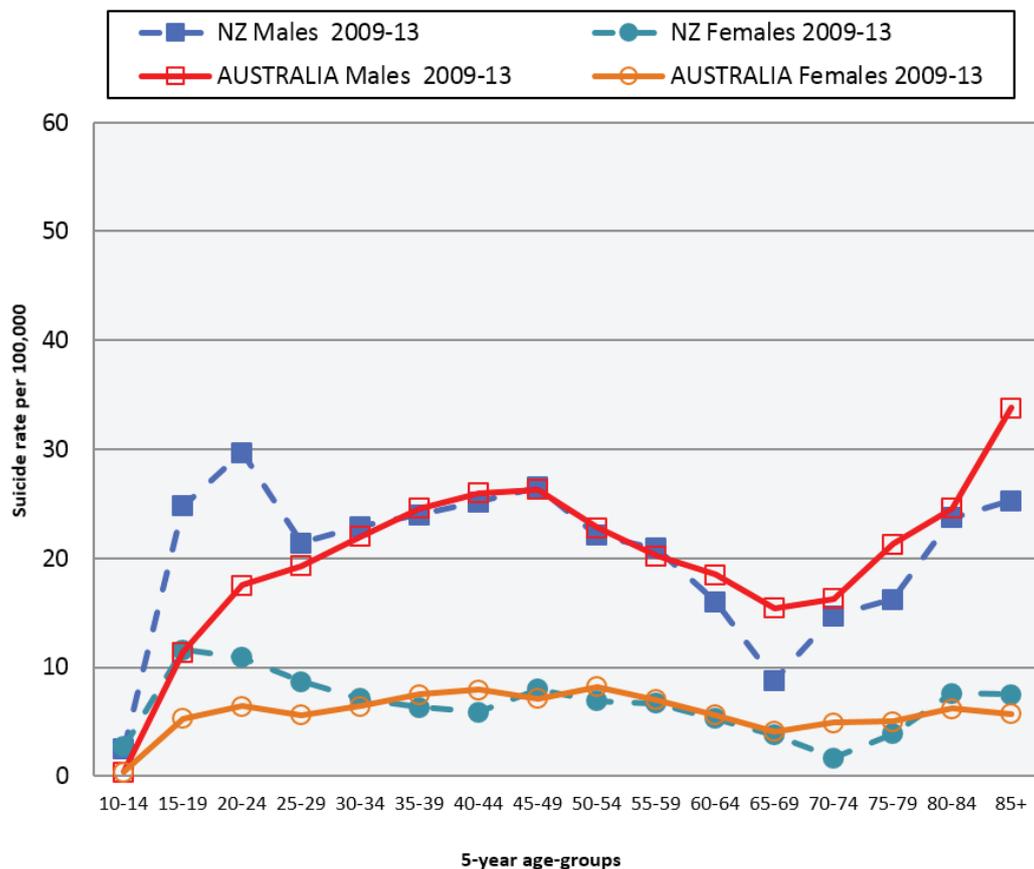


Figure 5: New Zealand and Australian suicide rates per 100,000 in 2009–13.



15–24 years in 2003–2011 were 43.7 (male) and 21.3 (female). In 2012 the Māori and non-Māori rates (age 15–24) were, respectively, 48 (male 57.2, female 38.4) and 17.3 (male 26.2, female 7.7); in 2013 they were 44.5 and 11.8. In 2011–13 (when 14% of the New Zealand population and 6% of Māori were aged 65 years or more), only one of the 326 Māori who died by suicide was aged over 65 years. Of 1,224 suicides in the non-Māori population in the same years, 154 (12.6%) were of people aged at least 65 years.

The ABS provided comparable figures regarding suicide numbers and rates in the indigenous populations (Aboriginal or Torres Strait Islanders) living in mainland Australian states during 2010–15. During this time, 6.9% of suicides were of indigenous people (6.6% in 2015). Of Australians aged 15–24 years who killed themselves, 18.5% of the males and 19.8% of the females were indigenous; their suicide rates per 100,000 in 2010–15 were, respectively, 52.7 and 23.1, compared to 13.7 (male) and 5.5 (female) in the non-indigenous population in that age-group. At age 25–34 the rate per 100,000 was even higher among indigenous

men (60.8) but somewhat lower among women (22.3). Suicide rates of indigenous Australians older than 35 were lower in successive age-groups, except for a small increase among men aged over 60 years. Only 19 (0.6%) of the 2,988 Australians aged over 60 years who killed themselves in 2001–10 were from Aboriginal or Torres Strait Island backgrounds.

The age patterns of suicide rates in New Zealand and Australia in 1989–98, 1999–2008 and 2009–2013 can be compared (Figures 3, 4 and 5). Suicide rates of males in New Zealand and Australia in 1979–88 reached peaks at age 20–24 years (28.0 and 28.4 per 100,000, respectively), and higher peaks in late old age. By 1989–98 the peak male rate of suicide in New Zealand was at age 20–24 years (50.7 per 100,000), much higher than the late life peak (29.4 per 100,000 at 80+ years) (Figure 3); in Australia there was an initial peak in male suicide rate at age 20–24 (36.7 per 100,000), but there was a second, higher peak in very late life (40.6 per 100,000). By 1999–2008 (Figure 4), and even more so in 2009–13, the suicide rate of younger males had decreased in both

countries. In New Zealand the 2009–13 peak male suicide rate was at age 20–24 years (29.7 per 100,000), double the rate recorded among Australian males of the same age; by 2009–13 the early male peak in Australia had shifted to age 45–49 (Figure 5). In 2013, 21% of male suicides in New Zealand were of people aged 15–24; the corresponding percentage in Australia was 16.6%. The suicide rates of indigenous people aged 15–24 in the two countries are similar, but the proportion of Māori people in New Zealand is higher than that of indigenous people in Australia; thus 8.6% of those aged 20–24 in New Zealand are Māori, but only 3.8% of Australians aged 20–24 are indigenous. Because indigenous youth suicide rates are higher, the difference partly explains the higher rate of youth suicide in New Zealand than Australia. The number of suicides of New Zealand females aged 15–24 years in 2013 was 37 (25.9% out of 143), while in Australia it was 93 (14.3% out of 634). In Australia the peak male rate was at age 85+ years in 2013 (38.3 per 100,000), with an earlier peak of 25.7 per 100,000 at age 40–44. The peak suicide rate in late life among New Zealand males in 2009–13 (28.2 per 100,000) was lower than the peak 2009–13 rate recorded among men aged 20–24 (29.7 per 100,000).

In Australia in 2014, 6,460 deaths were deemed to be accidental, with 2,864 deemed as suicides; in 280 cases the cause of death was “undetermined”. Finalised figures for Australia deaths in 2006–8 showed a ratio of 100 suicides to 15.5 deaths with cause undetermined. The rate of deaths with undetermined cause was reported as 1.6 per 100,000. The New Zealand rate for cases similarly coded (Y10-Y34) in 2006–8 was 0.6 per 100,000.

Discussion

It is widely believed that suicide results from a complex interplay of factors, one being psychological distress. Shneidman⁶ argued that suicide occurs when psychache (intensely felt psychological pain) becomes unbearable. The data presented in Table 1 show relatively huge variations in suicide rates. At least part of the variation may be attributable to varying levels and types of stress and consequent mental perturbation (anguish and distress).

In cautioning against the commonly held view that suicide is usually a consequence of mental disorder, Pridmore⁷ pointed to differences between cultures and over time in the age pattern of suicides. For example, he stated that there is no clear difference in prevalence of mental disorder between men and women, and therefore a 3:1 gender difference in suicide rate cannot be explained by a gender difference in the rate of mental disorder. He posited that cultural factors and gender roles are responsible for this robust difference. In China's urban populations, male and female suicide rates are similar,⁴ and the age pattern is very different from that recorded in New Zealand and Australia. Pridmore⁷ accepted that suicide may be the result of a mental disorder or a single socioeconomic stressor (such as a public disgrace), but stated that more often it is the result of a *number* of stressors, one of which may be a mental disorder, together with (for example) unemployment, relationship failure, substance abuse and/or painful emotions such as shame.

This view accords with findings from the present examination of variations in age pattern of suicides. The dramatic rise and fall of suicide rates of young adult males in New Zealand and Australia may well have been related to a changing incidence of mental perturbation (psychache⁶) but maybe also of substance abuse, rather than being due to changes in prevalence of other DSM-5 mental disorders.

Pridmore⁷ commented that New Zealand's suicide rate is greater than Australia's. However, the latest figures show that suicide rates of men aged 25–64 years in Australia and New Zealand are almost identical (Figure 5). The same applies to women aged 30–69 years. The fact that the overall suicide rate is higher in New Zealand than Australia is attributable to the markedly higher suicide rates of New Zealand youths (male and female). As seen in Table 1, suicide rates of those aged between 15 and 39 years rose to a peak in the 1990s. The highest rate was recorded for the male 20–24 age group, whose averaged suicide rate for 1989–1998 was 50.7 per 100,000. Rates for all age-groups younger than 40 years have fallen since then from their peaks, some substantially. However there must be continued concern regarding the relatively high youth suicide

rate in New Zealand versus the much lower corresponding rates in Australia.

Indigenous youth suicide

Suicide appears to be especially a problem among Māori youth. Skegg et al⁸ reported on the high suicide rates in the 1980s of Māori and non-Māori males aged 15–24 years (about 24 and 28 per 100,000 respectively), but with progressively lower rates across the age-range among Māori males, contrasting with increasing rates across the age-range of non-Māori. Striking, even then, was the comparatively high suicide rate of Māori females aged 15–24 years (15 per 100,000), which was more than double that of non-Māori females, though with a steep fall to less than five per 100,000 at 25–34. It was even lower at age 35 to 64, with no suicides of Māori females aged 65 years or more. By 2002, the suicide rate at age 15–24 of Māori males and females had risen, respectively, to 43.7 and 18.8 per 100,000, contrasting with male and female non-Māori rates in the same age-group of 18.0 and 9.1 per 100,000.⁹ Suicide rates of Māori aged 15–24 reached peaks of 57.2 (male) and 38.4 (female) per 100,000 in 2012.

Explanations for the high Māori youth suicide rate have been proposed.⁹ One was that the rate largely or wholly reflects the disadvantaged status of Māori in the context of New Zealand society. Another was that the rates reflect factors unique to Māori and to the experience of colonisation. Beautrais and Fergusson⁹ referred to cultural alienation, intergenerational modelling and confusion over identity. It was also suggested that Māori, who traditionally identify themselves as members of a collective group, may find difficulty in societies which value individualism. Evidence pointing conclusively to causative explanations that could lead to preventative strategies is lacking.

The suicide rates of young adult indigenous populations in both countries have remained high, but the recent fall in the suicide rate of non-indigenous youths in Australia has been much greater than the reduction in the non-Māori youth suicide rate in New Zealand. However, the suicide rate of men entering middle age in *both* Australia and New Zealand has remained at about 25 per 100,000. Table 1 shows that the New Zealand suicide rate of the 45–49 years

age-group fluctuated in a narrow range, from 22.3 to 26.9 per 100,000 during the last 60 years, and the 40–44 years group (male and female) maintained a fairly steady rate for most of those years. The fact that the suicide rate among Australian males aged 15–29 has fallen so much (Figures 4, 5), and that the peak rate in 2013 was at 45–49 is likely to be due to a cohort effect;¹⁰ the group now in their forties had a high suicide rate when aged 20–29. Drugs and socio-economic issues have been blamed. The current 20–29 years cohort's suicide rate is markedly lower.

Comparisons between New Zealand and Australian age patterns of suicide show remarkable similarities over time, and differences from suicide patterns in other countries. The patterns of male suicide in both countries have changed from one where suicide appears to increase as a function of age (the type still observed in some Asian countries¹¹), to a bimodal pattern. The Māori age pattern of suicide is unimodal, with the peak in youth and a late life rate close to zero since at least the 1980s. The indigenous Australian age pattern of suicide is virtually unimodal, but with a small rise in the late life rate. Such observations are potentially instructive.

Late-life suicide in New Zealand and Australia

The substantial decrease in suicide rates of males and females in New Zealand aged over 55 years has been progressive since the 1980s, and is similar to what has been observed in Australia.¹³ The fall cannot be related to the near-zero late life suicide rate of Māori, since this rate was already low in the 1980s.⁸

Possible explanations for the fall in late life suicide rates in both countries include:

1. Undoubtedly the use of therapeutic doses of antidepressants has increased since the 1950s. Compliance with doctors' prescription instructions has improved, particularly since selective serotonin reuptake inhibitors and other antidepressants with fewer side-effects have become available. There is evidence¹² that older people who kill themselves are more likely than younger people to have major depression at the time of death, and that such cases respond better than

non-major depression to biological treatments. Beautrais and colleagues¹⁴ noted evidence that serious suicidal behaviour in old age is largely attributable to major depression.

2. Snowdon and Baume,¹⁵ reviewing coroners' files, found that commonly, in cases of late life suicide, circumstances (physical illnesses or distressing situations) appeared to have precipitated suicidal feelings. Increased attention to health and welfare needs and to feelings of emotional deprivation among older and/or disabled people may have reduced suicide risk. Expansion of health services organised specifically for elderly people with physical problems (such as pain, breathlessness and fatigue) and for people requiring palliative care may well have reduced the hopelessness that can precipitate suicide. Reports suggest that health workers and interventionists are better trained and able, these days, to provide appropriate help, whether biological, psychological or environmental, thus helping to maintain self-esteem. The low suicide rate among older Māori has been attributed to their feeling more valued and being given more meaningful roles and status than non-indigenous older New Zealand people.⁹

Limitations

For various reasons, a country's suicide statistics may be recorded inaccurately. Changes in the way data are gathered may lead to false conclusions about changes in suicide rate. In Australia, underreporting of suicides probably grew between 2002

and 2006, with at least 11% of cases in 2004 uncounted.¹⁶ New Zealand figures point to a lower proportion of "undetermined intent deaths", and it seems unlikely that changes in the ratio have contributed significantly to the apparent fall in the elderly suicide rate or to the rise in the recorded youth suicide rate.

Conclusion

The Figures and Table show the remarkable change in the age patterns of suicide rates in New Zealand and Australia over the last six decades. Caution in interpreting the data is needed because of concerns about how suicide data are obtained and recorded. Those concerns apply across the age range and therefore, even if the size of the rates may be questioned, the observation that the rates in men and women, and in young and elderly, have changed in different directions, and substantially, gives good reason to examine differences between groups.

A complexity of factors is likely to have contributed to dramatic decreases in the suicide rates of older men, significant changes in elderly female suicide rates and the rise and fall of youth suicide rates. Changes within society and cultural nuances have doubtless been of major importance, and in different ways for young and old. There is evidence to suggest that improvements in health and community services have had effects on suicide rates, particularly in relation to both biological and psychological depression. It is hoped that publishing these data will provoke discussion about what leads to reduction in suicidal thinking, and how such factors vary between cultures, groups and personalities.

Competing interests:

Nil.

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Alcohol sponsorship of a summer of sport: a frequency analysis of alcohol marketing during major sports events on New Zealand television

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ABSTRACT

AIMS: This research aims to assess the nature and extent of alcohol marketing through sport sponsorship over a summer of televised sport in New Zealand.

METHODS: Frequency analysis of New Zealand television broadcasts of five international sporting events during the summer of 2014–2015. Broadcasts were analysed to identify the percentage of time when alcohol brands were visible during game-play. The number of independent alcohol brand exposures was recorded.

RESULTS: Alcohol brands were observed during every televised event. Audiences were exposed to between 1.6 and 3.8 alcohol brand exposures per minute. Alcohol brands were visible between 42 and 777 times across the games examined. For three out of the five events alcohol brands were visible for almost half of the game.

CONCLUSION: Alcohol sponsorship was prevalent in international sport on New Zealand television. Given the popularity of broadcast sport, especially with children, there is an urgent need for regulation of alcohol sponsorship of sport. There are viable models of alcohol sponsorship replacement but their implementation requires the will of both sporting organisations and politicians. This research adds weight to arguments to implement recommendations to remove all alcohol sponsorship of sport.

Harmful use of alcohol contributes to an estimated 3.3 million deaths each year. This accounts for 5.9 percent of all deaths worldwide.¹ In New Zealand, alcohol contributes to 5.4 percent of all deaths of people under 80 years, an estimated 13,769 years of life lost.²

Alcohol-related harm is a wicked problem.³ Exposure to alcohol advertising is positively related to consumption, particularly in children.⁴ Further, exposure to alcohol advertising encourages current drinkers, particularly youth, to drink more.^{3–5} Alcohol sponsorship has also been shown to increase alcohol consumption in sportspeople.⁶ Restrictions on tradi-

tional forms of alcohol marketing are now commonplace. These include watershed times for marketing, restrictions on content and complete bans.³

Globally, alcohol marketers have adapted to the aforementioned advertising restrictions by adopting other less regulated forms of marketing, such as sponsorship, to persuade people to consume their products.³ The alcohol industry continues to increase its sponsorship of many major sports and cultural events globally.⁷ Alcohol sponsorship is effective in communicating the industry's messages to audiences, including young people who should not be exposed to alcohol advertising according to the

World Health Organization (WHO)¹ and the industry's own self-regulatory codes on advertising.⁸ For example, in the UK the sponsorship of sport has enabled alcohol marketers to bypass regulations that tend to focus on traditional forms of advertising.⁹

Sport is emotionally captivating, which may make its sponsorship more persuasive than traditional television advertising.⁹ One study found 71% of Thai youth watching the 2006 World Cup appreciated the broadcast sponsorship of the ThaiBev alcohol company and wanted to repay the sponsor by purchasing their product.¹⁰ A longitudinal study of 552 12–13 year-old children showed 61% recalled alcohol sponsorship of televised sport, with a further 66% recalling the logos on sports clothing. This study also found that awareness increases the odds of children drinking alcohol by 35%.¹¹ Another study found children who owned alcohol-branded merchandise were both more likely to initiate drinking as well as binge drink.¹²

The effects of sponsorship are of particular concern when considering the amount of exposure to alcohol sponsorship communicated during sports broadcasts. Audiences of English football broadcasts were exposed to an average of 111 alcohol-related images per match.¹³ Other frequency analyses have produced equally high rates of exposure.^{9,14–16} They include analysis of football,⁹ rugby,^{14,16} cricket^{14,15} and other sports.¹⁴

The WHO prioritises regulation of all sponsorship activities that promote alcohol to reduce alcohol-related harm. Specifically, the establishment of a regulatory system with a legislative basis for all alcohol-related sponsorship.¹ The WHO grades alcohol sponsorship restrictions as strong for effectiveness and very strong for breadth of evidence. This rating is based on the growing evidence of the persuasive nature of alcohol sponsorship, its ability to circumvent current industry regulations on advertising and recommendations for legislative regulation.³

In New Zealand, alcohol marketing is subject to industry self-regulation through the Advertising Standards Authority (ASA).⁸ A number of New Zealand agencies, including the Law Commission,¹⁷ the Medical Association¹⁸ and the Ministerial Forum on Alcohol Advertising and Sponsorship

(MFAAS)¹⁹ recommend removing alcohol-related sponsorship of cultural or sports events and activities. The timing of this research is particularly important as we still await the government response to the 2014 MFAAS recommendations noted above.

