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Toitū Te Tiriti

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Toitū Te Tiriti

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We have identified using current evidence that the proposed Government's changes to legislation will unfairly and inequitably have huge negative impacts on Māori health.

Discrepancies between two D-dimer assays and impact on clinical decisions; a retrospective analysis of samples tested in community and hospital-based laboratories in Auckland

Melanie J Adriaansen, Ian M Morison, Holly E Perry

A D-dimer test is a laboratory test that looks for unsafe blood clots that have formed in veins. Different laboratories in the Auckland Region use tests manufactured by different companies. We found that the test used by community laboratories has a higher D-dimer result on average than the hospital D-dimer test. Nearly a quarter of people who tested positive in the community tested negative when they came to hospital. In 6% of people, the difference in results was so great that this is most likely explained by the presence of antibodies that cause interference. The lack of similarity in test results, which is a world-wide problem for this test, can lead to confusion and wasted resources.

Exposure to digital vape marketing among young people in Aotearoa New Zealand

Antonia C Lyons, Angela Moewaka Barnes, Ian Goodwin, Nicholas Carah, Jessica Young, John Spicer, Timothy McCreanor

We don't know much about the marketing of vape products on social media and young people's exposure to this marketing. We surveyed 3,698 young people (aged 14–20 years) with a range of genders (55.7% females; 38.3% males; 6% another gender), ethnicities (25.6% Māori; 46.7% NZ European; 6.5% Pasifika and 21.2% another ethnicity) and social classes. Half of the sample reported seeing vape marketing on at least one social media platform, and a quarter engaged with this marketing (including purchasing vapes online). Younger respondents were more likely to report seeing vape marketing than older respondents, and Māori and Pasifika more likely than other ethnicities. Patterns of exposure to vape product marketing on social media mirror the inequitable marketing exposure of harmful commodities in physical environments.

Radiation cystitis in acute admissions for haematuria

Nasya Thompson, Chris Frampton, Giovanni Losco

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Megan Pledger, Sue Buckley, Jacqueline Cumming

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Opiate prescription after hip and knee arthroplasty: a retrospective cohort study

Bradley S Atkinson, William M Oldfield, Hannah M E Sim, Nemandra A Sandiford

The use of strong pain relief (opioids) prior to hip and knee joint replacement surgery is directly associated with worse patient outcomes. This study found that 2–3 times as many patients use opioids prior to joint replacement surgery in rural New Zealand settings compared to established rates in urban New Zealand settings. Further research is necessary to establish why this is occurring and how any identified causes can be addressed.

ACC and treatment injuries: is it time to rethink injury causation?

Albert Andrew

This article investigates the deficiencies in the current treatment injury provisions outlined in the *Accident Compensation Act*. It argues that the criteria for obtaining treatment injury cover is marked by ambiguity and arbitrariness. Additionally, the review process for challenging declined claims is criticised for its perceived unfairness towards claimants. The article advocates for the necessity of legislative reform to rectify these issues and provides an example to illustrate what such reform might entail.

A foodborne outbreak of Group A streptococcus: an under-recognised method of spread

Kate Gatman, Bryn Thompson, Jay Harrower, Subha Rajanaidu

In New Zealand at a pot-luck event an uncommon occurrence took place. The bacteria that causes rheumatic fever (Group A streptococcus) was spread via the food. Due to the high rates of rheumatic fever in New Zealand, this was an extremely important event for Auckland Regional Public Health Service to track.

Toitū Te Tiriti

Suzanne Pitama, Tracy Haitana, Maira Patu, Bridget Robson, Ricci Harris, Christina McKerchar, Terryann Clark, Sue Crengle

Concern about the new coalition Government's proposed 100-day plan has seen the term "Toitū Te Tiriti" come to prominence within the Māori community, serving as a call to action expressed in art, community placards, social media and more recently within forums such as hui-ā-motu and Rātana Pā. This term refers to the need to uphold and honour Te Tiriti o Waitangi. The celebration of Waitangi Day traces its origins back to 1934, with the formal annual commemorations of the signing of Te Tiriti o Waitangi commencing in 1947. Notably, the designation of Waitangi Day as a public holiday occurred in 1974. These pivotal events collectively underscore a progression toward acknowledging the intricate tapestry of Aotearoa New Zealand's Indigenous and colonial history.[1,2]

Scholars and legal experts have meticulously documented the pivotal role of Te Tiriti o Waitangi as the foundational document of Aotearoa New Zealand. This document delineates the rights afforded to iwi and enumerates the corresponding responsibilities of the Crown.[3–5]

Published literature well documents compelling evidence that, despite the promises enshrined in Te Tiriti o Waitangi, equity in Aotearoa New Zealand is yet to be attained.[6–8] Academics have methodically documented the underlying exposures associated with increased health and social risks that contribute to this persistent inequity for Māori—most notably systemic racism that restricts equitable and fair access to quality education, employment, housing, nutritious food and healthcare access. Additional health disparities are noted for geographic factors, notably rurality, disability and those living in low-income households and with material deprivation.[9–27] Māori also have a youthful population structure (median age 25.4 years) relative to European/Pākehā populations (median age 41.4), and are disproportionately affected by changes in policies that restrict income, education, healthcare, justice and employment.[28–31] A nuanced critique has materialised concerning the deleterious impact of processes within the healthcare system that uphold racism on Māori health outcomes. This encompasses policies, algorithms informing clinical practices, resource allocation priorities, healthcare access to quality care and clinical bias perpetuated by systemic inequities.[32–35] Moreover, the *New Zealand Medical Journal* has also provided incontrovertible evidence regarding the role of Indigenous resources from Te Ao Māori as protective factors that mitigate health inequities. These encompass the validation of Indigenous rights, including access to te reo, ancestral lands and culturally significant resources conducive to hauora, including the fundamental role of whānau in health service delivery.[12,16,17,32,36–46] Political advocacy processes, such as those involving the Waitangi Tribunal, Māori health professional groups, health professional colleges with proactive commitment to Te Tiriti o Waitangi, Māori providers, and iwi feature prominently in the literature, diligently monitoring the Crown's obligations to ensure access to quality healthcare for Māori.

In light of the compelling evidence presented in current literature, health practitioners, researchers, managers and professional staff should also be concerned about the potential direct impact of the proposed changes by the current coalition Government on Māori health outcomes and the concomitant exacerbation of existing inequities. The impending shifts are signalled by:

1. The targeted measures directed at low-income households that will negatively impact the social determinants of health, including the removal of free prescriptions, repeal of the *Fair Pay Agreement Act*, adjustments to benefit increments indexed to wages, removal of the Reserve Bank's mandate to maximise sustainable employment, elimination of medium-density residential standards and introduction of no-cause eviction bans.
2. The repeal of the *Smokefree Environments and Regulated Products (Smoked Tobacco) Amendment Bill*, and the lack of active consultation processes in regards to its impact on Aotearoa New Zealand and specifically Māori communities.

3. The anticipated adverse environmental effects and subsequent negative health impacts from the cessation of public transport and cycling/pedestrian initiatives, the repeal of clean car incentives, abolition of Auckland regional fuel taxes, termination of new speed limit reductions, removal of public transport discounts, repeal of Three Waters reforms, calls for the reversal of Labour Government *Resource Management Act* reforms, amendments to section 58 of the *Marine and Coastal Area Act* and repeal of the *Canterbury Regional Council (Ngāi Tahu Representation) Act 2022*.
4. A heightened emphasis on the penal system and the unequal adverse impact of these changes on Māori whānau/communities (especially young Māori) that are characterised by the reintroduction of the three-strikes rule, increased restrictions on gangs, withdrawal of funding for Section 27 pre-sentencing background cultural reports provided to judges under the *Sentencing Act 2002* (the purpose of these reports are to provide the context and reasons for offending), and the removal of Section 7AA from the *Oranga Tamariki Act 1989* (requires the chief executive to meet duty to improve outcomes for tamariki, rangatahi and their whānau).
5. A targeted political approach towards Māori communities and their resources, involving the elimination of Te Aka Whai Ora – The Māori Health Authority, resistance to endorsing policy changes recommended by the World Health Organization, removal of co-governance in public service delivery, "prioritisation of public services based on need rather than race", local referendums on the establishment of Māori wards, cessation of work on *He Puapua*, disavowal of the *United Nations Declaration on the Rights of Indigenous Peoples* as legally binding in Aotearoa New Zealand, amendments to Waitangi Tribunal legislation and a comprehensive review of legislation referencing "the principles of the Treaty of Waitangi", with subsequent replacement or repeal of such references. Additionally, directives ensuring English as the primary language for public service departments, with exceptions for those specifically related to Māori, further underline the political agenda, and the review of affirmative action education programmes that aim to increase unrepresented populations in the health workforce.

The conspicuous signposts erected by the coalition Government necessitate a proactive stance among health professionals in safeguarding the accrued gains in Māori health. This entails leveraging extant health evidence to fortify existing strides and resist the erosion of progress made.

As Waitangi Day unfolds, the health community is afforded an opportune moment for collective introspection. This entails reflecting on the progress achieved as a community of practice and contemplating collaborative pathways forward, including public advocation, political lobbying, aligning as allies with iwi and Iwi–Māori Partnership Boards and maintaining our current course. The overarching aspiration is to align with Te Tiriti o Waitangi, thereby demonstrating both nationally and internationally that the requisite evidence and resources are at our disposal to effectuate equity for Māori. In that way we can demonstrate our commitment to Toitū Te Tiriti.

COMPETING INTERESTS
Nil.

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Discrepancies between two D-dimer assays and impact on clinical decisions; a retrospective analysis of samples tested in community- and hospital-based laboratories in Auckland

Melanie J Adriaansen, Ian M Morison, Holly E Perry

ABSTRACT

AIM: In patients with suspected venous thromboembolism, an elevated D-dimer level provides an important branch-point in the management pathway. This study compared two D-dimer assays, INNOVANCE® DDimer (Innovance) and STA®-Liatest® D-Di Plus (Liatest), to assess potential impact on clinical management.

METHOD: Reflecting current practice in Waitematā, Auckland, we compared paired samples from 805 patients referred to hospital following a community D-dimer test. Samples were determined to be positive or negative using a 500µg/L fibrinogen equivalent units (FEU), and age-adjusted cut-offs.

RESULTS: In the Innovance assay, 2% of samples had a result <500µg/L FEU. In contrast, by Liatest, 18% were below 500µg/L. This positive bias of Innovance was amplified with use of age-adjusted cut-offs; 23% of samples with an elevated Innovance result showed a normal result by Liatest. On average, the Innovance values were 22% higher than Liatest. Results suggestive of interference from heterophile antibodies were seen in 6% of sample-pairs.

CONCLUSION: Innovance D-dimer test yielded higher values than Liatest and experienced interference from suspected heterophile antibodies. Discrepancies in nearly a quarter of patients may be leading to substantial under or over investigation, inefficient use of resources and clinical confusion.

In patients with suspected venous thromboembolism (VTE) a low D-dimer level is an important component of clinical algorithms that allows the safe discharge of patients with a low clinical probability score.[1] Although the decision-making cut-off points for D-dimer levels are internationally standardised, the assays themselves appear to show clinically important differences.

In the Auckland Region, patients in the community with suspected VTE undergo D-dimer testing at a community laboratory using the INNOVANCE® D Dimer assay (hereafter referred to as "Innovance"). If the D-dimer level is elevated, the patient may be referred to hospital for further investigation and re-tested by the hospital laboratory with the STA®-Liatest® D-Di Plus assay (hereafter "Liatest"). Laboratory staff at Auckland hospitals have observed that samples with high results from the Innovance assay can be normal when tested with the Liatest assay.[2,3] Laboratory staff have also received calls from general practitioners questioning the integrity of D-dimer testing when patients have discordant results.

D-dimers are degradation products of human blood coagulation, produced by dissolution of fibrin mesh. High levels of D-dimers are seen up to 20 days following a VTE, with laboratory D-dimer measurements considered most useful within 11 days of a suspected thrombotic event.[4]

The cut-off value used for classifying D-dimer levels as normal (negative) or high (positive) is often set at 500µg/L fibrinogen equivalent units (FEU).[1] As D-dimers positively correlate with age, cut-off values are frequently adjusted by raising the cutoff by 100µg/L FEU for each decade above 50 years.[5] The test has high sensitivity, meaning that either a level below 500µg/L or cut-off values

adjusted for age are useful for ruling out VTE; however, it lacks specificity.[1,6]

Many different quantitative D-dimer assays are available for laboratory testing and there is a lack of standardisation between them.[6,7] Large differences have been detected in patient samples and laboratory quality assurance surveys tested with different commercial kits.[8–10] In addition, there are numerous reports of falsely high positive D-dimer results caused by artefacts in patient samples, including lipaemia, some drug metabolites[11] and interfering antibodies including rheumatoid factor, anti-species and heterophile antibodies.[2,12–20] Heterophile is a blanket term for any antibody in the patient's plasma that can bind with low affinity to a range of naturally occurring antigens and antibodies, including the Fc portion of the monoclonal antibody used in an immunoassay.[21,22] Sources report heterophile antibody incidence in general populations in the range of 0.17% to 40%.[17] Despite the use of reagents to block these antibodies, interference can still be detected at reported rates of 0.05–0.5%.[17]

The aim of this investigation was to compare two commonly used assays in a real-world setting to assess systematic bias and heterophile antibody-like interference, and to assess the potential impact of discrepant D-dimers results on patient admissions and management.

Methods

This is a retrospective analysis of 818 paired samples collected from 805 individuals for D-dimer analysis over a 38-month period between January 2019 and March 2022, as part of routine healthcare. Each sample pair was collected within a 24-hour period, with a median time difference of 8 hours. The first of the sample pairs was collected in the community and analysed by the Innovance (Siemens) assay on a Sysmex CS-5100 platform. Patients with an age-adjusted elevated D-dimer result in the Innovance assay were referred to hospital, and a second sample was collected and tested by the Liatest (Stago) assay on a Stago STA R Max3. A small number of cases (2.6% of samples) with an Innovance result of <500µg/L FEU were retested in the hospital laboratory for other reasons. Females accounted for 68% of patients. Ages ranged from 14 to 102 years, with a median of 64 years.

D-dimer results were extracted for analysis from the laboratory management system. The upper limit of reporting in the Liatest assay in the hospital laboratory was 4,000µg/L FEU, whereas the community laboratory reported up to 40,000µg/L FEU with Innovance. Sample pairs with a result of >4,000µg/L FEU on Liatest (n=86) were removed from the dataset when analyses required numerical statistical comparison.

A cut-off of 500µg/L FEU for a positive or negative D-dimer result was applied to all samples for the first analysis of data. Subsequently, age-adjusted cut-offs were applied by raising the cutoff by 100µg/L FEU with each decade above 50 years of age. For example, for a patient in the age range 51–60 years, D-dimer was classified as negative when <600µg/L FEU.[5]

Statistical analysis was performed in Microsoft Excel. Sample pairs were analysed to compare numerical results with two different statistical tools: XY scattergram and Bland–Altman difference plots.

Results

In accord with the reasons for patients' hospital assessment, almost all (798; 98%) of the 818 paired samples had a D-dimer result at or above a single-point cut-off of 500µg/L FEU in the Innovance assay. In contrast, only 671 (82%) of the paired samples were above this cut-off with the Liatest assay.

Using age-specific cut-offs, 190 (23%) of the sample pairs with a positive Innovance result had a negative result value from the Liatest assay (Table 1). Reflecting the lower level of D-dimer in younger people,[5] a greater proportion of those under 50 years (34%) had a discordant result between Innovance and Liatest assays compared to the older age groups (Figure 1).

In addition to simply designating results as positive or negative, we compared quantifiable results from both assays. Of the 818 sample pairs, 86 with a value of ">4,000µg/L" from the Liatest were excluded, leaving 732 numerically comparable sample pairs. Of these 732, the median D-dimer result was 1,160µg/L FEU by Innovance, and 928µg/L FEU by Liatest.

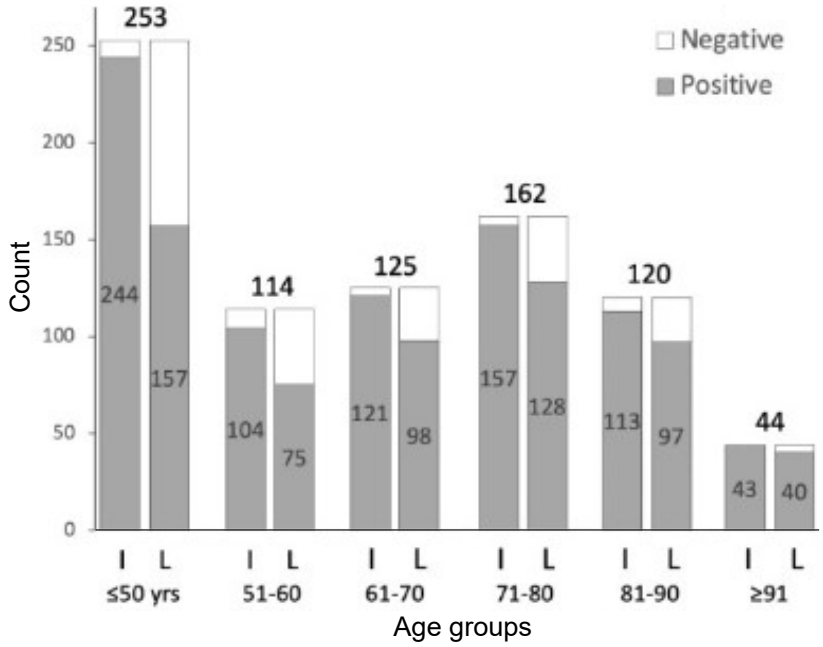
Results of these 732 pairs were converted to log base 10 to allow comparison, and are plotted in Figure 2.

Comparison of results revealed that 44 (6.0%) of 732 sample-pairs had values substantially higher (defined as 3-fold or greater) in Innovance than Liatest (Figure 2). It is suspected these 44 cases were affected by heterophile antibodies.[17] Due to the minimum reportable Liatest result of 270µg/L,

Table 1: Innovance versus Liatest using age-adjusted cut-offs (n=818).

	Innovance negative	Innovance positive	Totals
Liatest negative	33 (4%)	190 (23.2%)	223 (27.3%)
Liatest positive	3 (0.4%)	592 (72.4%)	595 (72.7%)
Totals	36 (4.4%)	782 (95.6%)	818

Figure 1: Comparison of Innovance (I) and Liatest (L) positivity by age group using age-adjusted cut-off values (n=818).



the Innovance result needed to be at least 810µg/L to exceed the 3-fold cut-off.

For further test comparison, we excluded the 44 highly discordant results where the Innovance result was greater than 3-fold higher than the Liatest result, leaving 688 paired results. Based on these 688 results, the relationship between the two assays was: Innovance = 1.25*Liatest + 22. On average the Innovance assay was 22% higher than the Liatest assay.

The Bland–Altman plot of these 688 cases shows a clear bias toward higher result in the Innovance assay (Figure 3). The mean positive bias was 336µg/L, but as shown there is a proportional bias, i.e., an increasing difference with increasing D-dimer values.

Given that the two sets of results were obtained on two different samples collected within 24 hours, it was possible that a biological change in D-dimer might have occurred between the two tests. No statistically significant difference was found between time elapsed and the two values (r^2=0.00002, p=0.91, Figure 4).

Discussion

This retrospective analysis of patient data provided a real-life opportunity to compare D-dimer results of 818 paired samples tested by two different immunoassays performed on two different platforms within a 24-hour time period. Among patients referred to hospital with a high

Figure 2: Comparison of D-dimer assay results between Innovance and Liatest. The tests were performed on separate samples within 24 hours for 732 sample pairs. Axes are displayed in logarithmic scale. The solid black line is the line of identity, and the dashed line shows where the Innovance result was 3-fold higher than the Liatest result.

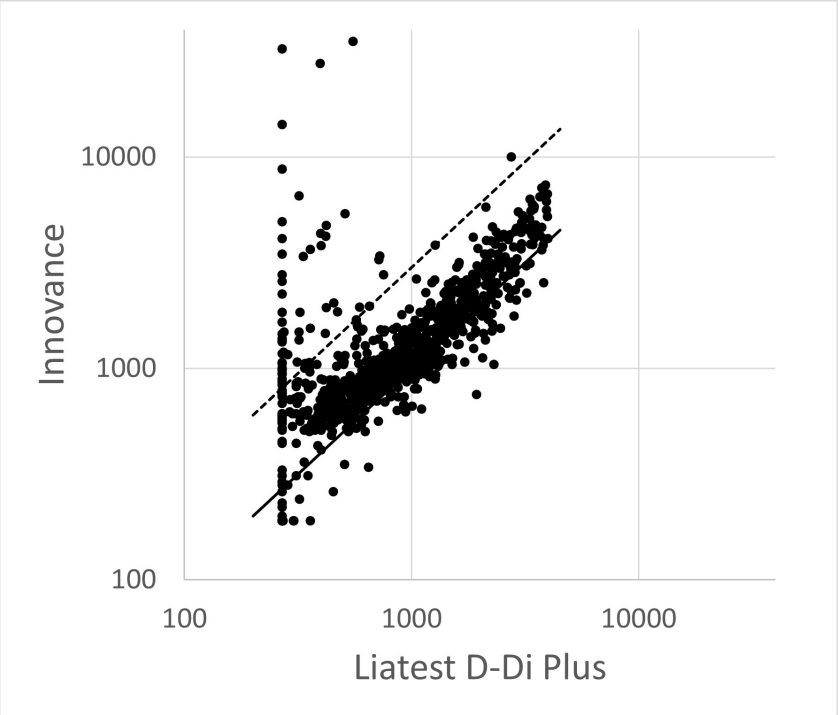


Figure 3: Bland–Altman plot of the difference between the Innovance and Liatest assays against the mean of the two assays. Lines represent the mean difference (central line), mean difference + 2SD (upper line) and mean difference—2SD (lower line).