This study aims to identify the nature and extent of alcohol sponsorship visible during a range of major televised sports events on New Zealand television over the summer of 2014/2015. It aims to examine differences in alcohol sponsorship across a range of sports and to include sports with both female and male sportspeople. Finally, it aims to provide New Zealand data to help inform the current policy debate.

Methods

Study design and sample

Five major sporting events broadcast on commercial television in New Zealand during the summer of 2014–2015 were purposely selected to identify any alcohol brand sponsorship observed during each broadcast. Selected sports are popular with men, women and children, Māori and Pacific audiences and watched by large audiences. These events were the Rugby League 9s test match (rugby league, women, played in Auckland), the Australian Open Final (tennis, men, played in Melbourne), Asian Cup Final (football, men, played in Sydney), Football Ferns International Friendly (football, women, played in Chicago) and the ICC (International Cricket Council) ODI (One Day International) Cricket World Cup Final (cricket, men, played in Melbourne). Each of the sports events selected in this study attracted large audiences of all ages. For example, the Rugby League 9s test match was watched by an audience of 109,600 in New Zealand²⁰ and the Australian Open Final attracted 42,000 New Zealanders²⁰ and 13 million Australians.²¹ All events were analysed using the broadcasts produced by the major satellite sports broadcaster in New Zealand *SkyTV*. *SkyTV* broadcast was chosen, as they are the primary broadcaster of sport in New Zealand with over 830,000 subscribers, including residential and commercial customers.²²

Ethics approval was not required, as the data source was available through *SkyTV* (NZ).

Data collection

Games were recorded using the recording function of *SkyTV's MySky*. Data were analysed using *VLC* media player, which slows the frame rate, allowing brand exposure to be measured precisely. Broadcasts were recorded in their entirety but only game time was included in the analysis. Analysis of broadcasts commenced with the start of play (excluding warm-ups and pre-game interviews) and ended when the final whistle, successful match point or fall of the final wicket signalled the end of the game. All advertisements, pre- and post-match interviews and half-time shows were excluded. The rationale for this exclusion involved water-shed restrictions, preventing any alcohol advertising during commercial breaks as well as research questions focused on alcohol marketing through alcohol sponsorship.

Data analysis

Each broadcast was analysed for alcohol brands screened during the game, including on advertising hoardings, players' uniforms, on-field sign writing, goal posts, corner flags and commercial graphics. An alcohol brand exposure was recorded when at least half of a legible brand name was clearly visible somewhere on the screen.¹¹ The duration of clear images was recorded to the nearest second. The location and marketing medium of the alcohol-sponsorship exposures were recorded. The brand of alcohol was also recorded.

Researchers recorded the length and number of times a brand was observed on screen in a Microsoft Excel spreadsheet. The timestamp on the video file was used to calculate the length of time a brand was clearly visible. The time of exposure (duration) was divided by the total time of the game play to calculate the percentage of time where alcohol brands were observed during game-play. Each individual alcohol exposure was counted to calculate the frequency of exposure. Rates were calculated by dividing the absolute number of exposures by time (minutes).

Results

Alcohol brands were observed during every televised event. A single alcohol sponsor's brand was observed at four events, the

Asian Cup (Kirin), Australian Open (Jacobs Creek), Cricket World Cup (Victoria Bitters (VB)) and Football International Friendly (Budweiser). Three different alcohol sponsors' brands were observed during the Rugby League 9s Test (Woodstock, Peter Yealands Wines, Bottle-O). The Asian Cup, Cricket World Cup and Football International Friendly were sponsored by beer brands, the Australian Open was sponsored by a wine brand and Rugby League Test was sponsored by a spirit brand, wine brand and an alcohol store. The range of brands and products demonstrate sport's appeal to alcohol marketers. It also shows the problem is not isolated within a particular sport or to particular brands or products.

Alcohol brands were observed between 42 and 777 times a game (Table 1). Alcohol brands were visible from 24.1 to 47.1% of the duration of a match, except for cricket at 9%. The low duration in cricket was due to the absence of an alcohol brand as a major sponsor of the tournament.

Audiences were exposed to between 1.6 and 3.8 alcohol brand exposures per minute. Sports that are played over a long duration tend to have a high frequency of exposure. The playing time of a cricket match is much longer than the other sports selected for this study. Viewers watching the entire Cricket World Cup Final were exposed to alcohol brands 519 times (exclusively due to the sponsorship of Australia Cricket by VB), although this amounted to 1.6 exposures per minute (the lowest rate for all sports). Only the Australian Open, where alcohol brands were observed 777 times, exposed viewers to an alcohol brand more frequently. In contrast to the cricket, the frequency of exposure was compounded by a high rate of exposure, 3.8 exposures per minute.

The duration of exposure in sports played by female athletes was just as high as (and higher in some cases than) the sports played by male athletes. The women's football international friendly had the longest duration at 47.1% and the women's rugby league test 24.1%. The two sports had an average of 3.3 exposures per minute of broadcast. These results demonstrate sports played by female athletes are susceptible to alcohol sponsorship.

Table 1: Nature and extent of visible alcohol sponsorship at televised sports events.

Event	Asian Cup Final	Australian Open Final	Rugby League 9s Test	Cricket World Cup Final	Football International Friendly
Sport	Football	Tennis	Rugby League	Cricket	Football
Location	Sydney (AUS)	Melbourne (AUS)	Auckland (NZ)	Melbourne (AUS)	Chicago (USA)
Gender of sports-people	M	M	F	M	F
Brands	Kirin	Jacobs Creek	Woodstock Bottle-O Peter Yealands	Victoria Bitter	Budweiser
Type of alcohol	Beer	Wine	RTD (bourbon) Alcohol outlet Wine	Beer	Beer
Number of times brand observed	433	777	42	519	340
Duration of exposure	42.6%	46.6%	24.1%	9.7%	47.1%
Rate of exposure (per minute)	3.4	3.8	2.3	1.6	3.8
Marketing medium	Sideline hoardings	Sideline hoardings On-court Signage	Field signage Sideline hoardings Fan signs	Players' uniform	Sideline hoardings Scoreboard

Most brands were observed on advertising hoardings on the sideline. Alcohol brands featured on cricket players' uniforms and spectators' replica jerseys. At the Rugby League 9s Test, an alcohol brand was printed on the playing field. Spectators were given signs with a blank centre boarded by an alcohol brand's marketing which they could write on.

Discussion

Audiences are exposed to a range of brands and products. In three of the five sports analysed, alcohol sponsorship was visible for almost half the broadcast. This finding is consistent with other research on televised sport.^{9,13,14} The extent of alcohol sponsorship demonstrates audiences were exposed to a high frequency and duration of alcohol marketing during sports broadcast.

The nature of alcohol sponsorship contributes to its persuasiveness as a marketing medium for alcohol manufacturers. In this study, one sport featured

brands on player's uniforms, implying that these athletes use and endorse this brand. Sports merchandise including player's uniforms, complete with sponsor's branding are popular with fans (particularly children), reminding consumers of the brand and reinforcing associations. The association of alcohol with sporting heroes deals a double blow to health promoters as role models to children are used to promote an unhealthy and harmful product.²³ An association that is not permitted in more traditional forms of advertising subject to the industry's self-regulatory codes.⁸

The size and diversity of sport viewership exacerbates the problem of alcohol sponsorship. Each of the sports events selected in this study attracted large audiences of all ages (100,000s).²⁰ International broadcasts extend sponsorship reach to global markets. For example Budweiser, an American beer brand, sponsored New Zealand versus the US football. This provided the brand promotion to New Zealand, United States and other global consumers. Similarly the

Australian Open tennis was sponsored by an Australian wine brand with the event broadcast to 40 countries.²¹ New media such as livestreaming increases access to broadcast sport and provides another media for brand marketing. There were more than 24.3 million views across all Australian Open video platforms by the end of the 2015 tournament.²¹ The size and popularity (particularly among children) of sport viewership demonstrates the urgent need for international collaboration to regulate unhealthy sponsorship of sport.

New Zealand sport administrators justify seeking sponsorship income as necessary to fund operating expenses.²⁴ They imply reducing sponsorship income may result in reduced opportunities for participation in sport at all levels with the greatest impact on children playing club sport.²⁴ However only a few sports receive the majority of the income from alcohol sponsorship.²⁵ This suggests regulations to limit alcohol sponsorship would be unlikely to impact on most sports organisations in New Zealand. Even in sports with large amounts of alcohol sponsorship suitable replacements could be found from other sectors as after the removal of tobacco sponsorship.¹⁸ In fact, the year after Australia banned tobacco sponsorship, sponsorship revenue increased by 45%.²⁶

There are examples of sports organisations forgoing the sponsorship of alcohol companies. Sixteen national sporting organisations partners in Australia signed up to a deal to relinquish ties with alcohol companies in sponsorship replacement programmes.²⁷ Other organisations, such as Netball New Zealand²⁸ voluntarily refuse alcohol sponsorship. The French government passed the landmark legislation *Loi Evin* in 1991 that removed all alcohol sponsorship of sport and cultural events and activities.¹⁷ These examples provide evidence that there is political will within some sporting organisations and governments to create healthy environments for athletes and spectators.

The strengths of this analysis include the inclusion of sports played by women. An over-emphasis on male sport had left a gap in the literature, which this current research has addressed. This study focused on a range of sports, over an entire summer, that was broadcast in multiple countries.

The conservative approach to data analysis means the results produced are likely to be an under-estimate of the true level of exposure. It could be argued that brands (particularly reoccurring ones) are identifiable when less than 50% of the brand logo or name appears on screen.

This study has several limitations. The five sports were purposively selected and represent summer sports, which are broadcast on paid television. The extent of alcohol sponsorship in a wider range of sports including winter sports is unknown. Nor have we identified how much sponsorship is visible in sports broadcasts on free-to-air channels. This media will likely have wider reach. This is an avenue for further research.

This research adds weight to arguments to implement the recommendations to remove all alcohol sponsorship of sport.^{1,3,17-19,27} This is particularly valuable in the context of the New Zealand Ministerial Forum of Alcohol Advertising and Sponsorship recommendation for the complete removal of alcohol sponsorship of sport, which is still awaiting a governmental response, as noted earlier. Tobacco sponsorship replacement provides an effective framework for alcohol sponsorship replacement. This has already begun in Australia with the government replacing funding from alcohol companies with the revenue generated from the 'alcopops tax.'²⁹ Similarly, *Healthway* in Western Australia has an alcohol replacement programme for sports willing to end alcohol sponsorship and promote healthy messages.³⁰

Failing a complete ban of alcohol sponsorship, there needs to be regulation with a legislative basis. Alcohol companies have utilised sponsorship to circumvent their own regulatory codes on advertising.³ There is a wide breadth of evidence that has concluded alcohol industry self-regulation is ineffective in limiting children's exposure to alcohol marketing.³ Consequently, any suggestion of industry self-regulation of sponsorship should be dismissed in favour of regulations with a legislative basis. While this would not prevent the broadcast of international events with alcohol sponsorship, it would significantly reduce the exposure from domestic sports with high viewership such as rugby, cricket and football. Moreover, the Cricket World Cup

provides a template of how international tournaments can be run without major sponsorship from alcohol companies.

In conclusion, alcohol sponsorship was prevalent in international sport on New Zealand television. The large audiences were exposed to between 1.6 and 3.8 alcohol brand exposures per minute. For three out of the five events, alcohol brands were visible for almost half of the game, most frequently on side-line hoardings. Alcohol marketing, including sponsorship, is associated with

increases in alcohol-related harm and encourages children to initiate drinking.³⁻⁵ Given the popularity of broadcast sport, especially with children, there is an urgent need for regulation that addresses alcohol marketing through sport. There are viable models of alcohol sponsorship replacement but their implementation requires the will of both sporting organisations and politicians. This research adds weight to arguments to implement recommendations to remove all alcohol sponsorship of sport.

Competing interests:

Nil.

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New Zealand rugby health study: motor cortex excitability in retired elite and community level rugby players

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ABSTRACT

AIMS: Rugby union is a high contact sport in which players frequently experience brain injuries. Acute brain injury is associated with altered corticomotor function. However, it is uncertain if long-term exposure to rugby is associated with any alterations in corticomotor function. The aim of the study was to assess measures of corticomotor excitability and inhibition in retired rugby players in comparison to retired non-contact sport players.

METHODS: The design was a cross-sectional study with three groups of retired athletes: elite rugby (n=23), community level rugby (n=28) and non-contact sport control (n=22). Assessments of corticomotor excitability were made using transcranial magnetic stimulation.

RESULTS: Resting motor threshold was significantly higher and long-interval intracortical inhibition was greater in the elite rugby group compared to the control group. Participants in the two rugby groups had sustained significantly more concussions than the control group.

CONCLUSIONS: We provide some evidence of altered corticomotor excitation and inhibition in retired elite rugby players in comparison to retired non-contact sport players. Given the absence of findings in the community rugby group, who had experienced a similar number of concussions, the association with previous brain injury is unclear.

The long-term effects of head injuries in professional athletes have become a high-profile topic as evidence accumulates of the potential negative effects of repeated concussion on brain function. In contact sports such as rugby and American football, where high velocity impacts are a common feature of the game, concussions are frequently encountered. The incidence rate in adult rugby players has been reported at 3–23% in a single season,¹ while a recent meta-analysis determined a concussion incidence of 4.73 per 1,000 player match hours, or approximately one in every five games.²

Numerous studies using transcranial magnetic stimulation (TMS) have shown that corticomotor excitability, or the excitability of the pathway from the primary motor cortex to the motoneurons, is altered

in the acute phase following concussion.^{3–8} Consistent findings are an elevated motor threshold and a prolongation of the cortical silent period. The cortical silent period in particular, reflects an enhancement of gamma-aminobutyric acid B (GABA_B) receptor mediated intracortical inhibition. Enhanced GABA_B-inhibition has been shown to be associated with impaired motor performance,^{7,9,10} suggesting that this could be a clinically relevant finding. The outcomes are less consistent in studies that have examined the long-term (>12 months) effects of concussion on corticomotor excitability. While some show a continued prolongation of the silent period,^{10,11} others have shown no differences¹² or a relative shortening of silent period duration.¹³ Similarly, long-interval intracortical inhibition

(LICI), a further measure reflecting GABA_B receptor activation, has been reported to be reduced,¹³ enhanced^{9,14,15} or unchanged¹² in the long term, following concussion. Thus, there are inconsistencies in the studies to date on the potential long-term effects of concussion on corticomotor function.

The cumulative effect of multiple concussions may be more influential than the effect of a single concussion. The term “chronic traumatic encephalopathy” has been used to describe the progressive neurodegenerative effects of concussions, and it is particularly common in athletes who have experienced multiple blows to the head.¹⁶ De Beaumont and colleagues¹¹ provide some evidence that athletes with multiple concussions have exaggerated alterations in corticomotor excitability compared to those with a single concussion.

The goal of the current study was to examine corticomotor excitability in athletes retired from competitive rugby union in comparison to athletes retired from non-contact sport. Given the potential differences in playing time, player size and skill, and data from previous studies showing differences in concussion rates among different levels of competition, separate groups of participants were recruited from retired elite (national and international) and community (club) level players.

Methods

Participants

Participants were 73 males who had previously played competitive rugby, hockey or cricket in New Zealand. They were a cohort from a larger study investigating the health of retired rugby and non-contact sport athletes who volunteered to participate in an additional session assessing corticomotor excitability. Participants were separated into three groups: elite rugby (n=23), community rugby (n=28) and a non-contact sport control (hockey and cricket; n=22). Elite rugby players were required to have played at international or national level, while the community level group played at club level. Non-contact sport players were club, national and international level. All participants were required to be male, aged 30–65 years and to be retired from competitive sport for at least five years. They were

excluded if they had any contraindications to or did not want to undertake TMS (n=4), or were taking medication known to influence corticomotor excitability (n=1).¹⁷ Ethical approval was obtained from the Auckland University of Technology Ethics Committee and informed consent was obtained prior to participation.

Protocol

Participants were asked to complete an online questionnaire assessing general physical and mental health, including concussion history. A detailed description of the assessment and the relevant findings is provided elsewhere.¹⁸ Participants then completed an additional test session using TMS to assess intracortical and corticomotor excitability.

Motor cortex excitability assessment

Procedure

Participants were seated in a comfortable chair with their self-reported dominant arm resting on a pillow positioned over their lap. TMS was applied to the contralateral brain hemisphere. Magnetic stimuli were applied using a Bistim 200² (Magstim Co) and a 70mm figure-of-eight coil. The coil was held perpendicular to the scalp with the handle directed posteriorly at approximately 45° to induce a posterior-anterior current in the motor cortex. The “hot spot” for the participant’s dominant first dorsal interosseus (FDI) muscle was found by moving the coil around the scalp and locating the site that elicited the largest motor evoked potentials (MEPs) in the FDI. This site was marked with a felt pen and all further stimuli were delivered with the coil over this location. The resting motor threshold (RMT) was established as the lowest intensity that elicited at least four MEPs >50 µV in a train of eight consecutive stimuli.¹⁹

Electromyography

The FDI muscle was selected as the target muscle, as it has almost exclusively been used in other studies assessing the impact of concussion on corticomotor excitability in sporting populations, and thus would enable comparison with previous work in the field.^{10,11,13,14,20} Self-adhesive bipolar surface

electrodes (Norotrode, USA) were applied over the belly of the FDI of both hands. The skin was shaved and cleansed with alcohol prior to application of electrodes. A ground electrode was applied over the dominant styloid process or 5th carpometacarpal joint. Electromyography (EMG) signals were amplified (AMT-8, Bortec Biomedical, Canada), filtered (10–1000Hz) and sampled at 5,000Hz using a data acquisition board (Micro 1401, CED, UK) and Signal software (CED, UK).

Corticomotor excitability

Corticomotor excitability was assessed using stimulus-response curves. To obtain the curves, participants were given magnetic stimuli at eight intensities from 90–160% RMT in 10% steps. Ten stimuli were given at each intensity with the FDI muscle relaxed. Eighty stimuli were delivered 5–7 s apart with the order of intensity randomised.

Intracortical inhibition and facilitation

Measures of intracortical excitability reflect excitability of cortical interneurons, providing a specific measure of neural excitability within the brain itself. To examine short-interval intracortical inhibition (SICI), conditioning and test stimuli were delivered with an interstimulus interval of 2ms. The test stimulus intensity was set to elicit a MEP of 1mV amplitude (TS_{1mV}). Two intensities of conditioning stimulus were provided at 70% and 80% RMT.

To examine short-interval intracortical facilitation (SICF), a conditioning stimulus was delivered at TS_{1mV} followed by a test stimulus at 90% RMT. Two interstimulus intervals of 1.4 and 2.8ms were used.

To examine long-interval intracortical inhibition (LICI), a conditioning stimulus was delivered at 120% RMT followed by a test stimulus at TS_{1mV} . The interstimulus interval was 99ms.

Ten stimuli were given for each condition described above with the FDI muscle completely relaxed. An additional 10 stimuli were provided at TS_{1mV} . The 60 stimuli were delivered 5–7 s apart with the order of condition randomised.

Silent period

The silent period induced by single-pulse TMS was examined by delivering 10 stimuli at 120% RMT while the dominant FDI was

activated at 10% of maximum isometric voluntary contraction (MVC). To determine MVC, participants performed an isometric abduction of the target index finger against a loadcell (Precision Transducers Ltd, New Zealand) for 5–10 s, and the maximum level of force identified. To generate a contraction of 10% MVC, participants were provided with visual feedback of the target force and their actual force.

Transcallosal inhibition

Transcallosal inhibition is a measure of efficacy of connections between the two primary motor cortices. It was assessed by recording responses in the non-dominant FDI while stimulating over the hot spot for the dominant FDI. Ten stimuli were delivered at 80% of maximum stimulator output while the non-dominant FDI was activated at 50% MVC. The MVC of the non-dominant FDI was determined in similar manner to that described for the dominant FDI. During stimulation, participants were provided with visual feedback of the target force and their actual force.

Data processing

Stimulus-response curve and intracortical facilitation and inhibition data were visually inspected, and any responses containing unwanted muscle activation were removed prior to further analysis. The maximum peak-to-peak amplitude of each MEP was measured and then averaged across each intensity level or condition. For the stimulus-response curve data, a Boltzman equation was fitted for each participant and the overall group data using the following formula:²¹

$$\text{MEP amplitude (S)} = \text{MEP}_{\text{max}} / (1 + \exp((S_{50} - S)/m))$$

where MEP_{max} represents the maximum MEP amplitude or plateau, S is stimulus intensity, S_{50} is the stimulus intensity at which the MEP amplitude is 50% of MEP_{max} and m is a slope parameter. The maximal steepness of the function at S_{50} is directly proportional to the inverse of the slope parameter (ie, 1/m). In addition, the variability of MEP amplitude at 120% RMT (MEP_{CV}) was determined by expressing the standard deviation of response amplitude relative to the mean MEP amplitude. This provides a measure of the fluctuations in corticomotor excitability.

Responses obtained during the assessment of the silent period and transcallosal inhibition were rectified and averaged. The mean background EMG activity 80ms pre-stimulus was determined in the averaged response. The duration of the silent period was defined as the time from stimulation to the point at which the rectified EMG activity returned to the background mean level following the MEP (Figure 1). The onset and offset of transcallosal inhibition were defined as the time points at which rectified EMG activity dropped below and returned to the background mean level, respectively (Figure 1). The duration of transcallosal inhibition was the difference between these two time points.

General health assessment

The full online questionnaire took approximately 40 minutes to complete. Data were collected on participant demographics, injuries and illnesses, current physical and mental health, sleep quality, drug and alcohol use, and beliefs regarding sport and health. Participants were asked if they had ever experienced a concussion while playing or training for their sport. The following definition of a concussion was provided:

“A concussion is a blow to the head followed by a variety of symptoms that may include any of the following: headache, dizziness, loss of balance, blurred vision, ‘seeing stars’, feeling in a fog or slowed down, memory problems, poor concentration, nausea or throwing-up. Getting ‘knocked out’ or being unconscious does NOT always occur with a concussion.”

The severity of concussions was assessed using the Rivermead Post Concussion Symptoms Questionnaire (RPQ).²² Scores from the questionnaire were separated into two components reflecting predominantly early (RPQ-3) and late (RPQ-13) symptoms of brain injury.²³

To evaluate current levels of physical activity, participants were also asked the number of days in the previous week that they undertook exercise.

Statistical analysis

Using the Kolmogorov Smirnov test, it was determined that all outcome variables except for the silent period duration, transcallosal inhibition duration and two of the Boltzmann equation coefficients were

not normally distributed in at least one of the three groups. Therefore, corticomotor and intracortical excitability variables (RMT, MEP_{CV}, SICI, SICF, LICI, silent period duration, transcallosal inhibition duration, Boltzmann equation coefficients) and concussion data were compared among groups using Kruskal-Wallis tests. Significant findings were investigated using the Mann-Whitney *U* test, with the alpha level adjusted using a Bonferroni correction. Categorical data were compared among groups using Chi-Square tests. Effect size data were also determined for comparisons between the two rugby groups and the control group. Effect sizes for continuous and numerical data are expressed as Cohen’s *d*. Effect sizes for categorical data were converted from the odds ratio.²⁴ Statistical analyses were undertaken using SPSS V23 (IBM, USA) and Comprehensive Meta-Analysis (Biostat, USA). An alpha level of 0.05 was adopted.

Results

Demographic and concussion information for the groups is shown in Table 1. Concussion information was missing from one elite rugby and one community rugby participant. The groups were matched for age, the numbers of years active in sport and current frequency of exercise, but there were significant differences in height, weight and body mass index (BMI). Participants in the elite rugby group were taller and heavier than the other two groups (all $P < 0.001$; adjusted alpha = 0.012). Community rugby players were also heavier than the controls ($P = 0.004$). Overall, participants in the two rugby groups had a significantly higher BMI than the control participants (both $P \leq 0.002$), but the difference between the rugby groups was not significant ($P = 0.09$).

There were also differences among groups in concussion history. All rugby players except one had experienced at least one concussion during their playing career, while only six of the control group had experienced concussions. Therefore, there were significantly more control participants who had not sustained a concussion compared to the two rugby groups (both $P < 0.001$), and significantly less who had sustained three or more concussions (both $P < 0.001$).

Table 1: Demographic, general health information for the three groups. Data are mean (standard deviation) or effect size (95% confidence interval).

	Elite Rugby (n=23)	Community Rugby (n=28)	Control (n=22)	P-value	Effect size ER v Control	Effect size CR v Control
Age (years)	43 (7)	45 (8)	44 (9)	0.77	0.18 (-0.40 to 0.77)	0.03 (-0.53 to 0.59)
Height (cm)	188 (7)	178 (6)	178 (5)	<0.001 ^{*a,b}	1.64 (0.95 to 2.33)	0.05 (-0.61 to 0.7)
Weight (kg)	107 (17)	88 (9)	81 (10)	<0.001 ^{*a,b,c}	1.83 (1.12 to 2.55)	0.76 (0.09 to 1.44)
BMI (kg/m ²)	31 (5)	29 (4)	26 (3)	<0.001 ^{*a,c}	1.35 (0.70 to 2.00)	0.88 (0.26 to 1.49)
Years of sport	23 (8)	23 (7)	24 (9)	0.92	0.08 (-0.53 to 0.70)	0.04 (-0.52 to 0.6)
Exercise days	2.9 (1.0)	2.8 (1.2)	2.8 (0.9)	0.38		
Reported concussions						
0 concussions (n)	0 (0%)	1 (4%)	16 (75%)	<0.001 ^{*a,c}	NA	2.34 (1.12 to 3.55)
1–2 concussions (n)	3 (13%)	3 (11%)	5 (21%)	0.50	0.37 (-0.49 to 1.24)	0.47 (0.39 to 1.33)
≥3 concussions (n)	20 (87%)	23 (85%)	1 (4%)	<0.001 ^{*a,c}	2.72 (1.43 to 4.02)	2.64 (1.39 to 3.89)
RPQ-3	3.5 (2.1)	4.5 (2.9)	2.5 (1.0)	0.21	0.59 (-0.33 to 1.51)	0.93 (0.03 to 1.83)
RPQ-13	11.8 (8.4)	11.7 (10.9)	8.3 (11.8)	0.41	0.34 (-0.57 to 1.25)	0.30 (-0.60 to 1.19)

ER = elite rugby; CR = community rugby; BMI = body mass index; RPQ = Rivermead Post Concussion Questionnaire; * = significant difference among groups; ^a = significant difference between control and elite rugby groups; ^b = significant difference between community and elite rugby groups; ^c = significant difference between control and community rugby groups.

Motor cortex excitability

Example MEPs from single- and paired-pulse stimulation and group stimulus response curves are shown in Figures 1 and 2, respectively. The mean MEP amplitude obtained during stimulation at TS_{1mV} was 0.97±0.95mV, 1.02±1.10mV and 1.02±0.63mV for the elite rugby, community rugby and control groups, respectively. This indicates adequate matching of test MEP amplitude for the assessment of paired-pulse data.

Summary information for all of the dependent variables is provided in Table 2. There was a significant difference in RMT among the groups. RMT in the elite rugby group was significantly higher compared to the control ($P=0.004$) group. There was also a difference in LICI among the groups, with the elite rugby group showing significantly more LICI (reduced MEP size) in comparison to the control group ($P=0.005$). There were no other significant differences among groups in the other motor cortex excitability or inhibition outcome measures.

Discussion

We found some evidence for altered corticomotor excitability and intracortical inhibition in retired elite rugby players in comparison to retired non-contact sport players. Resting motor threshold was elevated in the elite rugby group, reflecting reduced excitability, and LICI was increased, reflecting enhanced inhibition. Both of these findings follow some of the previous research on the impact of concussion on measures of motor cortex excitability. However, although both rugby groups had experienced a greater number of concussions compared to the control group, there were no similar differences in RMT and LICI in the community rugby group. Therefore, the association with concussion history is unclear.

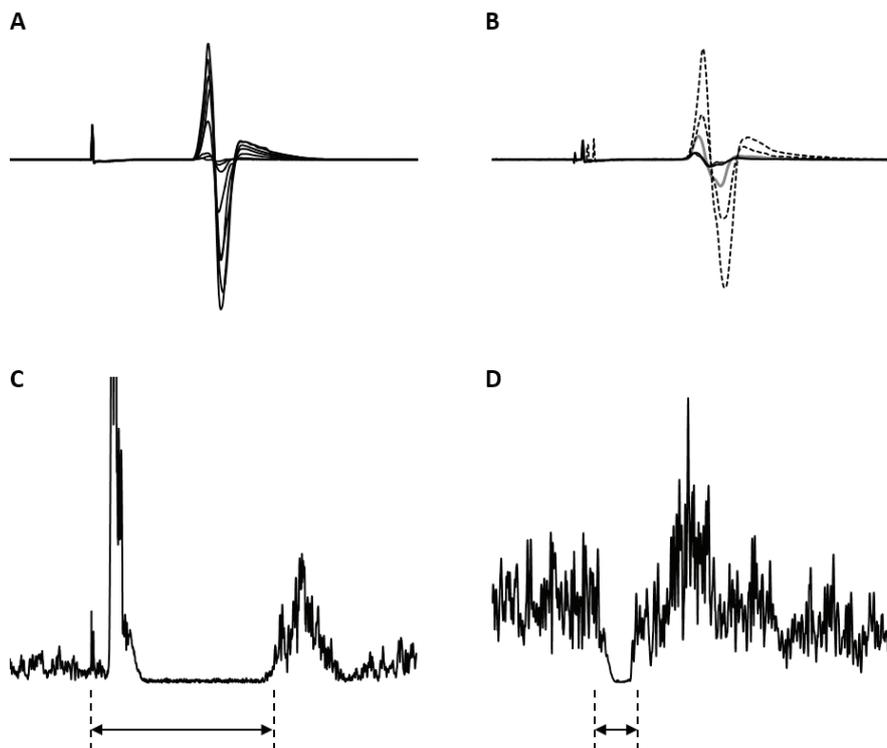
Motor threshold

The elite rugby group had a higher resting motor threshold compared to the control group. An elevated motor threshold normally

Table 2: Group results of corticomotor and intracortical excitability data. Data are mean (standard deviation) or effect size (95% confidence interval).

	Elite Rugby (n=23)	Community Rugby (n=28)	Control (n=22)	P-value	Effect size ER v Control	Effect size CR v Control
RMT (% MSO)	50 (7)	46 (10)	44 (8)	0.01 ^{*a}	0.89 (0.27 to 1.50)	0.21 (-0.35 to 0.77)
MEP variability (%)	71 (24)	80 (54)	61 (22)	0.43	0.41 (-0.18 to 1.00)	0.46 (-0.11 to 1.02)
Boltzmann equation coefficients						
MEP _{max} (mV)	4.3 (2.0)	4.9 (3.3)	5.8 (3.5)	0.57	0.47 (-0.12 to 1.07)	0.21 (-0.35 to 0.77)
slope	8.4 (3.7)	8.0 (3.5)	7.3 (4.0)	0.52	0.23 (-0.36 to 0.81)	0.12 (-0.43 to 0.68)
S ₅₀ (%RTh)	126 (10)	126 (12)	126 (14)	0.77	0.02 (-0.56 to 0.61)	0.02 (-0.54 to 0.58)
Paired-pulse stimuli						
SICI ₇₀ (mV)	0.33 (0.40)	0.37 (0.33)	0.44 (0.39)	0.20	0.27 (-0.31 to 0.86)	0.19 (-0.37 to 0.29)
SICI ₈₀ (mV)	0.45 (0.67)	0.51 (0.50)	0.44 (0.37)	0.27	0.02 (-0.56 to 0.61)	0.17 (-0.39 to 0.73)
SICF _{1.4} (mV)	2.27 (1.43)	2.49 (1.79)	2.41 (1.42)	0.86	0.10 (-0.48 to 0.69)	0.05 (-0.51 to 0.60)
SICF _{2.8} (mV)	1.51 (0.84)	1.73 (1.61)	2.07 (1.52)	0.39	0.46 (-0.14 to 1.05)	0.22 (-0.34 to 0.78)
LICI (mV)	0.22 (0.53)	0.31 (0.44)	0.50 (0.86)	0.03 ^{*a}	0.40 (-0.2 to 0.99)	0.28 (-0.28 to 0.84)
Silent period (ms)	157 (33)	151 (30)	153 (28)	0.63	0.12 (-0.47 to 0.70)	0.07 (-0.49 to 0.62)
Transcallosal inhibition (ms)	41 (11)	48 (16)	39 (18)	0.13	0.13 (-0.46 to 0.72)	0.48 (-0.09 to 1.06)

ER = elite rugby; CR = community rugby; RMT = resting motor threshold; MSO = maximum stimulator output; MEP = motor evoked potential; S₅₀ = stimulus intensity at which MEP amplitude is 50% MEP_{max}; SICI = short-interval intracortical inhibition; SICF = short-interval intracortical facilitation; LICI = long-interval intracortical inhibition. * = significant difference among groups; ^a = significant difference between elite rugby and control groups.

Figure 1: Example motor evoked potentials (MEPs) from individual participants. Each response shown is an average of 10 stimuli.