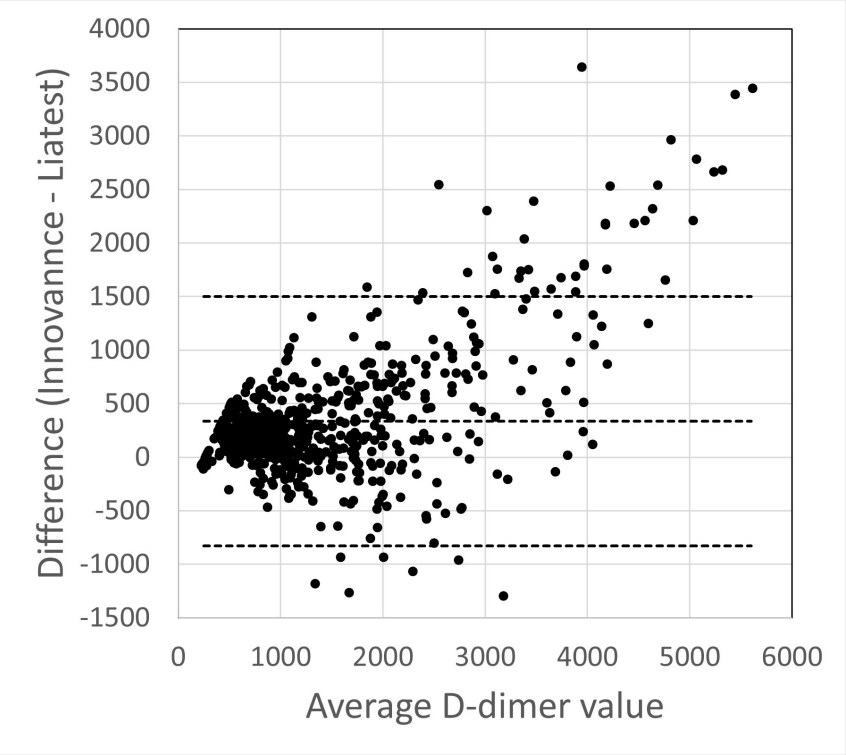
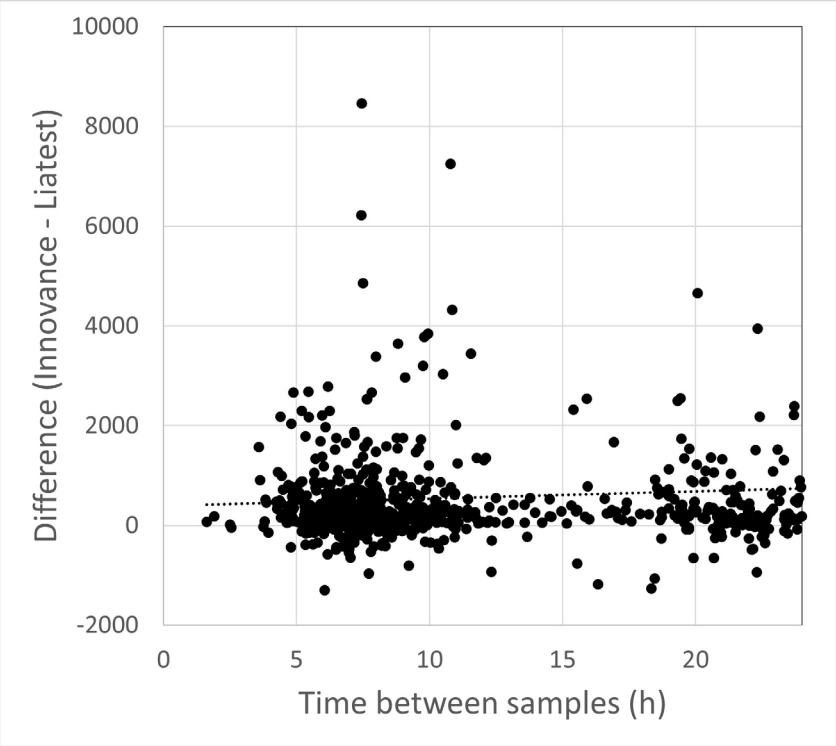


Figure 4: Comparison of difference between test results and elapsed time of the 732 comparable samples. Three extreme outliers with a difference of >13,000 were excluded from the analysis. The dashed line shows the line of best fit (r^2=0.00002, p=0.91, y=-0.59x + 448).



D-dimer result, 24% had a normal D-dimer when retested with the second assay. In the age group of 50 years and under (Figure 1), 35% of samples tested positive by Innovance but negative by Liatest. Six percent of total patients showed an Innovance D-dimer result at least 3-fold that of Liatest. The possibility that these differences were due to the difference in collection time, for reasons such as renal clearance or clot extension, was considered; however, there was no relationship between D-dimer level discrepancy and time elapsed between specimen collection (Figure 4). While we cannot completely exclude physiological differences in the two samples of each pair having an influence on results, others have observed the same positive bias of Innovance when testing the same sample by Innovance and Liatest.[8–10] Although comparison of the same samples/blood draws on the same methods is most scientifically accurate, this investigation reports on what is happening in a current real-world scenario.

Regardless of assay used, the same internationally standardised cut-offs are used to exclude thrombotic events, or to progress patients to further investigation.[1] The differences we have shown demonstrate that either cut-offs need to be individually established for each specific testing method, or assays must be standardised.[7]

Internationally, including Australasia, Innovance and Liatest are among the most commonly used D-dimer kits.[9,23] Discordance in D-dimer results between different assays (not restricted to Innovance versus Liatest) has been widely reported.[6,7,11] In an analysis of three quality survey samples, Favaloro and Thachil[10] found the median D-dimer result from participating laboratories that used the Innovance assay was approximately twice that of laboratories using Liatest. Hamer and colleagues[9] analysed D-dimer results from a survey sample sent to 645 different laboratories using a range of assays, and found that laboratories using the Innovance assay reported values 1.6 times higher than those using the Liatest assay. We observed a 22% difference in the mean D-dimer result in patients, with values from the Innovance assay consistently higher than from Liatest.

Antibodies present in patient samples leading

to false positive D-dimer results have previously been reported as isolated case reports,[2,14–20] but large-scale studies of the problem are limited[17] and may be under-reported. Here we report that 6% of D-dimer results may have been affected by heterophile and other interfering antibodies. This is in contrast to the rates of interference in immunoassays reported elsewhere as 0.05–0.5%.[17]

The problem of interfering antibodies occurs with various immunoassays, including D-dimer assays,[2,14–20] and causes diagnostic confusion, anxiety and sometimes unnecessary medical interventions for patients. Poor characterisation of the diversity of heterophile antibodies compounds the problem.[24]

Clinicians have a right to expect results for D-dimer tests to be consistent, regardless of assay manufacturer. As Hamer et al. commented, lack of D-dimer assay standardisation has "significant impact on costs, time and radiation exposure."[9] In nearly one quarter of patients in this study, measurement of D-dimer by a different assay may have led to altered clinical decision making. Discordant results erode trust in laboratory testing and healthcare providers. Currently, the Liatest assay is used to guide hospital-based management in Auckland hospitals, whereas the Innovance assay is widely used for community and hospital testing in other regions of New Zealand. It is unclear if either test provides more appropriate guidance for investigation and treatment in comparison to the international studies that were used to determine cut-off points for VTE clinical algorithms. Our study was retrospective and carried out in one region with a relatively small sample size. International cooperation must aim to standardise D-dimer assays to produce comparable results that are not prone to interference.

COMPETING INTERESTS
Nil.

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Exposure to digital vape marketing among young people in Aotearoa New Zealand

Antonia C Lyons, Angela Moewaka Barnes, Ian Goodwin, Nicholas Carah, Jessica Young, John Spicer, Timothy McCreanor

ABSTRACT

AIMS: Little is known about the exposure of young people in Aotearoa New Zealand to marketing of vape products on social media. This study investigated vaping behaviour and the extent of vape marketing exposure and engagement that young people (14–20 years) report on social media and examined differences across socio-demographic groups.

METHODS: An online survey was conducted with 3,698 participants aged between 14–20 years (M=17.1; SD=1.8). A range of genders (55.7% females, 38.3% males and 6% another gender), ethnicities (25.6% Māori, 46.7% Pākehā or NZ European, 6.5% Pasifika and 21.2% another ethnicity) and social classes took part.

RESULTS: Half (50.8%; n=1,110) of the respondents (N=2,185) reported that they had vaped at least once; vaping history was positively related to exposure to and engagement with digital vape marketing. Half (50.3%; n=1,119) of the respondents (N=2,224) reported seeing vape marketing on at least one social media platform. Binary logistic regressions showed that younger respondents were more likely to report seeing vape marketing than older respondents, and Māori and Pasifika more likely than other ethnicities. Over a quarter (26%; n=563) of respondents (N=2,148) reported engaging with vape marketing online, with Māori and Pasifika respondents more likely to engage than other ethnicity groups, and similarly for respondents of lower compared to higher socio-economic status. No interaction effects were found.

CONCLUSIONS: Many young people, including a subset under the legal age for purchase, reported seeing vape product marketing on social media platforms. Patterns of exposure to vape product marketing on social media mirror the inequitable marketing exposure of harmful commodities in physical environments. Improved transparency and regulation of social media marketing is required.

Vape products are currently one of the main sources of substance use in young people in Aotearoa New Zealand. A 2019 survey demonstrated that vaping was 2–3 times more prevalent than smoking, with 10% of students vaping regularly (monthly or more often), and 6% weekly or more often, compared with 4% and 2%, respectively, for tobacco smoking.[1] Over 80% of those who vaped reported that they were not smokers, while half of regular vapers said they had never smoked. Dual use of both vapes and cigarettes among Māori was twice the rate compared to the rest of the sample. A 2021 survey with 19,000 year 9–13 students found that 20% were vaping regularly and 15% were smoking, with more than half of respondents reporting that they were vaping more often than they used to, were using higher nicotine products, were feeling addicted and felt that the vaping was damaging their health.[2]

Increasing youth vaping rates have led to recent changes to vaping regulations, including restrictions on disposable devices, prohibition of new vape outlets within 300m of schools and marae and limits on marketing product brands that target young people.[3] Legislation has imposed R18 sales restrictions and also "*prohibits advertising and sponsorship of vaping products (with some minor exceptions) and bans specific sales promotions*".[4] Nevertheless, vaping and tobacco companies in Aotearoa New Zealand are marketing on social media platforms to appeal to young people, exposing young people to vape product content online and engaging potential consumers through comments, likes, questions, competitions and sponsorships.[4]

International research highlights how social media has been crucial in publicising, normalising and marketing vape products among young people.[5] Longitudinal US research showed that young people's (12–17 years) exposure to vape advertising on social media platforms, websites and in gas and convenience stores was associated with vaping 1 year later, while no associations

were found with advertising in newspaper/magazines, radio, billboards or television.[6] In Aotearoa New Zealand, researchers have shown how vape product retailers use Instagram to engage with young people, sponsoring festivals, linking vapes to appealing lifestyles and employing popular influencers.[7] Such findings question industry assurances that e-cigarettes are promoted only as cessation devices to adult smokers.[8]

Online marketing that highlights e-cigarettes as appealing lifestyle products is concerning, especially given the high rates of social media use in young people. Social media marketing differs from conventional marketing, being dynamic, participatory and data-driven, within constantly changing social media feeds that are obscured from public view.[9] The underlying algorithms operate to intensify engagement with marketing content and consumer-driven socialising.[10] We currently know little about the social media marketing of vape products to young people, the dynamics of exposure and engagement with this marketing and how this might vary across socio-demographic groups—information that is occluded within digital environments due to the nature of digital marketing. The current study aimed to 1) examine the vaping behaviours of young people aged 14–20 years, 2) investigate how much young people are exposed to and engage with vape marketing and promotion on the social media platforms they regularly use, and 3) examine whether exposure and engagement varied across different ages, genders, socio-economic groups and ethnicities to identify broad patterns in the digital promotion of vape products to different groups of young people.