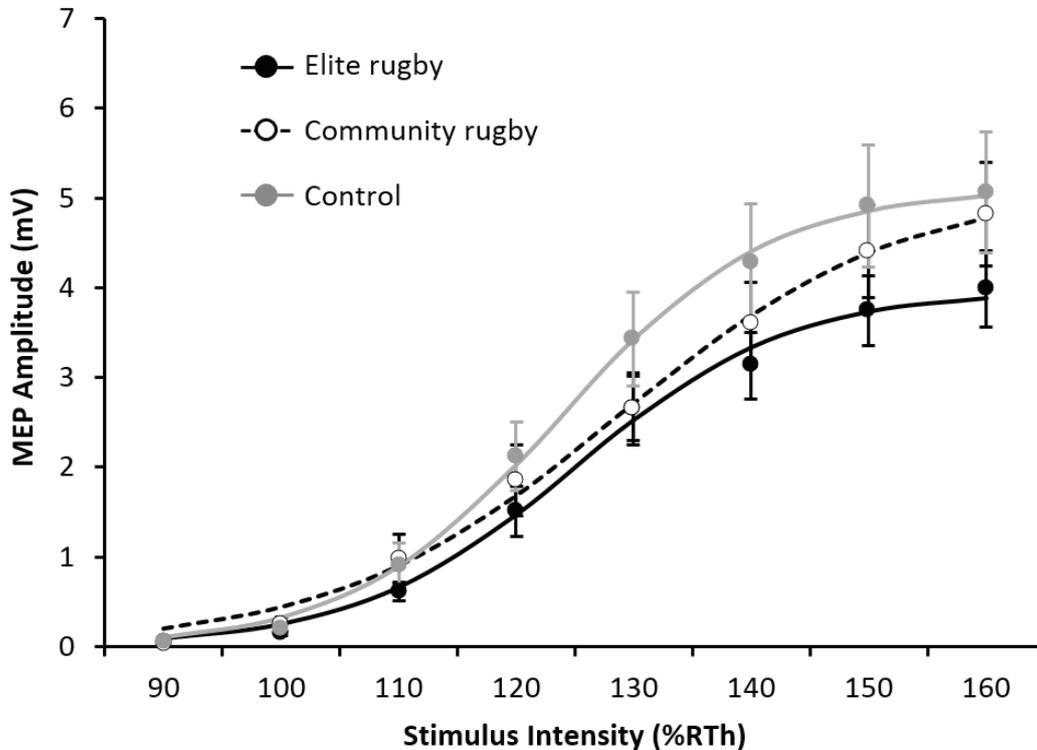
A. Overlaid stimulus-response curve MEPs from an elite rugby participant. Responses are from stimulus intensities from 90–160% of resting threshold.

B. Overlaid paired-pulse responses in a control participant. The non-conditioned (single-pulse) response is shown in grey. The black traces show the two short-interval intracortical inhibition conditions. The dotted traces show the two short-interval intracortical facilitation conditions.

C. Silent period in a community rugby player. The silent period duration is indicated by the arrow.

D. Transcallosal inhibition in a community rugby player. The duration of transcallosal inhibition is indicated by the arrow.

Figure 2: Stimulus-response curves showing mean motor evoked potential (MEP) amplitude for the three groups. The data have been fitted with Boltzmann equation curves. RMT = resting motor threshold. Bars are 1 standard error of the mean.



reflects impaired excitability threshold of cortical motor neurons and is one of the most common alterations evident in studies that have used TMS in people with acute concussion (<1 month).³⁻⁵ Studies involving people with a longer post-concussion period have produced less consistent findings. While motor threshold was increased in one study²⁵ investigating the effects of mild brain injury sustained an average of five years previously, two similar studies found no significant differences.^{10,26} The latter two studies involved people who were nine-months to two-years post-brain injury.

While the elite rugby group had an elevated RMT in relation to the control group, it is difficult to make an association with concussion history given the similar number and severity of concussions experienced in the community rugby group, whose RMT did not differ from the controls. A potential confounding factor is the larger size of the elite rugby group, both in terms of weight and BMI. The elite rugby group were on average 25kg heavier than the control group. Stokes and colleagues²⁷ identified that a 1mm increase in the distance from the

TMS coil to the motor cortex was associated with a 2.8% increase in motor threshold. Therefore, the potential for more adipose tissue and increased cranium thickness²⁸ in the larger elite rugby players may contribute to the increased resting motor threshold.

Corticomotor and intracortical excitability

The finding that corticomotor excitability, assessed using the stimulus-response curves, was equivalent to controls in the two rugby groups indicates that the excitability of the pathway from the corticospinal tract to the FDI muscle was not abnormal. Therefore, the strength of synaptic connections in the output pathway from the primary motor cortex was the same in the retired rugby players as the control group.

The intracortical excitability measurement of LICI was increased in the elite rugby group in comparison to the controls. Two previous studies have reported that athletes with multiple previous concussions (>12 months ago) had greater LICI than comparable athletes without concussion history.^{9,15} LICI is mediated by GABA_B receptors in the primary motor cortex.²⁹ Based on evidence

from drugs that block GABA re-uptake³⁰ or are GABA-receptor agonists,³¹ it has been proposed that the inhibition arises through the generation of slow inhibitory post-synaptic potentials following activation of the GABA_B receptor. Inhibitory circuits involving GABA receptors are implicated in the modulation of neural plasticity,³² and increased inhibitory activity constrains the potential for neural plasticity and may consequently impair cognitive and motor skill learning tasks that are dependent on such plasticity.^{9,33} An increased silent period duration, which also reflects over-activation of neural pathways that involve GABA_B receptor,²⁹ also has been consistently reported in people with chronic brain injury or concussion.^{9–11,14,15} However, a recent study that examined cortical excitatory and inhibitory function in American football players who had experienced a concussion (>10 months previously) reported no significant differences in LICI, silent period duration or any brain metabolites between concussed and non-concussed athletes.¹² We did not see any differences in the silent period duration among our groups. Other studies have previously indicated that LICI and the silent period duration are likely to reflect different aspects of GABA_B receptor-mediated inhibition,^{34,35} which may be explained in part by the spinal level contribution to the early part of the silent period.³⁶ Therefore, we provide partial evidence of dysfunctional GABA_B receptor-mediated inhibition in retired elite rugby players compared to retired non-contact sport players, in that LICI was reduced in the elite rugby group but the silent period duration was not altered.

Measures of SICI and SICF were comparable among the groups. These two measures reflect GABA_A receptor-mediated inhibition and excitatory descending volley interactions, respectively. As these measures were not clearly different among the three groups in our study, we find no evidence of altered function of these processes in retired rugby players.

Transcallosal inhibition

Transcallosal pathways are critical for inhibiting activation of muscles in the opposite side of the body during unilateral motor tasks, particularly fine motor skills.³⁷

For example, transcallosal inhibition is reduced in people with mirror movements who are unable to move the hands independently.³⁸ Conversely, an increase in transcallosal inhibition has been associated with higher performance on tests of unimanual dexterity.³⁹ There was no difference in transcallosal inhibition among groups in the current study, indicating that interhemispheric motor pathways in the two rugby groups were comparable to controls.

Limitations

There were several limitations to the study. Firstly, the recall of concussion history may not be accurate, particularly the symptoms assessed by the RPQ. We also did not assess the time since the last concussion, or assess concussions that were not related to sport. There is a large age range in the participant groups, which may contribute to the variability of the data and a reduction in study power. For example, there is evidence that some measures of corticomotor^{40,41} and intracortical⁴² excitability are altered in older people. Current levels of physical activity may be a confounding factor in the study, as it has been shown that exercise can influence the strength of GABA-mediated circuits.⁴³ However, there were no differences in the frequency of exercise reported in the previous week among the groups, so this is unlikely to have a large impact on the study findings.

Conclusion

We provide some evidence of altered cortical motor excitation and GABA_B mediated-inhibition in retired elite rugby players in comparison to athletes retired from non-contact sport, although differences in body size could be a confounding factor in the measure of resting motor threshold. These findings were not present in retired community-level rugby players. Given that the community rugby group had experienced an equivalent number of concussions and severity of symptoms as the elite rugby group, it is difficult to form an association between altered corticomotor excitability and concussion history. However, these alterations should be investigated further given the large number of athletes who participate in rugby at the elite level.

Competing interests:

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Stressful events and circumstances reported by patients prior to being prescribed antidepressants

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ABSTRACT

AIMS: This study investigates the extent to which those who receive a prescription for antidepressants perceive psychosocial stressors to be significant in their difficulties.

METHODS: This study draws on a survey of adults prescribed antidepressants. It analyses 1,683 responses to an open-ended question that enquired about difficult events and circumstances participants experienced in the time leading up to receiving an antidepressant prescription.

RESULTS: Sixty-five percent of respondents described experiencing one or more stressful events or circumstances, with 19 % reporting two and 20% reporting three or more. The most frequently reported stressors identified by participants were categorised as: relationship difficulties (19%), life transitions (19%), losses (18%), work related difficulties (15%) and participants' own or others' health issues (15%). Other less frequently reported stressors included isolation, academic difficulties, abuse and violence and financial difficulties.

CONCLUSIONS: Findings are that stressful life events or circumstances are significant for a large number of who are given a prescription for antidepressants. It is important for GPs to be aware of significance of these psychosocial stressors in their patients' lives and make treatment recommendations that address these difficulties. Conclusions need to be interpreted in the light of limitations arising from the sampling method.

General practitioners are central in the treatment of depression, with some estimates suggesting that up to 30–50% of patients in family practice experience depression.¹ It is therefore not surprising to learn that GPs deliver around three-quarters of the treatment for mental health disorders in New Zealand.²

There are a range of treatments commonly used for the treatment of depression, with the two most common treatments being antidepressants and talking therapy. Current clinical guidelines do not endorse antidepressants as a first line treatment for mild depression,³ which is reported to be the depression most commonly seen by GPs.⁴ There are also doubts about the effectiveness of antidepressants for all but very severe depression.⁵ In spite of this, antidepressants continue to be prescribed at high

rates across New Zealand, with an estimated one in nine adults receiving antidepressant prescriptions every year.⁶

Biological causal explanations for depression have been widely endorsed by health professionals working in primary care and these beliefs are likely to impact on treatment choices.⁷ Research has consistently shown that health professionals who recognise social rather than biological causes of depression are more likely to recommend talking therapy rather than medication.^{8,9}

With the current dominance of biochemical causal explanations of depression, there has been rather less attention paid to the role of social factors in recent times. However, both previous and current research has established strong links between depression and various stressful life events and circumstances.^{10,11,12} It is not known to what extent

New Zealanders who receive a prescription for antidepressants perceive themselves to be struggling with stressful events or circumstances in their lives and what the nature of these stressors might be.

This article describes the findings from a large-scale survey and addresses the question of the extent to which stressful events and circumstances are experienced as significant by those seeking an antidepressant prescription for self-described depressed mood. It also explores the range and the relative frequency of the forms of adversity that they report.

Methods

This study draws from a 47-question anonymous online survey. While the broader study investigated New Zealand adults' attitudes and beliefs about depression and antidepressants, this article draws primarily from just one open-ended question. Following a specific question about whether a loved one had died in the two months prior to first being prescribed antidepressants (to which 7.3% responded 'yes'), participants were asked to 'Please describe any other experiences or problems that you were having at this time'.

Recruitment

Ethics approval for the study was obtained from the University of Auckland Human Participants Ethics Committee. Following this, an anonymous questionnaire was placed online using a survey website that guarantees the protection of data. The study was promoted in the New Zealand media via media releases, interviews with the researchers and advertisements. Participants self-selected against the published criteria of the study that required that they be New Zealand based, over the age of 18 and had received a prescription for antidepressants in the past five years. The survey was opened to participants in March 2012 and was closed in January 2013 when there had not been any new completed surveys for some weeks.

Participants

This survey yielded 1,829 surveys for analysis. Females constituted 76.6% of the sample. The modal age group was 36–45 (24.2%); 16.3% were 18 to 25, and 15.9% were 56 or older. A large majority (92.1%) identified as 'New Zealand/European'; 2.9% as Māori, 1.2% as Asian, 0.4% as Pacific

Islander and 3.5% as 'Other'. In terms of education, 49.6% had a university degree; 26.1% gained a diploma or certificate after high school, 17.2% completed high school and 7.1% did not complete high school. Annual income (in New Zealand dollars) ranged from less than \$10,000 (15.0%) to more than \$100,000 (7.7%). The modal income was \$40,000 to \$59,999 (22.1%).

Data analysis

Initially the data was filtered to meet the criteria for this analysis. Of the 1,829 participants who completed the survey, only 1,683 participants who had reported depressed mood in the period prior to receiving an antidepressant prescription were included in this analysis. Of this number, 1,299 (77%) answered the question that asked participants to describe 'any experiences' occurring around the time that they were prescribed antidepressants.

Content analysis was used to establish the nature and frequency of any experiences identified by participants.¹³ The unit of analysis was selected as a theme, which identified a particular participant's description of an event or circumstance.¹⁴ An initial coding of these experiences was used to generate a list of categories that contained common content. After identifying over-arching categories of experience, the complete data set was coded under one or other of the established categories in the form of frequency counts together with exemplars that reflected the range of events contained within a single category. Where more than one type of experience was described in a participant's response (eg a loss and relationship difficulties), these experience types were counted separately for the purpose of analysis. In cases where a single type of experience was repeated for a participant (eg several different losses), this was coded only once to represent the presence or absence of that particular type of experience. The number of experiences described by each participant was also separately coded as "0 experiences", "1 experience", "2 experiences" and "3 or more experiences" in order to capture cumulative adversity. Some participants specifically noted an absence of events at the time or described something that did not seem to be an external occurrence. These responses were coded separately. The last step in the analysis was to check for internal and external consistency. The second author

independently coded 10% of participants' responses. Consistent with the recommendations in the literature, any consistency problems were resolved.¹⁵

Results

Frequency of reported stressful events

Of the 1,683 participants, 1,095 (65%) indicated that they had experienced one or more stressful events or circumstances in the period leading up to receiving an antidepressant prescription. The other 35%, who did not report any stressful events or circumstances, included both the 23% who did not answer the question at all and 12% who did respond to the question but reported no stressful events or only internal events (eg "a crisis of identity") or other symptoms (eg "a panic attack"). Twenty-six percent reported only one stressful event or circumstance, 19% reported two and 20% reported three or more. The most common types of events or circumstances reported were relationship difficulties, life transitions and losses.

Table 1: Number and percentages of stressful events described by participants.

Number of stressful events	
0	588 (34.9%)*
>1	1,095 (65.1%)
1 only	444 (26.4%)
2 only	314 (18.7%)
>3	337 (20.0%)
Frequency of event types	
Relationship difficulties	321 (19.1%)
Life transitions	321 (19.1%)
Losses	309 (18.4%)
Work-related difficulties	261 (15.5%)
Health problems	255 (15.1%)
Isolation	130 (7.7%)
Academic difficulties	117 (7.0%)
Abuse and violence	95 (6.5%)
Financial difficulties	90 (5.3%)
Other	100 (5.9%)

*Includes 384 not responding to the question.

Relationship difficulties

Relationship problems were described by 19% of participants. The majority of these described stress related to 'difficult' family members: "I had been under a great deal of stress with a particularly difficult child". A large number also described conflict between family members: "I had a falling out with family members and they had told me I was not worth knowing". Some also spoke of burdensome family responsibilities: "I had been going to my father's house every day during that time to make sure he was okay as he is 85, doesn't drive and won't accept help from anyone else". Many responses also included conflict or dissatisfaction that occurred in the context of intimate relationships: "Marriage difficulties—felt unloved, and trapped in the sense that there seemed to be nothing I could do that would effectively change the situation and leaving the marriage was not an acceptable option to me either". Several participants described infidelity as the source of marital dissatisfaction while others described a lack of communication, support or closeness with their intimate partner. Some participants also reported friendship difficulties as a source of stress.

Life transitions

Life transitions were described as a source of distress for 19% of participants. The majority of responses in this category included transitions within living circumstances such as moving to a new house, city or country: "Had moved from the South Island to the North Island...was trying to cope with two small children on my own in a new town with no car". Some described moving out of the family home or moving back into their family home. New roles and responsibilities were also described as stressful for a large number of participants in this category. These transitions included events such as unplanned pregnancies or having a new baby: "Caring for a premature, difficult baby. Stuck at home all day by myself, finding it hard to cope and hating my new life". Children moving out of the family home also featured in some participants' responses: "My daughter had left home to go to university...I felt redundant as a mum after my daughter left". Transitions in the context of education were also described by a smaller number of

participants. These largely focused on the demands of leaving school or university: “Concerns after finishing a first degree and future career/life direction”.

Losses

Events categorised as ‘losses’ were described by 18% of participants. Many participants described the death of family members—most often parents. Some participants described a single death event. For example, “My partner died traumatically”. Others described multiple deaths. For example, “I’ve been a mess for too long... after the death of both my partner and son died, they died within three months of each other, my partner dropped dead in front of me and my son coming up 21 hung himself over a girl”. Some deaths occurred suddenly while others appear to have been preceded by a long period of illness, with some participants having been a caregiver for the person who had died. In some cases, participants reported that their antidepressant prescription had been given only days following the death of a loved one: “[I] was still grieving at the time of the consultation.”

While death featured strongly in this category, the majority of losses described were those that related to the end of an intimate relationship: “My husband had left me for another woman after 10 years of marriage”. A smaller number of participants who described loss events spoke about a job loss as a source of distress. This included some descriptions of voluntarily leaving a job, however, the majority had been made redundant or been dismissed: “Replaced at a couple of days’ notice from position I had held for ten years”. A small number of participants in this category discussed a miscarriage or abortion as the source of their distress.

Work-related difficulties

Work-related stressors were described by 15.5% of participants. The majority of participants in this category described general workplace difficulties. Their responses included difficulty performing or attending, criticism or lack of support. For example, one participant wrote: “My manager was very unsupportive and demanding and unpredictable (sometimes he was really nice, sometimes he would yell and scream at everyone)”. Difficulty maintaining a work/life balance was described

by a number of participants and included descriptions of work demands competing with other demands in life. For example, “Work was interfering with life, eg I was on call for my son’s 21st birthday party”. Stress in the workplace seemed for most participants to reflect more chronic than acute circumstances: “Work stress for years. It had all just got too much and I couldn’t even get out of bed to go to work one day”. Many also spoke of the pressured nature of their work: “Work related pressures—sales targets”. A smaller number of participants described a range of workplace bullying and harassment experiences. There were also various descriptions of dissatisfaction with ones’ job. For example, “I was under a lot of pressure at work, which despite my senior status I found neither fulfilling or enjoyable, which spilled over into me being moody and difficult to live with”.

Health problems

Either one’s own or another person’s health problems were described as being a source of stress for 15% of participants. Nearly half the participants in this category described chronic or recurring illnesses and health conditions. For example, “I have had chronic pain from rheumatoid arthritis for nearly 20 years [...]. I take so many pills I didn’t want another one”. Many participants described the impact their physical health problems were having on their ability to engage in various aspects of life: “the viral infection, which had a huge effect on my ability to exercise, socialise or to perform well in my job”. However, more participants in this category described others’ health problems as significant sources of stress rather than their own. These problems were most often described in relation to one or both parents. Health issues of a child were also described by many participants, with half of these participants describing concerns with their child’s mental health. The majority of those describing their intimate partners’ health issues also described mental health concerns. The health problems of other family members and friends also featured in participants’ responses. In terms of others’ physical health, serious or chronic health conditions of others featured more strongly than acute conditions. The majority described cancer and stroke, while dementia and

disability were also reported: “My father had a massive stroke and is now severely debilitated. In many respects he did die”. The majority of participants’ descriptions of acute conditions related to others undergoing surgery, while injuries and heart attacks were also commonly described. A number of participants wrote about several family members having health problems at the same time as each other for example: “I went through my [...] mother having two heart attacks, my brother having a stroke and my partner being in a motorcycle accident that broke both their legs”. Some wrote of their experience of powerlessness in accessing help for a family member’s mental health problems: “Admitted to adolescent mental health unit [...]. Lack of treatment options or intervention—feeling really disempowered”.

Isolation

Limited social support or connection was described by nearly 8%. Participants attributed isolation or lack of support from friends and/or family to a variety of different factors, including physical health problems, work, location or family circumstances: “[I was] a first time mother, living in an isolated area with little support”. Some participants described their intimate partner as absent or unavailable for support, for example: “Home life was stressed as I was mainly raising my son alone while husband was away on business”.

Academic difficulties

Academic difficulties were described by 7%. The majority of these difficulties occurred within the context of tertiary education while others occurred within the context of secondary education or another unspecified context. Most participants emphasised the pressure of studying: “studying was very intense and placing time pressures and stress on myself was affecting my relationships”. Many also described some aspect of education not going well, including difficulties meeting expectations: “being unable to submit any work felt like I was letting myself and everyone else down”.

Abuse and violence

The event category “abuse and violence” was described by 6%. This included abuse and violence within the context of family, intimate partner relationships as well as

other relationships. Of participants who were victims themselves, by far the majority were female. Relatively equal proportions of participants described physical, sexual and emotional abuse. Within the family context, many participants described abuse from parents and grandparents. While some of these events appeared to have occurred some time ago, participants seemed to see them as having current impact. “I had commenced psychotherapy to begin to deal with issues due to having been sexually abused by my step-father through my childhood”. Most participants described abuse, violence or intimidation from people known to them: “I was sexually assaulted by a boyfriend who I had come to rely on heavily”. Fewer participants spoke of experiencing violence at the hands of a stranger.

Financial difficulties

Financial difficulties were described by 5%. Some participants spoke about an on-going inability to meet their financial responsibilities: “Was earning about \$35–\$45K and it was mostly used to pay day care, so there was not much left when this was paid.” The majority, however, described financial difficulties related to a specific event of financial adversity such as losing their job or closing a business: “My husband and I were as a last resort forced to leave our business and were left with no assets, finances and owing a mortgage after 30 years of saving and working”.

Other difficulties

This category included a miscellaneous range of events and circumstances that did not fit easily into any other category. Responses from nearly 6% of participants were coded here.

Discussion

This study suggests that many people who receive a prescription for medication are experiencing stressful events or circumstances at the time. About two-thirds of participants (65%) described dealing with at least one stressful circumstance or event and 39% were experiencing more than one. The five most frequent stressors were relationship difficulties, life transitions, losses, health issues and work-related stress. When considering these categories, it is not surprising that loss events featured

prominently in participants' responses. The association between depression and the occurrence of loss events has garnered substantial empirical support.^{12,16,17} The additional finding that 7% specifically reported the death of a loved one within two months prior to being prescribed antidepressants is germane to the ongoing debates about the overlap or distinction between depression and grief.¹⁸ Many other psychosocial difficulties were also described as chronic circumstances embedded in the context of people's everyday family and work life. While the family is often thought of as a sanctuary from the stresses of modern life, this analysis suggests that it may also be experienced as a significant source of unhappiness for many people. While research often points to the way that relationships with others may contribute to resilience and the ability to cope with stressful life events,¹⁹ these may equally operate as a pervasive and chronic form of adversity. There may be value in including family members in interventions aimed at addressing these kinds of problems.²⁰

It would also appear that common life transitions can also be experienced as a source of stress. The psychological impact of these 'normal' life changes may be underestimated by medical professionals. The availability of support to help those dealing with common transition points such as leaving school²¹ or having a new baby²² may go some way towards preventing or minimising the impact of depression.

New Zealand is particularly known for the long hours spent and the stress experienced in a work context.²³ In a context where difficult work conditions are seen as 'normal', the effects of this on psychological wellbeing may be frequently overlooked. Prevention of stress and intervention in the workplace may be a useful adjunct to other treatments for depression.²⁴

There is also a need for future research to explore the link between depression and one's own and others' health issues. Participants identified both of these as significant sources of stress. While there is relatively limited literature linking depressive symptoms to one's own chronic health issues,²⁵ there is even less literature exploring the impact of others' health issues

beyond that of caregiving roles.²⁶ This may be a particularly important issue given the cutbacks to health services and the likely burden this will have on family caregivers.²⁷

When considering the findings of other event categories, further points of similarity and difference were noted in relation to existing research. For example, financial difficulties did not feature as strongly as might have been expected given the substantial empirical attention this factor has received.^{28,29} This finding may well reflect the bias in the sample towards those with a higher income, which is discussed further under limitations of the study.

The "abuse and violence" event category was also relatively under-represented given the well-established association between these stressors and depression.¹⁷ Although participants had been asked to write about events that occurred around the time they were experiencing depressed mood, some referred to more longstanding issues or issues from their past—the majority of which were experiences of abuse and violence in childhood and adolescence. It seems that while these stressors occurred in their past, they continue to be seen by people as having an effect on the present. In New Zealand the availability of funding for therapy for historical sexual abuse is a valuable resource for professionals dealing with those who have had these experiences.

Social support and connection has long been recognised as a buffer in relation to stress¹⁹ but its absence registers less strongly as a source of stress than might have been expected. It may be, however, that isolation or lack of social support was implicit in a range of responses, which related to problematic interpersonal relationships with family members, intimate partners and work colleagues. This makes it likely that the relatively low frequency of stressors recorded under limited social connection underestimate this as a source of stress.

Given that a large proportion of participants have described chronic stressors and multiple stressors, the cumulative impact of life events should be considered. In this study, over half of the participants reporting described multiple stressful life events, either occurring over a long time, in quick succession or concurrently.

Limitations

Despite this being the largest sample size in a study specifically investigating antidepressant use in New Zealand, there was a risk of self-selection bias in the sample. There have been concerns about participation being limited by lack of access to the internet, however, it is recognised that this survey method has become increasingly acceptable over time and that its suitability depends on internet access, which varies considerably from one country to another.³⁰ In New Zealand, 80% of households are reported to have access to internet.³¹ Nonetheless, an Australian study conducted by Paige et al suggested the highest number of antidepressant users are in the age range of 65–74 years, a group poorly represented in our sample.³² This may reflect older peoples' reluctance to engage with new communication technologies and suggests that the experiences of this group require further investigation.

There are a number of other groups whose views are relatively poorly represented in this study. As noted above, the income of our sample was higher than the New Zealand average, which in 2012 was \$29,000.³³ This is a significant weakness given the association between low living standards and psychological distress.³⁴ Paige et al also found highest antidepressant use among those with lowest incomes, so this remains a group whose experiences also need to be investigated further.³² Māori and Pacific Island people are also under-represented in the sample although they are thought to be over-represented in mental health statistics more generally.³⁵ This may suggest the limits of an online survey for accessing the views of this group but it may be partly accounted for by the lower prescribing rates of antidepressants to Māori and Pacific Island people.³⁶ As the next largest group in New Zealand, Asians are also under-represented in this sample. One of the contributors to this may be the stigma associated with mental health problems thought to prevent this group making use of mental health services although their views about antidepressants in particular are not well-understood.³⁷

It is well-recognised that GPs might prescribe antidepressants for a wide variety of problems, which they believe have a depressive component ranging from adjustment problems and anxiety (including panic and obsessive compulsive disorder) to depression linked to drug and alcohol use,⁴ and the use of the single criteria of depressed mood to define the sample in this study does not reflect these subtle distinctions. Antidepressants may also be prescribed by GPs for other unrelated conditions such as pain or other physical problems.³⁸ However, in answer to a different survey question analysed in this article, only 0.5% of participants (n=9) reported that they had received antidepressants for a problem unrelated to psychological distress. Nonetheless, the study remains limited by relying on respondents' self-identification as having depressed mood around the time of antidepressant prescribing, and conclusions cannot be drawn specifically about the relationship between a formal diagnosis of depression and these stressful life events.

Limitations might also arise from our assumption that the 384 who did not respond to this question had not experienced any stressors. The fact that participants responded less frequently to all the open-ended questions in the survey suggests that some non-responses were more to do with convenience than having had no stressors to report. This, together with our exclusion of 'internal events' such as identity crises suggests that the frequencies reported in this study may well be underestimates.

Conclusion

It is important for GPs to be aware of the salience of stressful life events and circumstances that patients seeking antidepressants see as significant, and to recognise the common forms these take. This will enable them to engage more effectively with their patients' needs during consultations and to consider interventions that target these issues more directly as an alternative, or adjunct, to antidepressant treatment.

Competing interests:

Nil.

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Student-led intervention to inNOvate hand hygiene practice in Auckland Region's medical students (the No HHARMS study)

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ABSTRACT

BACKGROUND: Hand hygiene is important in reducing healthcare-associated infections. The World Health Organization has defined 'five moments' when hand hygiene compliance is required. During 2013, New Zealand national data showed poor compliance with these moments by medical students.

AIM: To improve medical students' compliance with the five moments.

METHODS: In this prospective student-led quality improvement initiative, student investigators developed, implemented and evaluated a multi-modal intervention comprising a three-month social media campaign, a competition and an entertaining educational video. Data on individual patient-medical student interactions were collected covertly by observers at baseline and at one week, six weeks and three months after initiation of the intervention.

RESULTS: During the campaign, compliance improved in moment 2, but not significantly in moments 1, 3, 4 or 5. Statistical analysis of amalgamated data was limited by non-independent data points—a consideration apparently not always addressed in previous studies.

CONCLUSIONS: The initiative produced improvements in compliance by medical students with one hand hygiene moment. Statistical analysis of amalgamated data for all five moments should allow for the non-independence of each occasion in which clinicians interact with a patient. More work is needed to ensure excellent hand hygiene practices of future doctors.

Hand hygiene is pivotal in reducing healthcare-associated infections (HAI).^{1,2} HAI are a major problem in hospitals worldwide and create a large financial and human burden.^{3,4} Hand hygiene is considered by many to be the most important element in preventing HAI.^{1,2,5} In 2005, as part of the first global challenge of the World Health Organization (WHO) World Alliance for Patient Safety, 'Clean Care is Safer Care', the WHO developed the WHO Guidelines on Hand Hygiene in Healthcare.⁶ Over 100 experts collaborated to establish best practice, evidence-based guidelines to assist clinicians. These guidelines emphasise the use of alcohol-based

hand rubs at each of five steps in patient care (five 'moments'). In Australia and New Zealand, national programmes have adopted and adapted the WHO '5 moments for hand hygiene' as follows: (1) Before touching a patient, (2) before a procedure, (3) after a procedure or body fluid exposure risk, (4) after touching a patient and (5) after touching a patient surroundings.⁷⁻⁹

Hand Hygiene New Zealand (HHNZ) was established in 2008 by the New Zealand Ministry of Health's Quality Improvement Committee (and subsequently continued by the New Zealand Health Quality & Safety Commission (the Commission)) to reduce HAI in New Zealand hospitals.

HHNZ adopted the WHO five moments as the basis for improving the hand hygiene of New Zealand clinicians, and established a nationally standardised approach to auditing hand hygiene performance. A cadre of certified observers were trained to audit hospital staff nationwide. Medical students had the lowest compliance rates of any group audited in New Zealand hospitals in 2013, successfully completing only 52.1% of 73 observed potential moments between July and October 2013.^{10,11} If practices as a student persist throughout a practitioner's career, the benefits of improving this behaviour early could be far reaching, with the potential to reduce patient harm for many years to come. These data were discussed at a meeting of the University of Auckland's Medical Programme's Board of Studies (which includes two student representatives) on the 4th July 2013. Representatives of the Commission took part. The evidence of poor performance by medical students was considered disappointing because formal instruction in hand hygiene is an important part of the curriculum and is started early in the course, both in lectures and through practical teaching during clinical skills tutorials. At this meeting the student representatives on the Board proposed a student-led initiative to address this problem.

Various approaches have been used internationally, with variable success, to improve hand hygiene compliance, including education on appropriate hand hygiene, audits with immediate feedback, optimisation of access to sanitisers, and gaming console-based interventions.^{12–16} Importantly, effective studies have typically used a multi-modal approach. A multi-modal approach is also recommended in the WHO 'Guide to the implementation of the WHO Multimodal Hand Hygiene Improvement Strategy'. The strategy has five components addressing: (1) System Change—improving access to hand hygiene facilities, (2) Training and Education, (3) Evaluation and Feedback, (4) Reminders in the workplace and (5) Institutional safety climate.¹²

In other contexts, student-led interventions have been effective in obesity reduction, safe alcohol use and smoking cessation.^{17–19} There is contemporary interest in the importance of placing the student

at the centre of the learning process, for example through problem-based learning whereby students learn a subject through their own experience, working with peers to formulate answers to problems, or help to lead problem-based discussion sessions.^{20,21} We could find no previous research on interventions led by medical students to improve hand hygiene, but a student-led approach is consistent with the principle of 'front line ownership' that has been a cornerstone of the HHNZ programme.²²

Therefore, we aimed to improve the overall compliance of medical students in our institutions with the WHO five moments of hand hygiene by introducing a student-led, novel multi-modal intervention.

Methods

Between March 2014 and October 2014 we conducted a prospective study to test the hypothesis that the overall compliance with the WHO 5 moments for hand hygiene could be improved in a cohort of University of Auckland medical students by the implementation of a student-led multimodal intervention. We obtained approval from the University of Auckland Human Participants Ethics Committee before starting the study (reference 011103).

The population eligible to participate in this study included medical students in Years 4–6 of the University of Auckland's medical programme allocated for their clinical attachments to one of three teaching hospitals within the Auckland region: Auckland City Hospital, Middlemore Hospital and North Shore Hospital (with Waitakere Hospital). About a third of the students in these years of the programme are allocated to other metropolitan regions. We excluded medical students involved in the development of the intervention.

Study oversight and development

A 'No HHARMS' oversight and intervention development committee was established. This consisted of four medical students from the Auckland University Medical Students Association, and one nursing student from the Nurses of Auckland University Student Association (NASA) who assisted in the recruitment of nurse auditors. Support was provided by two senior members of the University's

academic staff, the Commission's director of Health Quality Evaluation and Clinical Lead for Infection Prevention and Control programmes and HHNZ's Clinical Lead.

Our plan for data collection and analysis was based on the approach used by HHNZ (and other national programmes). However, in consultation with HHNZ and the Commission, it was decided that, to reduce the extent of the Hawthorne effect, our audits, unlike those of HHNZ, should be covert.²³ This required that medical students were not informed that their hand hygiene compliance was being audited, and ethics approval was sought on this basis. A protocol was developed for the four student investigators to follow if they came into contact with a nurse auditor to ensure their results were not included in the analysis.

Seventeen second and third year student nurses were recruited as paid auditors in November 2013 with assistance from NASA, and participated in HHNZ's one day 'Hand Hygiene 5 Moment Gold Auditor Training Workshop' in January 2014. To qualify as Hand Hygiene Gold Auditors, students must gain 90% in a written test at the end of the workshop. All 17 nursing students met this standard. These students carried out all the audits reported in this study (ie, the same auditors were involved before and after the intervention). All audit results were recorded on a paper version of the official HHNZ 'Hand Hygiene observation—data collection form'. We note that, independently of our study, the routine thrice-yearly DHB hand hygiene audits were also occurring.

Baseline phase

The 17 student nurses carried out 135 hours of pre-intervention observation in 45 separate three-hour periods over a fortnight, distributed between a specified selection of wards within the study hospitals, each ward subserving a particular medical speciality.

The intervention

The intervention had four elements.

- A video designed to be educational, entertaining and thought provoking, involving well-known members of the Auckland medical student body. The video was based around a fictional medical student, Gavin, who has a moral crisis over whether he should

prioritise bugs or humans. It includes an outline of the five moments, and highlights the use of alcohol gel as the most appropriate substance for routine hand hygiene. It can be viewed on: <http://www.youtube.com/watch?v=cK4BGPN6zao&feature=youtu.be>

- A social media campaign on *Facebook* named '#thehandhygieneproject'; this enabled students to have a centralised source of educational resources and current results.
- Medical student champions. One medical student, nominated by peers, was located in each district health board and underwent hand hygiene education and leadership training to continue to motivate and mobilise medical students, and communicate information about #thehandhygieneproject.
- Competition. A competition was run between each of the three DHBs, with the cohort with the best improvement receiving a prize (a lunch).

The intervention was launched on July 2nd 2014 to all medical students in Years 4 to 6 (ie not only those in the study cohort). The initiative was introduced in the first 15 minutes of a lecture on the University campus, which all students are expected to attend (and most do), the video was played and students were introduced to the student champions at each district health board; The *Facebook* page #thehandhygieneproject went online on the 2nd July 2014 and all students received an email from the faculty, using their university email addresses, introducing the campaign with links to the video on *Youtube* and the campaign *Facebook* page. During the evaluation phase, the student leaders of the study met regularly with the student champions and students were made aware of up to date results via the *Facebook* page, the student champions and in an email to all medical students.