Methods

All research processes were carefully designed to be bicultural in an effort to recruit equal numbers of Māori and non-Māori participants. The research received ethical approval from the Victoria University of Wellington Human Ethics Committee.

Survey

An online survey with six sections was designed and piloted with young people. It asked questions about internet access, social media use and activity, exposure to and engagement with vape, alcohol and tobacco marketing online, changes in social media use during COVID-19 lockdowns and vaping, drinking and smoking behaviours. Here we focus on vaping results only.

Demographic measures

Information was collected on respondents' age, gender, ethnic group(s) they belong to, sexual orientation, student and/or work status, who lives in their household, area of residence (e.g., town, city) and parent or caregiver status. Perceived socio-economic status (SES) was assessed by asking "how well off economically do you think your whānau/family is" and giving five response categories ranging from "not well off at all" to "very well off" (following Sverberg et al.[11]).

Internet access and use

Questions asked about devices used to connect to the internet, type of connection, frequency of internet use, time spent on the internet, the capacity of their connection and who pays for it.

Social media use

Respondents reported on the social media platforms they had used in the previous month (from a list of 18, and open text for any others).

Exposure to vape product marketing online

Respondents were asked if they recalled "seeing any vape product advertising on the following social media" and responded for each of the platforms used in the previous month.

Engagement with vape products online

Respondents were asked if they had done any of the following in the past 6 months: liked a vape brand; shared a status, picture or video related to a vape brand; followed a vape brand; entered a competition linked to a vape brand; searched for vape adverts on websites; used an image filter or effect related to vaping; engaged with other vape brand content; or purchased vape products online.

Vaping behaviour

Respondents were asked if they had "ever vaped/used an e-cigarette"; those who said yes were also asked "how often do you vape now" (Never—I don't vape now; Occasionally; Once or twice a month; Once or twice a week; Most days; Daily).

Procedure

We worked with a Māori graphic designer to develop a logo for the project and survey. A digital marketing agency was used to recruit respondents

aged 16–20 years from diverse socio-economic status backgrounds, gender identities and ethnicities. The campaign ran over a 6-week period in early 2022. The survey landing page provided the aims of the study and what participation would involve, and respondents agreed to take part under these conditions. At the end, participants were offered the opportunity to enter a prize draw to win one of six prizes. In total, 3,063 young people aged 16–20 took the survey.

To recruit participants aged 14–15, a number of high schools and kura across Aotearoa New Zealand were contacted in the last half of 2022, informed about the research and asked to assist with recruitment. Schools who agreed sent out an email to parents and caregivers of Year 10 students outlining the research and ensuring they consented to their young person being sent a link to the online survey, or stating they did not want the survey link to be provided to their young person. The survey link was subsequently sent to relevant Year 10 students; 731 respondents aged 14–15 completed the survey.

Participants

Following data screening, the final sample consisted of 3,698 participants. The mean age was 17.1 (SD=1.8), with between 307–665 within each age (see Table 1). Participants could select more than one gender identity; 96.2% checked one and 3.8% checked more than one category. Gender responses were recoded into three discrete categories with multiple responses grouped together, as shown in Table 1. Over half the sample identified as female, over a third as male, and 6% as another (or more than one) gender identity. Participants could select more than one ethnicity group; 73.6% selected one ethnicity and 26.4% selected more than one. Where participants selected more than one, we first re-coded selection of Māori into the Māori category, and then Pasifika into the Pasifika category, to provide independent groups as shown in Table 1. Almost half the sample were Pākehā or NZ European, with over a quarter identifying as Māori. Most respondents reported that they were heterosexual (68%), with 13% reporting that they were bisexual and 5% currently unsure of their sexuality. Most lived in cities (68%), with the rest in towns (26%) and in rural locations (6%). Most respondents were students (84%), while a small number (56; 1.4%) were parents.

Analytic strategy

Exploratory bivariate analyses were conducted on all the primary variables, and the detailed results are provided in the Appendices. The central analyses assessed the associations of vaping behaviour, exposure to vape marketing online and engagement with vape marketing online for the four socio-demographic variables. As there are correlations among the socio-demographic variables, the central analyses were conducted using three binary logistic regressions to control for confounding. Interaction effects were also sought, but none were found that achieved statistical significance. Two new variables were created for the logistic regressions: age was dichotomised (14–17, 18–20) and SES was trichotomised (low, middle, high). Statistical analyses were conducted using IBM SPSS Statistics v.20. Confidence intervals (95% CI) were reported; two-sided $p<0.05$ was considered statistically significant.

Results

Most participants (97%) reported using the internet “almost constantly” or “several times a day”. When asked about how much time they spend on the internet “on a normal day,” 91% reported 3 or more hours. Specifically, 1,700 (56.2%) stated they spent 5 or more hours per day on the internet, 1,038 (34.3%) 3–4 hours, 241 (8%) between 1–2 hours and 45 (1.5%) less than one hour per day. They were high users of social media platforms and reported using between 1–20 different platforms in the past month (M=5.1; median=6). The most commonly used platforms were Instagram (92.2%), YouTube (85.6%), Snapchat (72.8%), TikTok (72.3%) and Facebook (67.5%). The average time users reported spending on these platforms each day varied: 2.8 hours (TikTok), 2.5 hours (YouTube), 1.9 hours (Instagram), 1.7 hours (Snapchat) 1.3 hours (Facebook).

Vaping behaviour

Of the 2,185 participants who responded about whether they had ever vaped, half reported they had (n=1,110; 50.8%), and half had not (n=1,075; 49.2%). Of those who had ever vaped, 425 (38.4%) reported they do not vape now, while 297 (26.8%) reported that they now vaped daily or most days. To examine whether there were differences in vaping history (yes/no) across age, gender, ethnicity and SES groups, a binary logistic regression was undertaken. This and subsequent regressions were each run twice with different ethnicity reference groups in order to obtain all comparisons of interest. The model was significant ($\chi 2$ [8,

Table 1: Description of the sample (N=3,698).

Age (N=3,424)	**n**	**%**
14	386	11.3
15	307	9.0
16	646	18.9
17	586	17.1
18	665	19.4
19	464	13.6
20	370	10.8
Gender (N=3,382)		
Wahine/tamahine/woman/girl	1,817	55.7
Tane/tama/man/boy	1,251	38.3
Transgender, agender, non-binary, intersex, something else	195	6.0
Ethnicity (N=3,365)		
Māori	851	25.6
Pākehā or NZ European	1,552	46.7
Pasifika (Samoan, Cook Islands, Tongan, Niuean, Fijian)	215	6.5
Other	704	21.2
Perceived socio-economic status (N=3,136)		
Not well off at all	153	4.1
Not particularly well off	501	13.5
Fairly well off	1,154	31.2
Rather well off	734	19.8
Very well off	192	5.2
Prefer not to say	402	10.9
Sexuality (N=3,309)		
Straight (heterosexual)	2,236	67.6
Gay/lesbian	117	3.6
Bisexual	440	13.3
Queer, pansexual, asexual, something else	250	7.5
Takatāpui	12	0.4

Table 1 (continued): Description of the sample (N=3,698).

Not sure yet	170	5.1
Prefer not to say	84	2.5
Place of residence (N=3,196)		
Major city	1,743	54.5
Other city	426	13.3
Town	525	16.4
Small town	306	9.6
In the country	196	6.1

Table 2: Binary logistic regression showing differences in vaping history by age, gender, ethnicity and socio-economic status (SES).

	Adjusted odds ratio	95% CI for odds ratio		p-value
		Lower	Upper	
Age[1] 18–20 vs 14–17 years	2.26	1.86	2.74	<0.001
Gender				0.007
Female vs male	1.38	1.13	1.69	0.002
Female vs other	1.21	0.83	1.78	0.324
Ethnicity				<0.001
Māori vs Pākehā	1.84	1.43	2.35	<0.001
Māori vs Pasifika	1.34	0.83	2.16	0.227
Māori vs Other	2.89	2.16	3.86	<0.001
Pasifika vs Pākehā	1.90	1.20	3.00	0.006
Pasifika vs Other	2.47	1.49	4.08	<0.001
Socio-economic status (SES)				0.067
Low vs middle SES	1.35	1.04	1.74	0.022
Low vs high SES	1.28	0.98	1.67	0.073

[1]Coding: Vaping history 1 = yes, 0 = no. For all category contrasts in the predictor variables, the left-hand category = 1 and the right-hand category = 0. This coding favours odds ratios greater than 1 for ease of interpretation.

Table 3: Binary logistic regression showing differences in exposure to vape product advertising on social media by age, gender, ethnicity and socio-economic status (SES).

	Adjusted odds ratio	95% CI for odds ratio		p-value
		Lower	Upper	
Age[1] 18–20 vs 14–17 years	0.74	0.62	0.89	0.002
Gender				0.758
Female vs male	1.04	0.85	1.26	0.713
Female vs other	0.90	0.62	1.30	0.578
Ethnicity				<0.001
Māori vs Pākehā	1.47	1.16	1.85	0.001
Māori vs Pasifika	0.85	0.54	1.34	0.474
Māori vs Other	1.72	1.31	2.26	<0.001
Pasifika vs Pākehā	1.73	1.12	2.69	0.014
Pasifika vs Other	2.03	1.28	3.23	0.002
Socio-economic status (SES)				0.084
Low vs middle SES	1.26	0.99	1.61	0.061
Low vs high SES	1.32	1.02	1.70	0.033

[1]Coding: Vape advertising exposure 1 = yes, 0 = no. For all category contrasts in the predictor variables, the left-hand category = 1 and the right-hand category = 0. This coding favours odds ratios greater than 1 for ease of interpretation.

Table 4: Binary logistic regression showing differences in engagement with vape marketing by age, gender, ethnicity and socio-economic status (SES).

	Adjusted odds ratio	95% CI for odds ratio		p-value
		Lower	Upper	
Age[1] 18–20 vs 14–17 years	1.21	.97	1.50	0.084
Gender				0.403
Female vs male	1.17	0.93	1.47	0.191
Female vs other	0.99	0.65	1.51	0.950
Ethnicity				<0.001
Māori vs Pākehā	1.85	1.43	2.40	<0.001
Māori vs Pasifika	0.98	0.61	1.57	0.925
Māori vs Other	2.41	1.74	3.34	<0.001

Table 4 (continued): Binary logistic regression showing differences in engagement with vape marketing by age, gender, ethnicity and socio-economic status (SES).

Pasifika vs Pākehā	1.90	1.20	3.00	0.006
Pasifika vs Other	2.47	1.49	4.10	<0.001
Socio-economic status (SES)				0.005
Low vs middle SES	1.30	0.99	1.70	0.056
Low vs high SES	1.62	1.21	2.17	0.001

[1]Coding: Vape marketing engagement 1 = yes, 0 = no. For all category contrasts in the predictor variables, the left-hand category = 1 and the right-hand category = 0. This coding favours odds ratios greater than 1 for ease of interpretation.