Evaluation phase

The 17 student nurses carried out a further 135 hours of observation, divided between three one-week periods, each involving 15 individual three-hour audits at approximately one week, six weeks and three months after the launch of the inter-

vention. We aimed to achieve a similar distribution of these observations between the wards (and hence medical specialities) to that in the baseline audit.

Sample size, data collection and analysis

Statistical analysis was undertaken using R (R: A Language and Environment for Statistical Computing, Vienna, Austria). To correct for non-independence of data points (see Discussion, below)²⁴ we adopted the approach of Allegranzi et al²⁵ and assumed a variance inflation factor of 2. We presented results as percentages and differences in percentages with 95% confidence limits. We used χ^2 tests to compare proportions of compliant moments before the intervention with the proportion after the intervention, designating $P < 0.05$ as significant, and presenting all P values without correction.

The sample size was pragmatic: our resources permitted a maximum of 45 periods of three hours each of observation time before and after the intervention, and we did not know before starting how many observations would be obtained within these two periods.

Results

The cohort included 492 medical students, 198 in year four, 158 in year five and 136 in year six of the six-year programme. We observed 780 potential moments for hand hygiene (our baseline data) between 20th March and 6th May 2014. The intervention was launched on 2nd July 2014, and our campaign ran until 14th October 2014. Over this period the Facebook page gained 244 likes and the educational video had over 600 viewings. We collected evaluation data

at one week (11th July to 15th July 2014), six weeks (August 15th to August 19th 2014) and three months (7th October to 14th October 2014). During this period there was one instance in which a student became aware of being audited; the study investigators were notified of this, and the auditor was asked to flag the student's results for subsequent exclusion. This left 726 moments for analysis. The distribution between specialities at baseline and evaluation phases were similar (see Table 1).

Overall, there was a modest improvement in compliance with appropriate hand hygiene practices. A statistically significant increase was seen in hand hygiene compliance for moment 2 ($p=0.01$). Increases in compliance for moments 3 ($p=0.07$) and 4 ($p=0.11$) were not statistically significant. No statistically or clinically relevant change in compliance for moments 1 or 5 (see Table 2).

Discussion

The medical students' compliance increased substantially (by 51%) and significantly ($P=0.01$) for moment 2 (before a procedure), but not moments 1, 3, 4 and 5, although there was a 31% non-significant ($P=0.07$) improvement in moment 3 (after a procedure or bodily fluid exposure). The data were collected over the three months of our campaign, and do not address the question of whether improvement was sustained beyond that period.

In the introduction of this paper we outlined the first global challenge of the World Health Organization (WHO) World Alliance for Patient Safety, 'Clean Care is Safer Care'. We are in no doubt that this initiative has had a huge positive impact

Table 1: Distribution of moments surveyed by clinical specialty at baseline and at evaluation of the intervention. Data from paediatrics and the emergency department ('Paeds/ED') were combined because numbers were small.

Specialty	Baseline survey	Evaluation survey
General surgery	111 (14.2%)	151 (20.8%)
Specialty medicine	107 (13.7%)	73 (10.1%)
General medicine	352 (45.1%)	300 (41.3%)
Paeds/ED	93 (11.9%)	106 (14.6)
Older people's health	117 (15.0%)	96 (13.2%)
TOTAL	780 (100%)	726 (100%)

Table 2: Compliance with hand hygiene moments during baseline and evaluation periods, overall and by moment: P values were calculated using χ^2 tests.

Moment	Baseline N correct/total (rate %)	Evaluation N correct/total (rate %)	Mean difference in rates % (95%CI), P
Total	374/780 (48)	397/726 (55)	n/a
1: before touching a patient	108/200 (54)	109/197 (55)	1.3 (-12.5, 15.2), $P=0.85$
2: before a procedure	3/15 (20)	17/24 (71)	50.8 (12.4, 89.3), $P=0.01$
3: after a procedure or bodily fluid exposure risk	11/27 (41)	23/32 (72)	31.1 (-3.1, 65.4), $P=0.07$
4: after touching a patient	124/191 (65)	138/183 (75)	10.5 (-2.5, 23.5), $P=0.11$
5: after touching a patient surroundings	128/347 (37)	110/290 (38)	1.0 (-9.6, 11.7), $P=0.85$

on patient outcomes around the world, including in New Zealand through the efforts of HHNZ. Thus we substantially adopted the approach used in the HHNZ programme and several other national programmes. In line with this approach we intended to report 95% confidence limits for the difference between the *overall* total baseline (48%) and evaluation (55%) scores (1.6% to 11.8%, with a point estimate of 6.7%) and a significance level based on a χ^2 test ($P=0.009$ in the absence of a correction for variance inflation). However, on reflection, we now have serious reservations about such statistical analyses for amalgamated overall hand hygiene scores, both for our own work and in respect of many reports from national hand hygiene programmes. This point does not undermine the impressive success of HHNZ in improving rates of hand hygiene, but goes instead to the question of these successes should be reported statistically. On each 'occasion' that a particular student (or, more generally, practitioner) is observed interacting with a particular patient, there are between one and five potential moments for hand hygiene, depending on the nature of the interaction. However, these data points *are not independent*—they involve repeated observations of the same practitioner and patient in the same environment. It follows that each of these occasions should be treated, in statistical analysis, as a cluster.²⁴ We have no argument with the well-established principle of *collecting* information on each of the five moments of hand hygiene.

However, we do question the analytical approach, which seems to be widely used in national hand hygiene programmes, of treating each of these moments as a source of an individual independent data point. Doing this substantially (and incorrectly) inflates the power of statistical tests and artificially narrows estimated confidence limits in relation to amalgamated rates of compliance with all of the five moments (but not for each moment, considered separately). For this reason, some investigators (see for example Allegranzi et al, 2010²⁵ and 2013²⁶) have adjusted for the effects of clustering (there are also several secondary clustering effects, including surgical 'firm' and DHB for example). Individual practitioners (ie, students in our study) are likely to be observed in repeated interactions, which further compounds the lack of data independence. This latter issue could also affect comparisons between baseline and evaluation phases with bias introduced if 'good' or 'bad' individuals are overrepresented in either phase. Ideally, therefore, individual practitioners should be tracked (using coded identifications to preserve anonymity if required) and their identity included as a factor in statistical models comparing phases, although this would be difficult to do in the context of national hand hygiene programmes. Other factors, such as the identities of patients and auditors, or the presence of particular senior doctors for example,²⁷ might also introduce bias and, ideally, should therefore also be tracked. However, judgement is needed to strike

a balance between the demands of data collection and the extent to which different factors are likely to threaten the integrity of planned analyses in any given context, but the identity of each observed practitioner does seem to be particularly relevant.

Unfortunately, we did not collect the identities of observed students or occasions, because in adopting the approach used in the HHNZ programme, we failed to anticipate these problems. Thus, we have not been able to undertake a robust statistical analysis of the overall data and report the intended primary outcome variable—the amalgamated rate of compliance for the five moments together. Instead, we have reported results for each individual moment, with a correction for variance inflation to allow for the secondary clustering effects discussed above.

The question of correction for multiple testing (because data from each of the five moments undergoes statistical testing) also arises, but because there is some inter-dependence between the moments, such a correction need not involve standard stringent adjustment such as, for example, a Bonferroni correction.^{28,29} Thus we are reasonably confident in the finding for moment 2, although we note that the numbers of observations for moment 2 were small (as they were for moment 3).

It is perhaps worth noting that the 48% overall compliance at baseline was similar to the 52% reported by HHNZ nationally for medical students for the period 1 July to 31 October 2013.¹⁰ Their data were based on only 78 observed potential moments vs 780 in the study. More recent results from this national programme suggest that the rate for medical students has improved to 79%³⁰ (this figure was generated from 216 observations and is in line with an overall national compliance rate of 81%). Given the above discussion, it is probably best to avoid further speculation about the possible interpretation of these rates, other than to say that we find the low rates of compliance in our own data concerning. Reports from other countries suggest that low rates of compliance with hand hygiene by medical students are not unusual: medical student's knowledge of and compliance with hand hygiene is typically poor.^{31–35} This raises

questions about the way hand hygiene is taught to medical students in general, not just at Auckland, and indicates the need for new approaches in this area.^{36,37}

It may be also be worth reflecting on the fact that the five moments apply at very different frequencies and may not be clinically equivalent. A failure in hand hygiene compliance for moment 5 (after contact with the patients' environment) might often be less clinically important than a failure after contact with bodily fluid (moment 3) for example, yet, because moment 5 may be the most frequently observed, it may have an undue influence on an amalgamated overall result. Nevertheless, compliance with moments 2 and 3 (which are clearly very important) was very poor at baseline (20% and 41% respectively). These were the two moments for which compliance improved the most (to 71% and 72% respectively), but even then students failed to comply with these moments in almost 30% of cases. This would seem to raise questions about the clinical supervision of our students, but it would be helpful to know a little more about the procedures or exposures in which compliance was poor. A narrative section on the data form would add information of considerable assistance in the interpretation of the numerical data in situations of this sort.^{38,39} Such information might well make calls for further improvement more compelling than quantitative data alone.

The study has other potential limitations. Our intervention was as substantial as we could make it, given the limitations on financial resources and on the time of the student leaders of this study, but a more substantial or prolonged intervention may have been more effective. Also, it is hard to know exactly how successful our campaign was in reaching all the students in the cohort, but the number of Facebook likes (244) and video viewings (607) suggests a reasonable level of participation. On the other hand we do not know whether all the likes came from medical students (some may have been from people outside the programme). We did not collect data to formally compare students in our pre-intervention sample with those in our post-intervention sample, but there is no obvious reason to suspect any systematic

difference between these two groups. We evaluated the impact of the intervention as a whole so we have no way of knowing which elements were important and which were not. Another potential limitation lies in possible inter-auditor variability. We attempted to lessen the effect of this by using the same 17 nursing students in both phases of the study and ensuring that all underwent HHNZ Gold Auditor training, followed by successful completion of the relevant standardised test. In fact, we believe this was one of the study's strengths. Other strengths were that we achieved reasonably similar distributions of cases across medical specialties in both phases (Table 1), and that we took steps to reduce the Hawthorne effect²³ by covert auditing. Also, the feedback given to students was in line with the WHO Guidelines on hand hygiene, which emphasise the importance not only of random audits, but also of real-time feedback to healthcare workers from these audits.⁹

The fact that the study was student-led reflects recent emphasis in the theory of medical education, which emphasises the importance of placing the student at the centre of the learning process.²¹ More generally, it is consistent with the principle of 'front line ownership' in quality improvement, which favours engaging clinicians in developing and implementing local solutions to problems over imposing ready-made directives in a top-down fashion.²²

The question arises therefore, 'What next?' New students have already replaced the cohort exposed to the intervention. Some changes have been made to strengthen the relevant parts of the curriculum at the University of Auckland, but more work is clearly needed if more substantial improvements in hand hygiene practices by students are to be achieved on a sustained basis.

In addition, we suggest that wider debate is needed about the most appropriate way to statistically analyse hand hygiene data. We do not doubt that substantial improvements have been obtained in hand hygiene practice through various initiatives based on the five moments in many parts of the world. There are many barriers to success

in efforts to improve hand hygiene, and for some of the people whose focus is, appropriately, on the central goal of achieving behavioural change in this important aspect of practice, technical statistical issues may appear to be something of a side issue. However, the importance of robust design, evaluation and reporting of practice research into patient safety has recently been emphasised by Shekelle et al, and we concur.⁴⁰ A careful review of the way in which data of the sort presented here are analysed in national programmes would seem to be warranted. Interestingly, an all-or-none approach to evaluating quality has been advocated in the context of quality improvement in general (ie, not specifically for hand hygiene) as a way of 'raising the bar' of performance⁴¹ and this would, as it happens, allow some of the statistical issues for hand hygiene to be addressed.

In conclusion, our student-led initiative produced a clear improvement in compliance by medical students in one of the WHO five moments of hand hygiene, but left considerable room for further improvement in all the moments. We have also discovered that some considerations related to the independence of data points in the statistical analysis of results of audits of the five moments may hitherto have been overlooked in at least some national hand hygiene programmes. For the future, we suggest that each discrete occasion on which clinicians interact with a patient should be recorded so that this can be used to help correct for non-independence of data points. Alternatively, reporting should be restricted to each moment separately, without amalgamation of data from all the moments (as in the present study). Consideration should also be given to including (if practical) the (anonymised) identities of observed clinicians in the statistical analysis of quantitative data on hand hygiene, and to adding narrative information to assist in the interpretation of these data. The modest improvement achieved by our initiative leaves more work to be done to ensure that sustained excellence in hand hygiene becomes embedded in the practice of our future medical practitioners.

Competing interests:

Dr Freeman was formerly Clinical Lead of the Hand Hygiene New Zealand Programme. Dr Merry reports affiliation with SaferSleep and personal fees from the Health Quality & Safety Commission New Zealand. Dr Merry is also Chair of the Board of the Health Quality & Safety Commission New Zealand.

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Should New Zealand introduce nationwide pulse oximetry screening for the detection of critical congenital heart disease in newborn infants?

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Pulse oximetry has been utilised internationally as a screening tool for the detection of congenital heart defects in newborn infants for more than a decade.¹⁻⁴ In recent years this practice has been introduced in various jurisdictions as it became evident that the number of late-diagnosed infants can be reduced significantly when pulse oximetry is used in conjunction with other screening strategies, namely antenatal ultrasound and newborn physical examination.⁵⁻⁸ In New Zealand, there currently is no national approach to newborn pulse oximetry screening for critical congenital heart disease (CHD). However, some district health boards have begun screening led at hospital level. Given the existing regional and demographic variation in maternity care,^{9,10} hospital-led approaches to screening are unlikely to improve health outcomes in an equitable way.

Congenital heart defects are the most common group of congenital malformations, with an incidence of between four and 10 per 1,000 live-born infants. Surgery and cardiac catheter interventions have resulted in marked improvements in survival, particularly for those infants with life-threatening conditions.¹¹⁻¹³ Successful intervention is dependent on timely diagnosis; if such defects are not detected early, severe hypoxaemia, shock, acidosis and death are potential sequelae. Detecting infants with severe cardiac malformations before or

immediately after birth is therefore of the utmost importance.

A recent population-based study found that only 46% of New Zealand-born infants with critical CHD are diagnosed in the antenatal period. Twenty percent of critical cardiac defects are currently diagnosed after discharge from hospital. It is estimated that four babies die each year in New Zealand as a result of late-diagnosed CHD.¹⁴ The impact on permanent disability, especially neurodevelopmental deficit, is likely to be greater, as late diagnosis of CHD is associated with a greater risk of hypoxaemia and acidosis, both of which are associated with neurological damage.^{15,16}

Researchers are in agreement that the question no longer is whether pulse oximetry screening should be performed on newborn infants, but rather how best to deliver the test.¹⁷⁻¹⁹ Pulse oximetry screening for critical CHD is highly specific, moderately sensitive and meets criteria for universal screening.²⁰ Various factors can impact on the sensitivity and specificity of this screening tool. Recent studies have demonstrated that test accuracy varies according to the healthcare setting in which screening is undertaken. Screening performed at tertiary centres located in first world settings is associated with sensitivity greater than 80%.^{21,22} Conversely, regional hospitals and those in developing countries often report lower test sensitivity.^{7,23-25}

The cost-effectiveness of pulse oximetry screening has been demonstrated in the US^{26,27} and the UK,²⁸ but a recent study evaluating screening in Chinese regions with diverse socioeconomic status demonstrated cost-effectiveness only in affluent regions.²⁹ A cost-effective analysis is currently being undertaken in the Netherlands where 18% of births occur at home. A Dutch national screening programme would warrant the provision of pulse oximeters to each of the country's 1,800 community midwives, adding to the cost in this setting.³⁰

The importance of considering region-specific factors is evident when international studies are reviewed. The American Academy of Pediatrics recommends that screening should be performed after 24 hours of age, thereby minimising the number of false-positive results. In a large Chinese study involving 122,738 newborn infants, the false-positive rate was 0.55% when screening was performed 6–24 h after birth compared to 0.29% when screening was done 25–48 h after birth.⁶ However, in countries where newborn babies and their mothers are discharged home prior to 24 hours, a late screening strategy will not be feasible. Furthermore, it is crucial to detect critical CHD prior to cardiovascular compromise. Early screening strategies can enable early diagnosis and treatment that can ultimately result in better outcomes for these infants. The potential harm caused by false-positive results has to be weighed up against the benefits associated with early diagnosis and treatment.

The Dutch recently investigated the feasibility and accuracy of a very early screening strategy, which was necessitated by the large number of community births and early discharges from hospital following uncomplicated births in this country. In order to minimise the impact pulse oximetry screening has on the workload of community midwives, the screening protocol was designed to fit in with the times midwives are routinely present following a birth. Measurements were obtained at approximately one hour after birth and again on day two or three. Higher screening rates were achieved in the community (97%) than in hospitals (70%). This study demonstrated that it is feasible to incorporate pulse oximetry screening into the daily routine

of midwives attending home births and that very early screening does not result in significantly high false-positive rates (0.6%).³⁰

It is important to appreciate that New Zealand will face unique challenges when implementing a new screening practice for newborn infants. The country's dispersed rural populations will pose a variety of challenges. We have a largely midwifery-led model of maternity care with the majority of primary maternity care provided by self-employed community midwives also known as the Lead Maternity Carer (LMC). The majority of women give birth at either tertiary or secondary facilities (with their midwife LMC in attendance) and may transfer either home or to a primary maternity facility for postnatal care. Many of these transfers occur between two and six hours following the birth provided that the mother and baby are well. The proportion of home births ranges from 1.3% to 7.6% (mean 3.4%) across New Zealand's 20 district health boards, and 9% of women are giving birth in one of many primary facilities predominantly located in rural settings.⁹ According to a ministerial report on maternal health, over a quarter of all women giving birth live in the most socioeconomically deprived areas of New Zealand.⁹ Furthermore, New Zealand has only one cardiac intervention centre located at Starship Children's Hospital in Auckland. Lack of availability and access to specialist centres can be perceived as barriers to the implementation of a nationwide pulse oximetry screening programme. Lack of availability of echocardiography services and concerns about the potential increase in workload for midwives and paediatric cardiology services have been named as the main barriers to implementation at tertiary Australasian hospitals.²¹

Midwives' involvement with the care of women and their babies at birth and in the first few days after birth would place them in the ideal position to carry out the screening test. A pragmatic approach would be to incorporate screening into the midwives' routine newborn health assessments. The place of birth and time at which screening is undertaken, which will be guided by the screening protocol, will likely dictate whether hospital-based midwives or self-employed community midwives are in

the best position to perform the screening test. Several groups have investigated the time taken to perform the screening process and consistently reported that approximately five minutes are required.^{8,21,22,31} These studies were done in various countries with differing models of care, and all reported that no extra staff members were needed to perform pulse oximetry screening.