N=1,860] = 160.34, p<0.001) and age, gender and ethnicity groups made statistically significant contributions to the model, as shown in Table 2. The odds of older respondents (18–20 years) having ever vaped are 2.26 times greater than those for younger respondents (14–17 years). For females, the odds of having a vaping history are 1.38 times greater than those for males. The odds of having vaped among Māori respondents are 1.84 times greater than those for Pākehā, and 2.89 times greater than those for other ethnicities, excluding Pasifika. Pasifika respondents have 1.9 times greater the odds of having a vaping history compared with Pākehā, and 2.47 times greater compared with other ethnicities, excluding Māori. There is a tendency for a vaping history to be more common in lower SES groups, but this overall trend did not achieve statistical significance (p=0.067).

Exposure to vape product advertising on social media

Within the total sample of 3,698 participants, 2,224 (60.1%) responded to whether or not they had seen vape product advertising on any of the social media platforms they reported using regularly. Of these, 1,119 (50.3%) reported they had seen such advertising on at least one platform, while 1,105 (49.7%) responded that they had seen none. Vape advertising was most commonly seen on Instagram (65%), TikTok (58.1%), YouTube (36.4%), Facebook (28%) and Snapchat (25.8%). A binary logistic regression was undertaken to explore differences in vaping advertisement exposure online across age, gender, ethnicity and SES groups. The model was significant (χ^2 [8, N=1,903] = 40.63, p<0.001) and age and ethnicity made statistically significant contributions, as shown in Table 3. The odds ratio of 0.74 shows an inverse relationship with age: younger respondents (14–17) are more likely than older respondents (18–20) to have been exposed to vape product advertising. Māori respondents have 1.47 times greater the odds of having seen vaping advertisements on social media compared with Pākehā, and 1.72 times greater the odds compared with other ethnicities. Pasifika respondents have 1.73 times greater the odds of having seen vaping advertisements compared with Pākehā, and 2.03 times greater the odds compared with other ethnicity groups. Again, the trend towards advertising exposure being more common in lower SES respondents is suggestive but not statistically significant.

Engagement with vape marketing on social media

Of the 2,148 participants who responded to whether they had engaged online with vape product marketing, 563 (26.2%) reported that they had engaged with at least one of the seven vape-related activities listed. Most commonly they had purchased vape products online (n=270; 48.0%), liked a vape brand on social media (n=228; 40.5%) or shared something related to a vape brand (n=221; 39.3%). Among those who had purchased vape products online, 38% (n=102) were aged 14–17 years.

A binary logistic regression was undertaken to explore differences in engagement with vape marketing online across age, gender, ethnicity and SES groups. The model was significant (χ^2 [8, N=1,841] = 67.12, p<0.001), with ethnicity and SES contributing, as shown in Table 4. The odds of Māori respondents engaging with vape marketing are 1.85 times greater than those for Pākehā and 2.41 times greater than those for other ethnicities. The odds of Pasifika respondents engaging with vape marketing are 1.9 times greater than those for Pākehā and 2.47 times greater than those for

other ethnicity groups. Respondents of low SES have 1.62 times greater the odds of engaging with vape advertisements compared with those of high SES.

Associations between vaping history with vape marketing exposure and engagement on social media

Chi-squared analyses were undertaken to explore associations between vape marketing exposure and engagement and vaping history (ever vaped). Respondents who reported seeing vape marketing on social media were more likely to have a vaping history (χ^2= 75.36, p<.001, Cramers V = .19) than those who had never vaped. Similarly, those who reported engaging with vape marketing on social media were significantly more likely to have a vaping history than those who had never vaped (χ^2 = 406.94, p<.001, Cramers V = .44; see Appendices for contingency tables).

Discussion

These findings show that high numbers of young people recall being exposed to vape product marketing on social media platforms, and they are engaging with this marketing in ways that encourage its use as an appealing lifestyle product. This includes young people who are under the legal age of product purchase (18 years), some of whom report purchasing vape products online. It is unlikely that these young people are using vaping as a smoking cessation tool. This marketing appears in young people's social media feeds in ways that cannot be easily tracked or assessed by researchers.

Half of the sample reported having vaped previously, while fewer (8%) reported being current regular vapers. Older respondents (18–20 years), female respondents and Māori and Pasifika respondents were all more likely to report having ever vaped, with no differences found across socio-economic groups. These rates are similar to those reported from the Youth19 survey, in which 10% of students reported vaping regularly (monthly or more), and 6% weekly or more.[1] Previous research with university students in Aotearoa New Zealand found daily vaping rates had increased from 2.7% in 2018 to 5.4% in 2019, with males and older students having higher odds of vaping.[12]

Despite the small number of participants who were current vapers, half of the sample had seen vape product advertising on the social media platforms they use regularly. However, this varied across the socio-demographic groups. Those aged 17 and under were more likely to report seeing vape product advertising compared to those aged 18–20, even though older respondents were more likely to regularly vape. This finding may be explained by the self-reported nature of this data. For older participants vaping may be normalised, and therefore its marketing may be less likely to be noticed or recalled. In contrast, those aged 14–17 years may be at a stage where they are considering vaping, their peers may be starting to vape and they may be more aware of older people vaping. As a result, they may be primed to notice vaping, more susceptible and therefore more likely to think about, notice and recall vape product advertising compared to older participants. There is also the possibility that the industry finds ways to target younger people who are developing formative behaviours and attitudes. Further, respondents were asked about seeing "vape product advertising"; their interpretation of advertising may be broader than paid advertisements and could include organic content from influencers and other popular figures.

While there were no differences in exposure to vape product marketing by gender or socio-economic status groups, Māori and Pasifika respondents were more likely to report seeing vape product advertising than other ethnicity groups. This relationship was not explained by socio-economic status. This finding is concerning given the higher rates of vaping in Māori and Pasifika respondents and raises the possibility that Māori and Pasifika are targeted more than others with vape marketing on their preferred platforms. We do not yet know if higher exposure to vape advertising in the digital environment replicates higher exposure in physical environments. Laking (2023) argues that "*although sales and marketing has had a big part* [of the debate over vaping], *it is not the whole story*".[13] We agree with his analysis that the life experiences of young people are crucial, particularly given Māori experiences of colonisation, poverty and racism[14] as the critical context for understanding some drivers of vaping. Yet this must be considered alongside the strategies of the tobacco industry, which has systematically promoted and targeted Indigenous peoples with commercialised nicotine products.[15,16]

Over a quarter of the sample reported that they had actively engaged with vape product marketing on social media platforms, including purchasing

vape products online, "liking" a vape brand on social media or sharing something related to a vape brand. Māori and Pasifika respondents were more likely to report engaging with vape marketing online than other ethnic groups, again raising issues around the broader life contexts of these young people as drivers of vaping. Lower socio-economic groups were more likely to engage with vape marketing online than higher groups, although there were no differences found by age or gender. Concerningly, of those respondents who reported purchasing vape products online, more than a third (over 100) were aged 14–17. This highlights that current legislation to prohibit underage young people purchasing vape products does not appear to be effective in the digital environment.

Social media's algorithmic marketing models aim to find the most valuable audience for the advertiser. Scholars from different disciplines have theorised how these systems target and deliver advertisements in ways that are likely to lead to skewed outcomes along racialised and gendered lines (e.g., Ali et al.[17]). This has been described as "discrimination by optimisation," even when marketers and advertisers aim to be inclusive.[17,18] While many platforms do not allow advertisers to explicitly target users by ethnicity, algorithms generate "ethnic affinity" categories and social proximity data to personalise advertisements and content in ways that can be racialised and discriminatory.[19] There is very little published empirical work that demonstrates these processes in action; one exception is a study of algorithmically targeted advertising of university scholarships in the USA, which concluded it reproduced ethnic inequities.[20]

Limitations

We need to treat these results with some caution, as they were obtained from a self-selected sample of people who chose to respond to an online survey regarding social media use and marketing. This sample may be more likely than other young people to both notice and engage with vape marketing online. The SES measure asked participants to rate their own perceptions of how well off their family is, and a more objective SES measure might have led to different results. However, previous researchers have noted difficulties in conceptualising and measuring SES among adolescents.[11] They have argued that perceived SES assesses more salient dimensions of their social status than more objective measures (such as parents' occupation), because these perceptions arise from their view of their social position within their own social worlds.[11] The survey design meant that all marketing exposure and engagement questions were asked for every social media platform that respondents reported using regularly. We had not anticipated that respondents would report such a large number of platforms, and this meant that many were replying to every question for a large number of platforms. This may explain the drop-off in responses for the digital marketing section in the online questionnaire and help explain why there were more missing data in this section. Reporting biases may also have affected these findings; for example, some questions may have been deemed more sensitive by specific groups who therefore chose to either not answer the question, or to answer in a way that portrayed them more positively (e.g., higher SES groups, particular age groups may have chosen not to respond about particular topics).

Conclusions

Despite the limitations of the study, these findings raise concerns about the high levels of vape product marketing that young people are being exposed to on social media platforms, and the inequitable targeting of such marketing. While not detracting from the potential effects of such specific targeting and exposure, we need to consider these findings within their context, where colonial trauma, structural forms of disadvantage and racism are associated with higher use of addictive products and inequitable health outcomes for Māori.[13,21] It is also worth noting that the patterns of exposure to digital marketing identified in this study are normally occluded due to the ways in which social media platforms operate, and only become apparent through the retrospective recall of users. Such lack of transparency is an issue that needs to be urgently addressed.

COMPETING INTERESTS
Nil.

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Appendices

Appendix 1: Bivariate associations among the socio-demographic variables

Appendix Table 1: Association between age and gender.

			Gender			Total
			Wahine/female	Tane/male	All others	
Age	14–17	Count	927	792	101	1,820
		% within age	50.9%	43.5%	5.5%	100.0%
	18–20	Count	889	458	94	1,441
		% within age	61.7%	31.8%	6.5%	100.0%
Total		Count	1,816	1,250	195	3,261
		% within age	55.7%	38.3%	6.0%	100.0%

Chi-square (2, N=3,261) = 46.88, p<.001, Cramers V=.12

Appendix Table 2: Association between age and ethnicity.

			Ethnicity				Total
			Māori	Pākehā	Pasifika	Other	
Age	14–17	Count	487	835	129	408	1,859
		% within age	26.2%	44.9%	6.9%	21.9%	100.0%
	18–20	Count	364	716	85	296	1,461
		% within age	24.9%	49.0%	5.8%	20.3%	100.0%
Total		Count	851	1,551	214	704	3,320
		% within age d	25.6%	46.7%	6.4%	21.2%	100.0%

Chi-square (3, N=3,320) = 6.15, p=.11, Cramers V=.04

Appendix Table 3: Association between age and SES.

			SES			Total
			Low	Middle	High	
Age	14–17	Count	301	613	558	1,472
		% within age	20.4%	41.6%	37.9%	100.0%
	18–20	Count	353	541	367	1,261
		% within age	28.0%	42.9%	29.1%	100.0%
Total		Count	654	1,154	925	2,733
		% within age	23.9%	42.2%	33.8%	100.0%

Chi-square (2, N=2,733) = 31.97, p<.001, Cramers V=.11

Appendix Table 4: Association between gender and ethnicity.

			Ethnicity				Total
			Māori	Pākehā	Pasifika	Other	
Gender	Wahine/female	Count	486	835	114	353	1,788
		% within gender	27.2%	46.7%	6.4%	19.7%	100.0%
	Tane/male	Count	302	560	84	281	1,227
		% within gender	24.6%	45.6%	6.8%	22.9%	100.0%
	All others	Count	40	103	7	41	191
		% within gender	20.9%	53.9%	3.7%	21.5%	100.0%
Total		Count	828	1,498	205	675	3,206
		% within gender	25.8%	46.7%	6.4%	21.1%	100.0%

Chi-square (6, N=3,206) = 12.25, p=.06, Cramers V=.04

Appendix Table 5: Association between gender and SES.

			SES			Total
			Low	Middle	High	
Gender	Wahine/female	Count	377	647	458	1,482
		% within gender	25.4%	43.7%	30.9%	100.0%
	Tane/male	Count	205	411	385	1,001
		% within gender	20.5%	41.1%	38.5%	100.0%
	All others	Count	45	62	58	165
		% within gender	27.3%	37.6%	35.2%	100.0%
Total		Count	627	1,120	901	2,648
		% within gender	23.7%	42.3%	34.0%	100.0%

Chi-square (4, N =2,648) = 19.14, p=.001, Cramers V=.06

Appendix Table 6: Association between ethnicity and SES.

			SES			Total
			Low	Middle	High	
Ethnicity	Māori	Count	234	263	139	636
		% within ethnicity	36.8%	41.4%	21.9%	100.0%
	Pākehā	Count	253	541	544	1,338
		% within ethnicity	18.9%	40.4%	40.7%	100.0%

Appendix Table 6 (continued): Association between ethnicity and SES.

Ethnicity	Pasifika	Count	43	72	38	153
		% within ethnicity	28.1%	47.1%	24.8%	100.0%
	Other	Count	115	265	202	582
		% within ethnicity	19.8%	45.5%	34.7%	100.0%
Total		Count	645	1,141	923	2,709
		% within ethnicity	23.8%	42.1%	34.1%	100.0%

Chi-square (6, N=2,709) = 115.99, p<.001, Cramers V=.15

Appendix 2: Bivariate associations among the vaping variables (behaviour, marketing exposure and engagement marketing)

Appendix Table 7: Association between vaping behaviour and advert exposure.

			Seen advert		Total
			No	Yes	
Ever vaped	No	Count	626	417	1,043
		% within ever vaped	60.0%	40.0%	100.0%
	Yes	Count	447	638	1,085
		% within ever vaped	41.2%	58.8%	100.0%
Total		Count	1,073	1,055	2,128
		% within ever vaped	50.4%	49.6%	100.0%

Chi-square (1, N=2,128) = 75.36), p<.001, Cramers V=.19

Appendix Table 8: Association between vaping behaviour and advert engagement.

			Engaged with advert		Total
			No	Yes	
Ever vaped	No	Count	952	60	1,012
		% within ever vaped	94.1%	5.9%	100.0%
	Yes	Count	580	470	1,050
		% within ever vaped	55.2%	44.8%	100.0%
Total		Count	1,532	530	2,062
		% within ever vaped	74.3%	25.7%	100.0%

Chi-square (1, N=2,062) = 406.94, p<.001, Cramers V=.44

Appendix Table 9: Association between advert exposure and engagement.

			Engaged with advert		Total
			No	Yes	
Seen advert	No	Count	905	151	1,056
		% within advert seen	85.7%	14.3%	100.0%
	Yes	Count	639	406	1,045
		% within advert seen	61.1%	38.9%	100.0%
Total		Count	1,544	557	2,101
		% within advert seen	73.5%	26.5%	100.0%

Chi-square (1, N=2,101) = 162.52, p<.001, Cramers V=.28

Appendix 3: Bivariate associations between socio-demographic and vaping variables

Appendix Table 10: Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vaping behaviour.

Socio-demographic variable	Subgroup	Ever vaped						df (N)	Chi-square	p-value	Cramer's V
		No		Yes		Total					
		Count	%	Count	%	Count	%				
Age	14–17	721	58.1	519	48.9	1,240	100				
	18–20	354	37.5	591	62.5	945	100				
	All ages	1,075	49.2	1,110	50.8	2,185	100				
								1 (2,185)	91.81	<.001	.21
Gender	Wahine/female	524	44.4	655	55.6	1,179	100				
	Tane/male	432	55.2	350	44.8	782	100				
	Other genders	72	49.0	75	51.0	147	100				
	All genders	1,028	48.8	1,080	51.2	2,108	100				
								2 (2,108)	21.95	<.001	.10
Ethnicity	Māori	181	34.5	343	65.5	524	100				
	Pākehā	529	50.0	529	50.0	1,058	100				
	Pasifika	59	50.9	57	49.1	116	100				
	Other	292	62.5	175	37.5	467	100				
	All ethnicities	1,061	49.0	1,104	51.0	2,165					
								3 (2,165)	78.61	<.001	.19

Appendix Table 10 (continued): Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vaping behaviour.

SES	Low	172	39.3	266	60.7	438	100				
	Middle	417	51.0	401	49.0	818	100				
	High	355	52.4	322	47.6	677	100				
	All SES	944	48.8	989	51.2	1,933					
								2 (1,933)	21.06	<.001	.10

Appendix Table 11: Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vape advert exposure.

Socio-demographic variable	**Subgroup**	**Seen vape advert**						**df (N)**	**Chi-square**	**p-value**	**Cramer's V**
		No		**Yes**		**Total**					
		Count	**%**	**Count**	**%**	**Count**	**%**				
Age	14–17	592	46.8	672	53.2	1,264	100				
	18–20	513	53.4	447	46.6	960	100				
	All ages	1,105	49.7	1,119	50.3	2,224	100				
								1 (2,224)	9.51	.002	.07
Gender	Wahine/female	587	48.4	625	51.6	1,212	100				
	Tane/male	400	50.7	389	49.3	789	100				
	Other genders	74	50.3	73	49.7	147	100				
	All genders	1,061	49.4	1,087	50.6	2,148	100				
								2 (2,148)	1.04	.60	.02

Appendix Table 11 (continued): Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vape advert exposure.

Ethnicity	Māori	221	41.5	311	58.5	532	100				
	Pākehā	567	52.7	508	47.3	1,075	100				
	Pasifika	46	37.4	77	62.6	123	100				
	Other	257	54.3	216	45.7	473	100				
	All ethnicities	1,091	49.5	1,112	50.5	2,203	100				
								3 (2,203)	29.63	< .001	.12
SES	Low	193	43.1	255	56.9	448	100				
	Middle	431	51.4	407	48.6	838	100				
	High	371	53.5	323	46.5	694	100				
	All SES	995	50.3	985	49.7	1,980	100				
								2 (980)	12.54	.002	.08

Appendix 12: Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vape advert engagement.

Socio-demographic variable	**Subgroup**	**Engaged with vape advert**						**df (N)**	**Chi-square**	**p-value**	**Cramer's V**
		No		**Yes**		**Total**					
		Count	**%**	**Count**	**%**	**Count**	**%**				
Age	14–17	919	75.8	293	24.2	1,212	100				
	18–20	666	71.2	270	28.8	936	100				
	All ages	1,585	73.8	563	26.2	2,148	100				
								1 (2,148)	5.96	.02	.05

Appendix 12 (continued): Chi-squared analyses of associations between socio-demographic variables (age, gender, ethnicity and SES) with vape advert engagement.

Gender	Wahine/female	829	71.5	330	28.5	1,159	100				
	Tane/male	595	77.4	174	22.6	769	100				
	Other genders	106	73.1	39	26.9	145	100				
	All genders	1,530	73.8	543	26.2	2,073	100				
								2 (2,073)	8.21	.02	.06
Ethnicity	Māori	313	61.3	198	38.7	511	100				
	Pākehā	805	77.3	237	22.7	1,042	100				
	Pasifika	77	64.7	42	35.3	119	100				
	Other	375	82.1	82	17.9	457	100				
	All ethnicities	1,570	73.7	559	26.3	2,129	100				
								3 (2,129)	69.15	<.001	.18
SES	Low	281	65.5	148	34.5	429	100				
	Middle	605	74.6	206	25.4	811	100				
	High	538	79.9	135	20.1	673	100				
	All SES	1,424	74.4	489	25.6	1,913	100				
								2 (1,913)	28.73	<.001	.12

Radiation cystitis in acute admissions for haematuria

Nasya Thompson, Chris Frampton, Giovanni Losco

ABSTRACT

AIMS: To assess the outcomes of patients with haematuria from radiation cystitis admitted to Christchurch Hospital's Urology Service and identify treatment differences and hospitalisation trends.

METHODS: From November 2021 to January 2023, a retrospective analysis of 144 acute haematuria admissions was conducted. Data covered demographics, diagnosis, surgeries, complications and hospital stay length. Predictive factors for admissions and surgical interventions were explored.

RESULTS: Of the 144 admissions, 22 (15.3%) were diagnosed with radiation cystitis. The management strategies for radiation cystitis and non-radiation cystitis patients showed no significant differences in transfusion requirements, anti-bleeding medication usage (finasteride and/or tranexamic acid), or the need for acute or elective surgery. The average length of stay for admission was similar between the groups (radiation cystitis: 3.7 days, non-radiation cystitis: 3.5 days, $p<0.05$), but the readmission rate was significantly higher for radiation cystitis patients (59.1% vs 25.4%, $p<0.01$).

CONCLUSIONS: The management and hospital stay duration were similar for both cohorts; radiation cystitis patients faced increased readmissions, underscoring the necessity for rigorous monitoring and subsequent care. Upcoming research should target refining early interventions and management methods.

Haematuria is a common clinical presentation requiring acute admission to the hospital. It can be indicative of a variety of underlying urological conditions such as benign prostate hyperplasia, renal bleeding, cancer and radiation cystitis.[1,2] As a result of the ageing population, the incidence of haematuria-related acute admissions is rising, placing a growing burden on the healthcare system. Consequently, there is a growing need to optimise management pathways for patients presenting to hospital with haematuria.[3]

Radiation cystitis is a chronic inflammatory condition of the bladder that is recognised as a common late complication of radiation therapy for pelvic malignancies, including bladder, prostate and cervical cancer.[4–6] With the enhancement of cancer treatments and radiation therapy techniques resulting in an increasing number of cancer survivors, the prevalence of radiation cystitis has also grown. The pathophysiology of radiation cystitis is a complex cycle involving damage to the vasculature and smooth muscle cells of the bladder, resulting in ischaemia, subsequent fibrosis and ultimately impaired bladder function.[7]

Patients with radiation cystitis may present with various symptoms, including haematuria, clot retention, urinary urgency, frequency and dysuria.[4] The severity of haematuria in these patients can range from microscopic to life-threatening macroscopic haematuria in which hospitalisation is necessitated. In cases of severe haematuria, bleeding may be refractory to conservative management strategies; in these situations, invasive interventions such as endoscopic coagulation, embolisation or cystectomy may be necessitated.[4] Moreover, radiation cystitis and its associated symptoms can significantly impair a patient's quality of life through recurrent hospital admissions and ongoing interventions to manage these. The aim of the current study was to understand the patient outcomes of acute admissions to the Urology Service at Christchurch Hospital with haematuria caused by radiation cystitis.