Failure to reach predetermined oxygen saturation targets should prompt clinicians to do a careful clinical examination and should not necessarily result in an echocardiogram or referral to specialist cardiac services. Approximately two-thirds of positive screening results will yield an alternative diagnosis.^{6,8,21,32–36} Persistent hypoxaemia can be the result of other important pathologies such as sepsis, pneumonia, pulmonary hypertension or metabolic disorders. If undetected, these pathologies may also result in death that could otherwise have been prevented. An Australian review of Sudden Unexpected Early Neonatal Death and Acute Life Threatening Events found that persistent pulmonary hypertension and infection were responsible for many of these events along with cardiac disease and accidental asphyxia. The majority of infants collapsed on the first day.³⁷ Transient hypoxaemia can be seen in newborn infants with transitional circulation. False-positive results should be minimised and therefore screening protocols should recommend repeating the test in infants with borderline low oxygen saturation levels. It is expected that 4–5% of newborns screened on day one of life will require repeat testing in order to exclude healthy infants with transitional circulation.³²

The majority of hypoxaemic infants can be managed at their local hospital. Echocardiography will only be warranted in infants with signs and symptoms suggestive of cardiac disease or in infants with persistent abnormal oxygen saturation levels in the absence of a non-cardiac diagnosis. An Australian study reported only five unnecessary echocardiograms over a 42-month period, during which 18,801 infants were screened.²¹ Similarly, a Swedish study that screened 39,821 infants

reported that three unnecessary echocardiograms, demonstrating no cardiac anomaly, were performed.⁸

Interventions designed to improve population health can ultimately lead to greater inequality in society. Adaptation and change often occur more rapidly among groups that already have better than average health status, and although the overall health of the population improves, the gap between the affluent and deprived widens.³⁸ Pulse oximetry screening may, however, be most valuable in populations where the antenatal detection rate of CHD is low. Implementing a national screening programme will likely have the greatest benefit to the most deprived communities of New Zealand.

To date, there have been no reports in the literature of New Zealand-specific data relating to pulse oximetry that can contribute to building a business case for the implementation of a national screening programme. Undertaking a research study exploring the feasibility of pulse oximetry screening in the New Zealand maternity setting can provide valuable information in support of national implementation. Making an assessment of local patient demographics and the impact of universal pulse oximetry screening on maternity, paediatric and cardiac services in New Zealand will be an essential step towards achieving this goal.

A uniform screening programme that is governed by the country's National Screening Unit will be superior to hospital-led initiatives. First, a screening programme should be funded sufficiently to ensure the availability of resources to all regions and services involved with the screening and subsequent care of newborn infants so screening can be offered to every baby regardless of place of birth. Secondly, central governance and monitoring of the programme will enable quality improvement initiatives, further promoting equity for all New Zealand-born infants. Thirdly, the morbidity and mortality related to congenital heart disease can be reduced when pulse oximetry screening is offered to all New Zealand-born infants.

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An unusual cause of acute appendicitis in New Zealand

Yee Chen Lau, Claire Hall, Robbie Robertson

Clinical presentation

Sixty-one year-old female from the Philippines, presented with right iliac fossa pain consistent with appendicitis. USS suggested appendicitis but raised the possibility of hepatic lesions. CT was requested, confirming the diagnosis of acute appendicitis without any significant liver disease (Figure 1).

The patient proceeded to an uncomplicated laparoscopic appendicectomy and was discharged the following day.

Histology revealed acute inflammation with parasitic organisms in the appendix wall (Figure 2) consistent with schistosomiasis.

Discussion

Schistosomiasis is a disease caused by trematode worms. WHO estimated that 61.6 million people were treated for schistosomiasis in 2014¹ while closer to 260 million

received prophylactic treatment. That said, this is a disease of tropical and sub-tropical countries with poor sanitation and not common in western society.

There are five main types of schistosomiasis. *Schistosoma* (S) *Mekongi*, *S. Guineensis*, *S. Mansoni*, *S. Japonicum* and *S. Haematobium*. The latter tends to lead to urogenital disease while *S. Mansoni* and *S. Japonicum* are frequently associated with intestinal disease.² The eggs cause an intense granulomatous inflammatory response leading to complications such as periportal fibrosis, gastrointestinal ulceration, obstruction and bleeding.¹ In countries where schistosomiasis is endemic, acute appendicitis secondary to the parasitic infection is not uncommon. Reports suggest it will be found in approximately 2% of appendicectomy specimens in Nigeria.²⁻⁴ In the US, a large retrospective review of 1,690 appendicectomies found schistosomes in only in 0.2% of the specimens.⁵

Figure 1: CT coronal reconstruction showing appendicitis (green arrow).

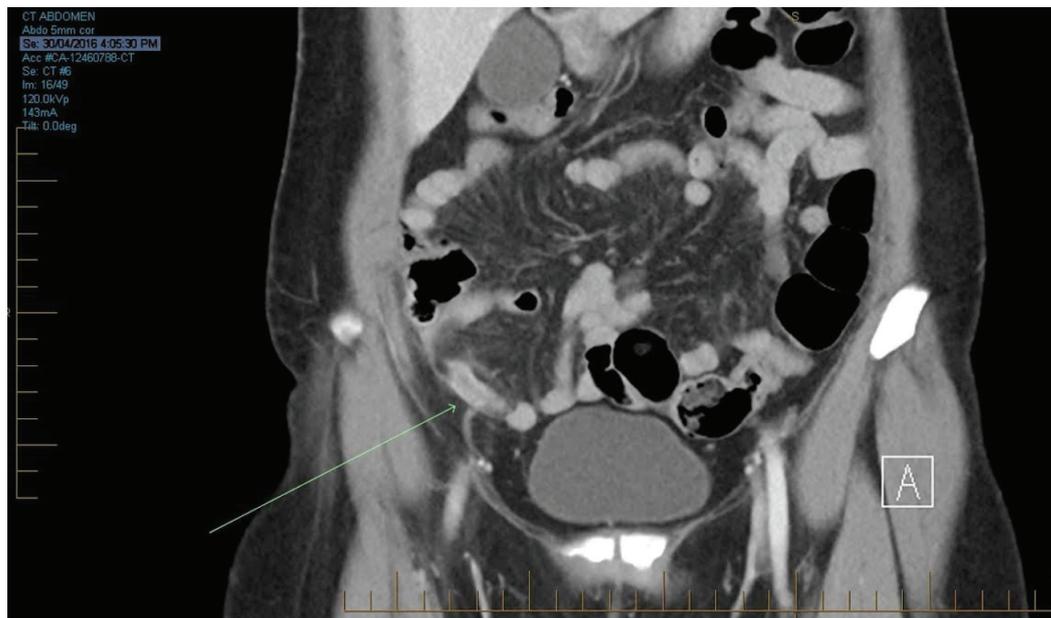
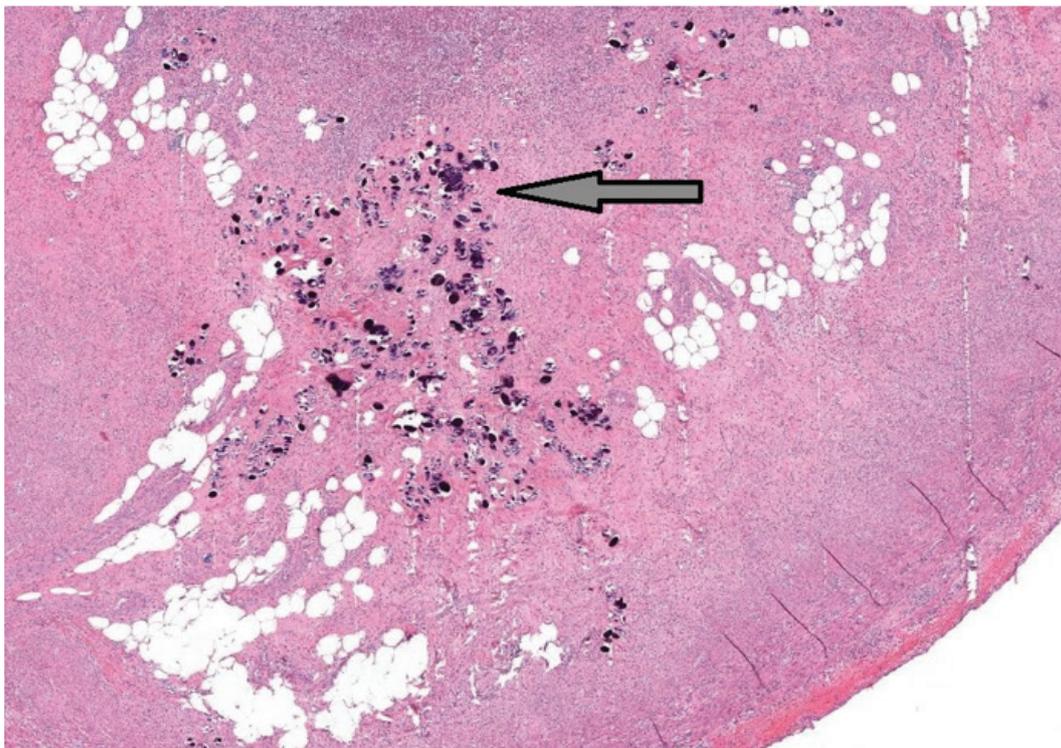
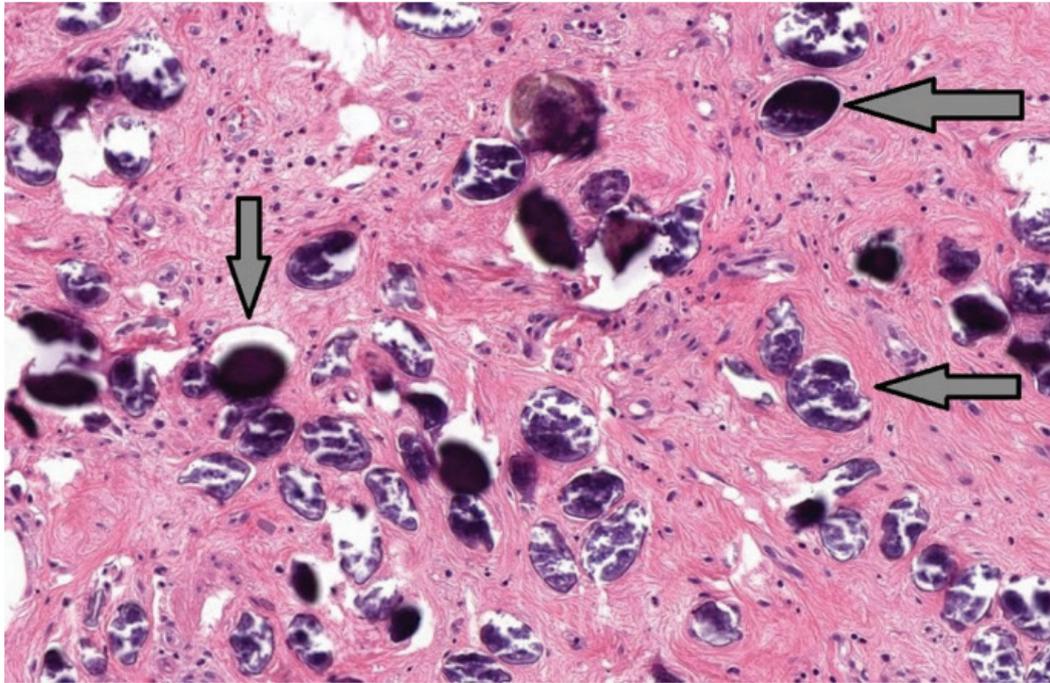


Figure 2: H&E staining showing schistosomiasis (arrows).



While schistosomiasis remains rare in western societies, there is increasing movement within populations due to both immigration and travel. We must therefore

remain vigilant about travel history and the potential for infectious diseases in our patients. Treatment with antihelmethics such as Praziquantel is highly effective.¹

Competing interests:

Nil.

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Renal artery embolisation for uncontrolled hypertension in ESRD

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Case report

We report the case of a 53-year-old New Zealand European woman with end stage renal disease (ESRD) from diabetic nephropathy, on thrice a week maintenance hemodialysis since three years with symptomatic, resistant hypertension requiring multiple admissions. She had a long-standing history of diabetes with autonomic dysfunction, including gastroparesis. Her other comorbidities included obstructive sleep apnoea (on CPAP), gastro-oesophageal reflux disease with propensity to frequent nausea and vomiting, bronchial asthma, multiple abdominal surgeries including a panproctocolectomy with end ileostomy in 2007, and cerebrovascular disease.

In the past three years, she had over 10 admissions for symptomatic, acute severe hypertension and posterior reversible encephalopathy syndrome (PRES), requiring intravenous anti-hypertensives. Hypertension remained poorly controlled despite aggressive ultrafiltration and optimising her goal weight. She did not have significant inter-dialytic weight gain and was fairly compliant to fluid restriction. Investigations for potential secondary causes of hypertension, including renal artery stenosis, pheochromocytoma, Cushing's disease and hyperaldosteronism were negative. Her management was complicated by intolerance to multiple oral antihypertensives, and recurrent gastroparesis episodes. In December 2011, she had undergone renal

Figure 1: Aortic flush DSA prior to embolisation.



Figure 2: Selective right renal DSA after alcohol.



sympathetic denervation with minimal therapeutic benefit.

Surgical nephrectomy was considered too high risk given multiple comorbidities. So bilateral renal artery embolisation (RAE) using alcohol and coils was performed for uncontrolled hypertension despite adequate anti-hypertensive therapy. She underwent the procedure in May 2015 without major complications. Alcohol was used as liquid embolic targeting collateral supply prior to main procedure to maximise success. She developed mild post embolisation syndrome manifested as flank pain and nausea,

which resolved within 48 hours. There was sustained reduction in post-procedure BP recordings (150 +/- 10mmHg systolic, and 85 +/- 8mmHg diastolic) with mean change of -14/8 mmHg (average of 10 readings). Over the subsequent nine months, she has had no admissions related to hypertension, with subjective improvement in quality of life.

Discussion

RAE has been utilised predominantly for renal masses,¹ and treatment of hypertension in some cases. In a large retrospective study performed at The New

Figure 3: Selective left renal DSA after alcohol and coils.



York Presbyterian Hospital, over half of 121 patients underwent RAE for renal masses (54.5%).² Only three patients (2.5%) had RAE for treatment of malignant hypertension. The authors concluded this to be a safe procedure with overall complication rate of 5%, consisting of incomplete embolisation, coil migration and groin haematoma in six patients. Post embolisation syndrome was reported in 75% of patients, most being mild and self-limited.

In one of the earliest case-series, Thompson et al reported improvement in blood pressure control in nine out of 13 patients who underwent RAE.³ Similarly, successful response was seen in five out of seven patients with ESRD or transplant, who underwent RAE for the treatment of hypertension.⁴ The average mean arterial pressure improved from 125mmHg to 106mmHg, and the average number of antihypertensive drugs decreased from four to two.

A randomised study in 16 haemodialysis patients suggested unilateral RAE, with the advantage of preserving residual renal function and milder post embolisation syndrome, was as effective as bilateral RAE.⁵

This limited data on RAE stands favourably in comparison to another therapeutic option, bilateral nephrectomy, with high morbidity (up to 85%) and mortality (up to 11%).⁶⁻⁸ Nephrectomy was not considered an option in our case due to significant anaesthetic risks. Also, RAE carries an advantage of avoiding general anaesthesia. Though RAE could result in elimination of residual renal function that carries a survival benefit in patients with ESRD,⁹ this was not a concern in our case as she was anuric.

Conclusion

RAE could be considered as one of the interventions for refractory hypertension despite optimal antihypertensive therapy in patients with ESRD.

Competing interests:

Nil.

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Endovascular versus open repair of abdominal aortic aneurysm

Short-term survival benefits of endovascular aneurysm repair (EVAR) versus open repair of intact abdominal aortic aneurysms have been shown in randomised trials, but this early survival benefit is lost after a few years. This study was designed to evaluate whether EVAR had a long-term survival benefit compared with open repair.

One thousand two hundred and fifty-two patients were randomised to either EVAR or open repair. Follow-up was for 15 years. Late aneurysm and total mortality were both greater in those assigned to EVAR. In the first six months the EVAR group had a lower mortality rate, but this benefit was lost after six months.

EVAR has an early survival benefit, but an inferior late survival compared with open repair, which needs to be addressed by lifelong surveillance of EVAR and re-intervention if necessary.

Lancet 2016; 388:2366–74

Beta-blockers are under-prescribed in patients with chronic obstructive pulmonary disease and co-morbid cardiac disease

The use of beta-blockers in patients with chronic obstructive pulmonary disease (COPD) and co-morbid cardiovascular disease remains contentious. Bearing this in mind and noting that there is considerable evidence that use of selective beta-blockers has been shown to be safe in patients with COPD, this study reviews the situation in Australia.