Methods

Population

All patients acutely admitted to the Urology Service at Christchurch Hospital, New Zealand with haematuria between November 2021 to January 2023 were included in the study. Decision Support identified all acute admissions under Urology where the diagnosis was haematuria. Patients were excluded from analysis if trauma was listed as the primary cause of their presentation.

Data collection

The dataset was identified and a retrospective review of individual health records up to January 2023 was undertaken. Demographics, past medical history, final diagnosis, surgical procedures, medications, length of admission and readmission were extracted from the electronic health record Health Connect South (HCS). HCS is an Orion Health solution that collates information such as test results, medications, previous hospital admissions and emergency department attendances from disparate sources and presents it in a single patient view. The data were then entered into a de-identified database for statistical analyses.

Ethics

Ethics was obtained from the local district health board ethics approval committee; locality authorisation was obtained from the Te Whatu Ora – Waitaha Canterbury Research Office (RO #23122). This study was out of scope of the national New Zealand Health and Disability Ethics Committee (HDEC) ethics review.

Statistics

The statistical comparisons of the different management approaches between the presentations with radiation cystitis vs non-radiation cystitis haematuria were undertaken using Chi-squared tests or Fisher's exact tests when the minimum expected frequencies were <5.0. The length of hospital stay was compared using the Mann–Whitney U test and the percent of admissions requiring a readmission was compared using a Chi-squared test.

Results

Case identification

A total of 99 patients who were acutely admitted to the Christchurch Urology Service for haematuria were identified by Decision Support. There were 145 admissions in total (including patient representations). Of these one was excluded, as the primary cause of their haematuria was acute trauma to the bladder. Data were extracted from the remaining 144 presentations for analysis.

Patient demographics and clinical characteristics

Table 1 outlines the demographic data of the population who were admitted under the Christchurch Urology Service with an acute presentation of haematuria. There were 98 patients (96% male). The median age at presentation was 77 years (range: 28–96).

All patients were investigated for a cause of haematuria using our standard investigation pathway, which involved CT IVU or renal ultrasound and flexible cystoscopy. Where no clear cause of haematuria was evident, the cause was determined as "unknown". It is expected that for many of the male patients in this group, benign prostatic bleeding will have been the most likely aetiology. All the patients had a cystoscopy to confirm the diagnosis of radiation cystitis and to rule out secondary malignancy.

Details of radiation therapy administered

Table 2 provides an overview of the radiation therapy details. The majority of patients received radiation for prostate cancer (N=20).

Management of radiation cystitis

Table 3 summarises the distribution of management approaches for each group (radiation cystitis versus non-radiation cystitis), along with the associated p-values.

There is no significant difference between the radiation cystitis and non-radiation cystitis groups in terms of patients requiring transfusion (p=0.2), starting on finasteride and/or tranexamic acid medication (p=0.4), undergoing acute surgery (p=0.9), or undergoing elective surgery (p=0.7) (Table 3). A significant difference was observed in the use of hyperbaric oxygen therapy (HBO), with 54.5% of patients in the radiation cystitis group receiving this treatment compared to only 3.3% in the non-radiation cystitis group (p <0.0016).

Hospital stay and readmissions

The table below summarises the average length of stay, readmission rates and associated p-values for each group.

There was no significant difference in the average length of stay for admission between the radiation cystitis group (3.7 days; range: 1–11) and the non-radiation cystitis group (3.5 days; range: 1–17) (p >0.05) (Table 4). However, a significant difference was observed in the readmission rate, with 59.1% of patients in the radiation cystitis group experiencing readmissions compared to only 25.4% in the non-radiation cystitis group (p=0.0016). The median time between a patient receiving radiation treatment and presenting with radiation cystitis-induced haematuria was 7 years (range: 0.2–14 years).

Figure 1: An overview of included and excluded patients who had an acute admission for haematuria.

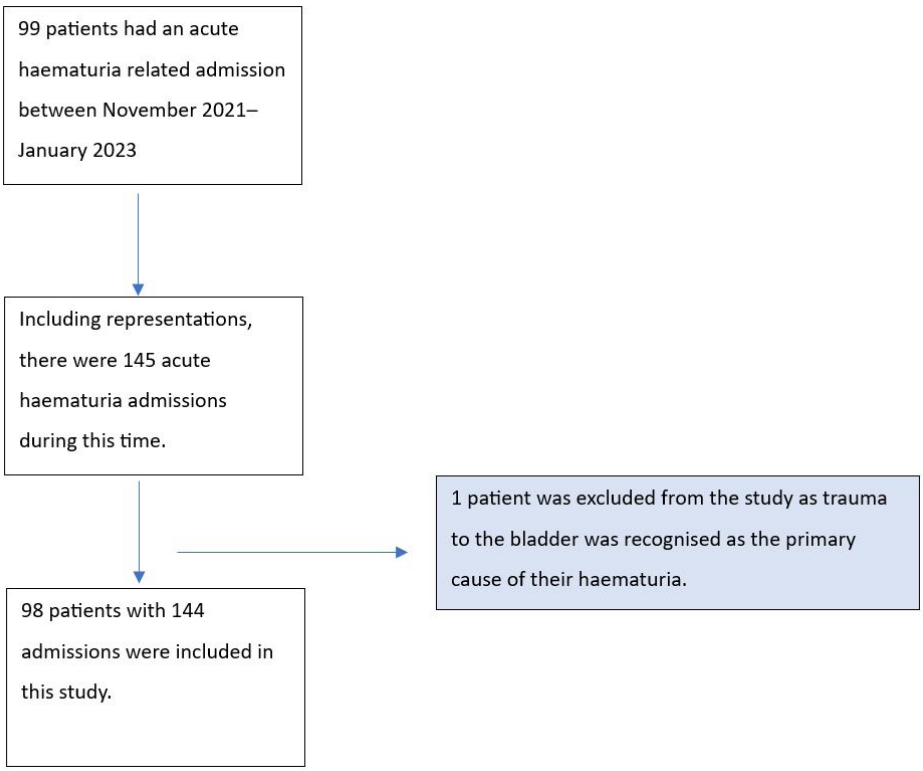

Table 1: Patient demographic data.

Demographics	**n (%)**
Total number of patients	98
Total number of admissions	144
Gender (male)	94 (96%)
Ethnicity	
NZ European	61 (61.6)
NZ Māori	5 (5.1)
Chinese	2 (2.0)
Samoan	1 (1.0)
Other	30 (30.3)
Median age at diagnosis (years)	77 (range: 28–96)
Final diagnosis	
Unknown	31 (21.5%)
Radiation cystitis	22 (15.3%)

Table 1 (continued): Patient demographic data.

Bladder malignancy	15 (10.4%)
Post-operative complication	14 (9.7%)
Vascular prostate	15 (10.4%)
Trauma related to catheter	13 (9.0%)
Renal malignancy	7 (4.9%)
Anticoagulant use	5 (3.5%)
Prostate cancer	6 (4.2%)
Secondary to UTI	6 (4.2%)
Not investigated at patient request	4 (2.8%)
Bladder calculi	3 (2.1%)
ESWL	1 (0.7%)
Ureteric stone	1 (0.7%)
Bladder invasion of uterine cancer	1 (0.7%)

* The classification of "Other" as the patient's ethnicity was sourced directly from the Health Connect South portal. It represents the primary ethnicity chosen by the patient at some point in time.

Table 2: Breakdown of radiation components and indications.

Overview of radiation treatment	**N (%)**
Indication	
Prostate cancer	20 (90)
Bladder cancer	1 (5)
Precursor T-cell ALL	1 (5)
Type of radiation	
Short-course	2 (9)
Long-course	15 (68)
Information not available	5 (23)
Length of radiation (mean, days)	49.8 (range: 2–58)

Table 3: Management of patients with radiation cystitis vs non-radiation cystitis haematuria.

Management	Radiation cystitis n (%)	Non-radiation cystitis n (%)	p-value
Transfusion required	6 (28.6)	20 (16)	0.2
Started on antibleeding medication (finasteride and/or tranexamic acid)	4 (19.0)	38 (30.6)	0.4
Underwent acute surgery	3 (14.3)	15 (12.1)	0.9
Underwent elective surgery	1 (4.8)	13 (10.5)	0.7
Hyperbaric oxygen therapy	12 (54.5)	4 (3.3)	0.0016

Table 4: Hospital stay and readmissions for patients with radiation and non-radiation cystitis.

Measure	Radiation cystitis	Non-radiation cystitis	p-value
Average length of stay for admission	3.7 (range: 1–11)	3.5 (range: 1–17)	>0.05
Number of readmissions	13 (62.0%)	31 (25.0%)	<0.01

Discussion

Radiation cystitis is a well-recognised complication of radiotherapy to the pelvis and a significant cause of haematuria admissions to hospital. As a result of increasing usage of radiotherapy in the management of pelvic malignancies (especially in prostate cancer), understanding the management pathways, hospital stays and readmission rates for radiation cystitis patients is critical in optimising patient quality of life and improving outcomes. Our findings revealed no significant differences in management strategies, but a significantly higher readmission rate among radiation cystitis patients compared to non-radiation cystitis patients indicated this complication represents a significant burden of care to the health system.

The management of radiation cystitis-induced haematuria often requires a tailored approach to optimise patient outcomes and can include a variety of treatment modalities. Strategies tend to focus on conservative measures including irrigation of the bladder, sufficient analgesia and the use of anticholinergics.[3] We found no statistically significant differences in terms of patients requiring transfusion (although this group are twice as likely to require a transfusion), commencement of anti-bleeding medication (such as tranexamic acid) or undergoing acute or elective surgery. Higher rates of transfusion and surgical intervention in radiation cystitis are markers of the more severe and refractory nature of the underlying condition, which can often result in prolonged and often more severe bleeding.[8] However, there is limited research surrounding the management differences and further investigations are required to substantiate our observations to delineate the treatment strategies among these patients.

HBO is recognised as an important treatment in radiation-induced haematuria, as it mitigates bleeding through the promotion of angiogenesis, tissue healing and anti-inflammatory processes.[9,10] Additionally, the utilisation of HBO in these patients has been shown to improve quality of life and reduce the likelihood of subsequent invasive interventions in patients with radiation cystitis.[9,10] In a study by Pereira et al. (2020), while they found a 92.4% success rate in the control of haematuria, 24.7% of patients presented with recurrence of haematuria within a 63 month follow-up period.[11] Similar rates of recurrence have also been found in other studies.[12–14] As a proportion of readmitted patients had previously received HBO treatment, it raises questions surrounding the efficacy of the treatment and the criteria in which patients have been selected. It is possible that some patients may not be experiencing long-lasting benefits from HBO and may require more intensive or extended sessions. Alternatively, a patient's underlying comorbidities or lifestyle factors, including smoking and drinking,

could influence treatment outcomes.[15] Bouaziz et al. (2016) and Mougin et al. (2016) demonstrated that anticoagulant therapy was a significant negative predictive factor in the success of HBO therapy.[16,17] Further research is required to better understand the complex interplay between patient characteristics, severity of radiation cystitis and the nuances of HBO.