The researchers retrospectively assessed the rates of beta-blocker prescription in patients admitted to two Australian tertiary hospitals for acute exacerbation of chronic obstructive pulmonary disease. There were 1,071 patients admitted with an exacerbation of their COPD over the one-year study period. The researchers noted an indication for beta-blocker prescription in 453 patients. They report that only 203 (45%) of this group were receiving beta-blockers.

The authors of the report regard this as significant under-prescribing and recommend that clinicians should optimise treatment in these patients and not overlook appropriate use of beta-blockers.

Internal Medicine Journal 2016; 46:1336–40

Long-term oxygen for COPD with moderate desaturation?

Long-term treatment with supplemental oxygen has unknown efficacy in patients with stable chronic obstructive pulmonary disease (COPD) and resting or exercise-induced moderate desaturation. Hence this trial.

The participants were patients who had stable COPD with moderate desaturation (SpO₂, 89–93%) or moderate exercise-induced desaturation. Seven hundred and thirty-eight patients were randomised to receive long-term supplemental oxygen or no long-term supplemental oxygen. Follow-up was for 1–6 years.

The researchers concluded that the prescription of long-term supplemental oxygen did not result in a longer time to death or first hospitalisation than no long-term supplemental oxygen, nor did it provide sustained benefit with regard to any of the other measured outcomes.

N Engl J Med 2016; 375:1617–27

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A Case of Diabetes Mellitis. Apparent Recovery.

Under the Care of DR. COLQUHOUN.

(For the following Notes we are indebted to Mr. D. E. Currie, Clinical Clerk in charge of the case.)

Thomas—, soldier, formerly house painter, aged 31, single, was admitted to Dunedin Hospital on June 16th, 1916, suffering from acute diabetes mellitus.

Patient states that he landed upon Gallipoli on June 2nd, 1915. He was well until early in July, when he began to suffer from dysentery. Then on August 28th he was put on board H.M.H.S. "Gloucester Castle," owing to his having contracted left pleurisy. Later he contracted enteritis. On January 16th, 1916, for the reason that he had had pleurisy, dysentery, and enteritis, he was discharged from the N.Z.E.F. He re-enlisted on April 12th, 1916. When he had been three weeks in Featherston Camp, the roof over his bed leaked one night, he got wet, and caught cold. He noticed stiffness across the back and occasionally stiffness and dull pain up the legs—e.g., when he raised his legs to put on his puttees. Also he developed a deep cough. He came down to Dunedin for his final leave on June 2nd (about a month after the night he got wet), and it was on this day that he first noticed any unusual thirst. He says he felt sleepy in the train, about Oamaru, went out for a walk on the platform, and felt thirsty.

The following day he bought a gallon of lemonade, and finished it in the day. He says: "I drank large quantities because it was nice. I did not have a craving for it"; but it is to be noted that he did not try to limit the quantity he drank. The following day (June 4) he took to drinking water, and oatmeal-water. He noticed that if he drank a glassful, he would micturate in ten or fifteen minutes' time. He drank, say, a glassful every half-hour or hour by day. He drank one or two glassfuls at bedtime, but did not drink through the night. He micturated at night—would fill a chamber between midnight and

8 a.m. During the week June 2nd to 9th, he felt a slight weakness, but was otherwise fit. He did not have much appetite. During the week the thirst lessened. At the end of the week he went to see Dr. Colquhoun, who tested his urine, and sent him into hospital.

During that week, when he drank water, he noticed a light sweet taste under the tongue. He also noticed a clammy dryness of the tongue and mouth and a dry throat. These were not relieved by drinking. By June 23rd this sensation of dryness had lessened, so that it recurred only for a few minutes at a time. By July 8th it had almost disappeared. The only time he then noticed it was for a couple of hours after the evening meal. By July 1st the sweet taste of which he complained had entirely gone. By June 23rd, he was drinking daily two cups of fluid at each of three meals, and five cups at other times (i.e., say, five pints daily). He says this is nothing to what he was drinking during the week June 2–9. On June 23rd he was feeling fit and in good spirits, and was interested in things around him. One noticed that he was very bright and intelligent.

With regard to body weight.—He says his normal weight is 12st. 8lb. on April 2, 1916 (the day he went into Featherston), but lost 7lb. in the next two months; but he had been missing a lot of meals in camp owing to the unappetising nature of the food. He would often just take a cup of tea at some refreshment place. His weight was 11st. 8lb. to 11st. 10lb. all the time he was in hospital.

His family history is good—parents and brothers and sisters are all healthy.

On examination at the end of June he was found to have a very slight cough, which he said did not trouble him. Breath sounds were heard on the right base posteriorly, where also there were a few coarse crepitations. X-ray examination showed mottling of the right chest and glandular enlargement in the left chest. Otherwise lungs and heart

were normal. Both eyes were normal, as regards both vision and the state of the fundus. Knee-jerks were normal. There was no pain on compressing the gastrocnemius. There was no ankle-clonus and no patellar clonus. The plantar, cremasteric, and abdominal reflexes were all normal. On July 1st, patient said that he thought the amount of fluid he was then drinking was not much in excess of what he normally takes, but the daily amount of urine at that time was about 76ozs. The state of the skin was then normal. Patient felt very well indeed.

(Note by DR. COLQUHOUN.)

The most interesting feature of the case was the disappearance of glucose from the urine. On June 24th there were 32.8 grs.

of glucose per oz. of urine; on July 29th there was 1 gr. per oz., and on August 2nd glucose had entirely disappeared; and has not (October 9th) reappeared. I have never seen so young a diabetic even apparently recover. He had a fairly rigid diet, and Benger's Liquor Pancreaticus was given several times a day. In another case of very severe diabetes in a woman of 40, under the use of pancreatised foods considerable improvement took place. Claims have also been made that good results have followed the use of Carnrick's preparations, and as many cases of diabetes are doubtless due to lesions of the pancreas, it is but reasonable to suppose that something in the way of an internal secretion is lacking.

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Proceedings of the 235th scientific meeting of the Otago Medical School Research Society

2016

Comparison of immune cell infiltrate between subcutaneous melanoma and colon carcinoma mouse models

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Cancer vaccines modulate the host's anti-tumour immune response and represent an area of emerging immunotherapy research for the treatment of cancer, including colorectal cancer (CRC). Murine subcutaneous injections of tumour cell lines are used to test cancer vaccines for the treatment of CRC. We aimed to determine the baseline immune response to subcutaneous injection of a colorectal cell line, CT26, compared to a melanoma cell line, B16-OVA, to investigate whether the tumour cell type would affect local and systemic immune responses.

CT26 adenocarcinoma cells were subcutaneously injected into mice. Control mice received B16-OVA melanoma cells or saline. The immune cells: dendritic cells, macrophages, T cells (CD4+ and CD8+) and B cells were identified via flow cytometry at the tumour site (local immune response) and in the spleen (systemic immune response).

The systemic immune response to CT26 tumours was characterised by a higher

frequency of dendritic cells, a lower frequency of T cells and twice the proportion of CD4+ to CD8+ T cells, compared to mice given B16-OVA tumours (n=14 (mice given B16-OVA tumours)-15 (mice given CT26 tumours), Mann Whitney, $P=0.0016$, $P=0.0366$, $P=0.0001$). The intra-tumoural immune response to CT26 tumours had a reduced macrophage and T cell infiltrate compared to B16-OVA tumours (n=14, Mann Whitney, $P=0.0233$, $P=0.0185$).

These data represent a baseline immune response to B16-OVA and CT26 tumours that will be used to investigate modulation caused by a therapeutic CRC vaccine. We have also identified immune cell populations likely to be involved in CRC compared to melanoma; these cells have also been shown to be important in human CRC. This work will help link animal models and human data, and help translate cancer therapeutics into treatments for human patients.

A mathematical model for urate transport across a proximal tubule cell

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Urate is a breakdown product of purine nucleotide degradation in humans. The under-excretion of urate, largely due to reduced renal clearance, is believed to be the most important cause of hyperuricemia and gout. Our

understanding of renal urate handling remains rudimentary. An improved comprehension of this process would facilitate further investigation into the effects of transporter polymorphisms or medications on serum urate concentrations. Thus the aim of this project was to develop a mathematical model to simulate urate transport across the proximal tubule in order to study these effects *in silico*.

Known urate transporters expressed in the proximal tubules of the nephron were identified as well as their respective urate transport kinetic parameters V_{max} and K_m . These were expressed as ordinary differential equations in order to describe the bidirectional flux of urate across the proximal tubular cell, and were coded in MATLAB® (version R2013b). The initial estimates of V_{max} and K_m were set to values from the literature. The parameter values were calibrated heuristically to achieve steady state urate concentrations in the blood and urine that matched known average values. The process was repeated to produce a similar model for the uricosuric, probenecid.

Future development of this model is expected to provide a basis to examine agents that affect urate transport and disposition and provide the basis for understanding genetic changes in transporter function.

Supported by a stipend from the New Zealand Pharmacy Education and Research Foundation.

Does the subarachnoid space extend into the eye?

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Intracranial hypertension is a neurological disorder characterised by an increase in intracranial pressure (ICP) within the subarachnoid space (SAS). Considered as an extension of the brain, intraocular pressure (IOP) in the eye has been used to estimate ICP. However, recent evidence indicated that although there was a significant correlation between the IOP and ICP, changes in IOP were a poor predictor of changes in ICP. The existence of physiological and pathophysiological relationships between them is still elusive. Anatomically, the optic nerve is divided into intraocular, intraorbital, intracanalicular and intracranial segments. The intracanalicular segment is the point where the SAS surrounds the optic nerve and extends into the eye, and thus may provide direct pressure transmission between the ICP and IOP. The aim of this study was to investigate the anatomical configuration of the optic nerve sheath in the optic canal.

A total of nine cadavers were examined in this study. Arachnoid mater of three cadavers were stained with haematoxylin via SAS perfusion. The specimens were prepared as sets of serial plastinated sections with a thickness of 2.5mm or 0.3mm and examined under a stereomicroscope and a confocal microscope.

The results showed that (1) the dura mater continued the periosteum of the optic canal and joined with the tendinous fibers of the eye muscles giving rise to the optic nerve sheath (n=3), and (2) in the specimens with a SAS staining, the SAS followed the optic nerve and entered the optic canal, but terminated at the midpoint within the canal (n=3). However, in specimens without staining the SAS could not be traced. Thus, the observations were not quantified.

This study concludes that the SAS is not continuous throughout the optic nerve sheath, suggesting that there is no anatomical basis to support mechanism of direct pressure transmission between the ICP and IOP.

IGF-R1 pathway in crizotinib-resistance in ALK-positive non-small cell lung cancer

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Non-small cell lung cancers (NSCLCs) account for approximately 85% of all lung cancer-related deaths worldwide. About 4% of NSCLCs contain rearrangements in the *EML4*—*ALK* genes which encode a fusion protein that drives cancer development. Crizotinib, an ALK inhibitor, gained fast-tracked approval from the Food and Drug Administration in 2011 on the back of unprecedented responses in clinical trials. Unfortunately, resistance to crizotinib invariably develops within two years through a variety of mechanisms. One of the major mechanisms of resistance is the activation of alternative cell signalling pathways, including the insulin-like growth factor receptor-1 (IGF-R1) pathway. This study aimed to investigate the role of the IGF-R1 pathway in crizotinib resistance and whether the combination of crizotinib with an IGF-R1 inhibitor may delay the development of resistance *in vitro*.

To model innate resistance, the established ALK-positive NSCLC cell line, NCI-H3122, was exposed to high dose crizotinib (10 μ M) for 24 hours. The drug was removed and cells were maintained for 12 days. In order to develop a crizotinib-resistant cell line (C.R-H3122), NCI-H3122 cells were maintained in crizotinib (0.8 μ M; the steady state plasma concentration in mice) for 114 days.

The IC_{50} of crizotinib in a model of innate resistance increased in treated cells (0.163 μ M) compared to non-treated

cells (0.071 μ M). Chronic exposure to crizotinib led to the development of a crizotinib-resistant cell line (C.R-H3122) with an IC_{50} of 2.082 μ M, 20.8 fold higher than control. Cytotoxicity testing of an IGF-R1 inhibitor, NVP-AEW541 (NVP) revealed a lower IC_{50} in the C.R-H3122 cells (2.205 μ M) compared to control (2.994 μ M). Moreover, combination treatment indicated the C.R-H3122 cells are sensitised to NVP.

These results suggest the IGF-R1 pathway plays a role in two models of crizotinib resistance, suggesting the combination of crizotinib with NVP may be particularly effective in crizotinib-naïve patients.

Protein modeling of nonsynonymous SNPs in apolipoprotein(a)

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Cardiovascular disease (CVD) is New Zealand's leading cause of death. Elevated plasma lipoprotein(a) [Lp(a)] is a strong risk factor for CVD. Lp(a) is a low-density lipoprotein (LDL) analogue comprised of Apolipoprotein B covalently linked to a unique glycoprotein apolipoprotein(a), which is transcribed from the LPA gene. Lp(a) bears significant homology to plasminogen with repeating kringle structure. This study aimed to model possible effects of nonsynonymous single nucleotide polymorphisms (SNPs) associated with altered plasma Lp(a) on 3D protein structures of apo(a) domains.

Thirty nonsynonymous SNPs were presented from a next-generation sequencing study that sequenced the LPA gene of 48 individuals. The population consisted of individuals with high, medium and low plasma Lp(a). Online protein prediction programs SIFT and PolyPhen-2 were used to indicate if SNPs were damaging to structure. There was general concordance between the two programs and ten SNPs were strongly predicted to be damaging to

protein structure, others were either possibly damaging or benign. 3D protein structures for four available kringle domains were downloaded from the Protein Databank. Four of the apo(a) kringle domains and the protease domain were unavailable and thus homology models based on the closest available apo(a) kringle structure (or the plasminogen protease domain) were generated using the FFAS Burnham server. The structures were opened in PYMOL and amino acid changes modeled using the mutagenesis wizard tool.

The SNPs R990Q and R1771C are associated with lowered Lp(a) levels and were shown to ablate polar contacts within their respective domains (KIV-4 and KV). Superimposition of the structures showed they are analogous arginine residues in different kringle domains. This indicates that apo(a) kringle structure may be perturbed by these changes. Functional studies in tissue culture are now underway to further elucidate their effects.

Evaluation of plasma cell-free DNA stability and preservation in Roche Cell-Free DNA Collection Tubes and Streck Cell-Free DNA BCT over a 14-day period

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Circulating tumour DNA (ctDNA), a blood based biomarker has the potential to diagnose early stage cancer, monitor treatment response and identify metastatic relapse. This study aimed to compare two commercially available Cell Free DNA Blood Collection tubes for the stability and preservation of plasma cfDNA for 14 days post-collection.

Twenty healthy volunteers had blood drawn via venipuncture into five Streck and five Roche Cell-Free Blood

Collection tubes. Samples were stored at 22°C and processed on 0, 4, 7, 10 and 14 days post-collection. cfDNA was extracted from 4mL of plasma using the Qiagen QIAamp® Circulating Nucleic Acid Kit to a final elution of 35µL. The cfDNA concentration was measured using 2µL of elution with the Quibit® 2.0 Fluorometer using the Quibit® dsDNA HS Assay Kit (ng/mL). Pair-wise student t-test was conducted to determine whether there were any differences in the preservation capability of the two tubes.

The results indicated a significant difference of the initial cfDNA reading between the two tubes on day 0 (mean Streck 6.58 ng/mL ± 3.55, Roche 5.67 ng/mL ± 3.31, $P=0.038$). However, no significant differences were found between the two tubes for samples processed on days 4, 7, 10 and 14 ($P>0.05$).

The findings of the study indicate that either Streck or Roche tubes are suitable for clinical sample collection as neither were significantly better in terms of preservation as measured from day 4 onwards. The initial cfDNA reading on day 0 was significantly different, however, this may be due to sub-standard venipuncture technique resulting in cellular lysis and genomic DNA release. Hence after consideration of price (per 100 tubes) and availability in New Zealand, the Roche tubes have been selected for developing ctDNA as a cancer surveillance assay in the clinical phase.

Rotator cuff-related pain: participants' understanding and experiences

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Persistent rotator cuff-related pain is common in the middle-aged and elderly. A psychosocial approach to treatment indicates individuals' beliefs and experiences need to be considered in the management of this pain. While

extensive research has explored beliefs of individuals with spinal pain, less is known about individuals' beliefs regarding shoulder pain. This qualitative study aimed to explore beliefs about the cause of pain in individuals with persistent rotator cuff-related pain and their experiences of the effect of pain on their daily lives.

Five men and five women, aged 47–68 years, with shoulder pain for more than three months were recruited from the local community via newspaper advertisements and flyers displayed at sporting facilities, physiotherapy and general practitioner clinics. Individual semi-structured interviews were audio-recorded, transcribed in verbatim and analysed using the general inductive approach.

Four key themes emerged following analysis: 'Understanding the pain'; 'It affects everything'; 'Pain-associated behaviours'; and 'Emotions, thoughts, and the future'. The cause of pain, 'Understanding the pain', was described in terms of anatomical factors within the context of the participants' lives. The pain impacted all areas of life, with participants reporting 'It affects everything'. Participants responded to their pain by adopting certain, 'Pain-associated behaviours' and sought information for general management and exercise prescription, 'Emotions, thoughts, and the future'.

The participants with persistent rotator cuff-related pain believed the cause of their pain to be local to the shoulder. Participants also described various work, sports and family related stressors in their lives. Such stressors can be pain-associated, however, the participants rarely considered these as being contributors. Rehabilitation may need to include educating individuals, expanding their understanding regarding pain mechanisms and addressing certain pain-related beliefs. The pain affected many parts of these participants' lives and the unique experiences shared, highlight the need for tailored treatment based on individual goal setting.

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