The length of stay for hospital admissions for patients presenting with haematuria is influenced by numerous factors, including the underlying diagnosis, severity of haematuria and the availability and effectiveness of treatment. Prolonged admission to hospital can negatively affect patient quality of life and outcomes; therefore, understanding the differences in duration of hospital stay for different underlying conditions is critical in optimising care. In our study, we found no significant difference in the average length of stay for admission between the radiation cystitis group (3.5 days; range: 1–11) and the non-radiation cystitis group (3.7 days; range: 1–17) ($p > 0.05$). However, it is essential to consider the influence that risk factors such as patient comorbidities, age and severity of the condition causing the haematuria may have on individual length of stay. Furthermore, additional investigations are required to explore the impact that early intervention and more intensive management have on altering the length of hospital stay. Although the average length of stay for admission did not differ significantly between the two groups, the readmission rate was substantially higher for radiation cystitis patients (62.0% vs 25.0%, $p=0.0003$). The increased rate of readmission in patients with radiation cystitis may be attributed to the recurrent and persistent nature of the underlying condition,[4] which can often be more challenging than non-radiation cystitis-induced haematuria to manage. Sanguedolce et al. (2021) examined patients with radiation-induced haematuria to pinpoint those at an elevated risk of hospital admission and invasive treatment. Their findings revealed a significant association between anticoagulant/antiplatelet therapy and salvage radiotherapy with a higher likelihood of hospitalisation.[18] These results highlight the need for closer clinical monitoring and follow-up care in patients with radiation cystitis to reduce the risk of acute admission to hospital and improve patient outcomes.

The median length of time between radiation treatment being delivered and first presentation with radiation cystitis was 7 years. This is similar to previous studies looking at HBO therapy.[12] It is anticipated that patients have often fallen out of regular oncology follow-up by this timeframe, and the long-term development of radiation cystitis must be considered a survivorship issue in patients undergoing this treatment. Appropriate patient counselling is recommended prior to radiation treatment to ensure that the potential long-term risks are clearly articulated, to inform patient decision-making.

The limitations of this study include its retrospective design and the relatively small sample size, which could affect the generalisability of the findings. Additionally, the study did not analyse potential confounding factors, such as comorbidities that may have influenced the management strategies and readmission rates. Moreover, the emergency department presentations and subsequent non-admissions represent a potential gap in our data. Some presentations that did not require admission under the Urology department may still have resulted in significant medical interventions or referrals. Future research should focus on larger, prospective studies or randomised controlled trials to further elucidate the differences in management strategies and readmission rates between radiation and non-radiation cystitis patients.

Conclusion

Radiation cystitis creates a significant burden on patients and the healthcare system. The complexities associated with radiation treatment and the difficult to manage long-term sequalae warrants consideration as part of the treatment decision to offer radiation to patients, particularly in conditions where the long-term benefit from a cancer-control perspective may be modest, or where valid alternatives exist. The findings of this study advocate for further research into effective management strategies and interventions to mitigate the burden of radiation cystitis.

COMPETING INTERESTS
There are no conflicts of interest to declare. This project was funded by the Canterbury Urology Research Trust.

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New migrants' access to primary healthcare services in Aotearoa New Zealand

Megan Pledger, Sue Buckley, Jacqueline Cumming

ABSTRACT

AIM: To explore new migrants' access to primary healthcare services in the first 10 years after arrival in Aotearoa New Zealand.

METHODS: Data come from three New Zealand Health Surveys (2014/2015, 2015/2016 and 2016/2017), which each sampled around 13,500 people, aged 15+ years, who were usual residents of Aotearoa New Zealand. Respondents who said they were born overseas were asked the first year they had come to Aotearoa New Zealand. Those who had arrived in the 10 years before their survey was completed were considered new migrants. The survey data were pooled and around 3,700 respondents were estimated to fit this category. Log-linear models, with adjustments for age, sex, ethnicity and New Zealand Deprivation Index, were used to look at last year use of primary healthcare.

RESULTS: Overall, new migrants used primary healthcare similarly to other New Zealanders. They were more likely to have comprehensive health insurance and paid more for GP visits upon arrival but acted similarly to other New Zealanders after 4 years.

CONCLUSION: Generally, new migrants—after adjusting for covariates—appear to be accessing primary healthcare services in a similar manner to other New Zealanders, on average, soon after arrival.

Due to the COVID-19 pandemic, the Aotearoa New Zealand Government closed the border to all but New Zealand citizens and permanent residents on 19 March 2020.[1] The borders remained closed, with very limed access by foreign nationals,[2,3] until 31 July 2022 when the borders reopened fully.[4]

While the rate of new migrants arriving after the borders were re-opened was initially slow, by March 2023 there had been a net gain of 88,900 non-New Zealand citizens in the previous 12 months.[5] In comparison, for the years 2015–2019—prior to the pandemic—the equivalent, average net gain in the March-ending years was 60,300 per year.[5] With strong rates of migrant arrivals, equal to a 1.8% increase in the population, it is important that we understand how migrants use health services in order to ensure that there is adequate and equitable service provision.

It is widely reported in literature that new migrants arrive with a "healthy immigrant effect", whereby migrants are seen to be in "good health" at the time of migration and tend to have better health status than those locally born, but that their health then deteriorates over time.[6–8] Explanations for their relatively good health statuses are partly because of "health screening" during the migration process and partly a consequence of "migrant selection", as immigrants tend to be those who are young, reasonably educated and have a successful business and professional background, particularly those who are in the "skilled migrant" category.[9] The subsequent deterioration in health has been attributed to problems with access to health services, including cultural and language barriers, lack of health insurance and lack of knowledge of the health system. Local health service providers may also be unfamiliar with some illnesses and may not have the trained staff to deliver culturally sensitive health services.[10]

In Aotearoa New Zealand, language and lack of knowledge of the Aotearoa New Zealand health system have been found to be barriers to appropriate healthcare.[11] Other barriers, as reported by health service providers, include cultural differences in assessment and treatment, lack of cultural competency among health professionals, stigma associated with health issues, concerns about lack of confidentiality, transport difficulties and cost issues.[12] This may be even more evident for refugees, who may come to Aotearoa New Zealand with long-term physical and psychological effects from escaping conflict and persecution and, as a result, have different needs and barriers to accessing care.[13]

Immigration requirements stipulate that a

medical certificate and a chest X-ray (with some exceptions) for adults staying in Aotearoa New Zealand for more than 12 months be provided as part of the visa application procedure.[14] These requirements mean that new migrants have had a recent, thorough medical check in the country they are applying from or, if applying for a long-term visa while in Aotearoa New Zealand, have had a medical check locally. In addition, refugees or asylum seekers arriving in Aotearoa New Zealand enter via the Māngere Refugee Resettlement Centre where they are screened for a range of health conditions and are referred, where necessary, to primary or secondary health services.[15,16] The Refugee Health Screening Service provides each person with information about the Aotearoa New Zealand health system, and with medical records, and also assists with transfer to primary healthcare in the area of settlement.[15,16] Therefore, we would expect that new migrants would 1) be healthy, and 2) have some experience in accessing healthcare services, primarily within their country of origin.

Our expectation would be that the possible difficulty in accessing a new health system and lower health need would mean that new migrants would access primary healthcare services less often initially but over time would increasingly resemble how other New Zealanders access these services. This paper set out to see if this expectation holds by exploring how new migrants use primary healthcare services in the first 10 years after arrival.

Methods

Te Manatū Hauora – Ministry of Health (MoH) has been running continuous, yearly, cross-sectional surveys about New Zealanders' health and health service use since 2011.[17] Each survey runs from July in one year until the end of June in the next. The data in this study are sourced from three New Zealand Health Surveys (NZHS), NZHS 2014/2015, NZHS 2015/2016 and NZHS 2016/2017.[17] These three consecutive surveys were chosen because they reported information about key variables on migration in an identical and more informative way.

Each survey contains approximately 13,500 respondents aged 15 years or older. Anyone in a household who was not a New Zealand citizen or resident but who intended to stay in Aotearoa New Zealand for 12 months or more was in the sample frame (personal communication: in an email from the Health Survey Team, Ministry of Health, 1 March 2019, on behalf of the Health and Disability Intelligence Group, HDI@moh.govt.nz; now healthsurvey@health.govt.nz).

The surveys used a complex method of sampling that included oversampling Māori, Pacific and Asian peoples, but has been weighted to produce a representative sample.[17] SUDAAN was used for the statistics analyses.[18]

Respondents who said they were born overseas were asked what year they had first arrived in Aotearoa New Zealand. For the purposes of this study, those who had arrived in the 10 years before their survey was completed were considered new migrants. Those who arrived more than 10 years before their survey was completed were categorised as old migrants and the remainder were Aotearoa New Zealand-born; together, these latter two groups were combined to form a group called other New Zealanders. The survey data were pooled and around 3,700 respondents were estimated to be new migrants and 37,000 were deemed to be other New Zealanders.

The healthcare variables of interest were primary healthcare service use and services that may substitute for other primary healthcare during the year prior to the survey. For example, pharmacy use and use of an after-hours medical centre, as well as emergency department use at a hospital, may substitute for utilising healthcare through a general practice.

Some new migrants had not been in Aotearoa New Zealand a full year and so two estimates of their health service use over the prior year were made—one estimate was their use since arrival and another estimate was what their use would be over 1 complete year.

Two further variables of interest were cost of seeing a GP on the last visit for those respondents who had seen a GP in the last year, and having comprehensive health insurance (i.e., covering day-to-day costs such as GP fees and pharmacy charges, as well as private hospital care). As these variables did not concern a span of time, no adjustment was made for those respondents who had spent less than 1 year in Aotearoa New Zealand.

The data that were available for time spent in Aotearoa New Zealand was the year of a respondent's arrival and the start and end dates that the survey was in the field. We were not able to access the actual dates of the survey interviews as these were not included in the publicly available datasets. For the 2016/2017 survey, we

calculated a first estimate for time in Aotearoa New Zealand as proxy-year = 2017–year of arrival. If someone said they arrived in 2017, then their proxy-year value was 0. If someone said they arrived in 2016, their proxy-year value was 1 but the potential time they had been in Aotearoa New Zealand before being interviewed could have been between 0 and 1.5 years—e.g., they could have arrived on 1 January 2016 and been interviewed on 31 June 2017 or they could have arrived on the 1 July 2016 and been interviewed the same day. Assuming that migrants arrived in Aotearoa New Zealand with equal probability on any day and that interviewing was equally likely on any day, we were able to work out by simulation (see Table 1) what proportion of each proxy-year a group had been in Aotearoa New Zealand for: 0, 1 or up to 10 years. All the people with proxy-year = 0 had been in Aotearoa New Zealand less than 1 year, about 6/7 of people with proxy-year = 1 had been in Aotearoa New Zealand less than 1 year, and around 1/8 of people with proxy-year = 2 had been in Aotearoa New Zealand less than 1 year. The value year that was used in modelling was the median complete year length for each proxy-year. So, for example, for proxy-year 2, 75% of respondents were likely to have been in Aotearoa New Zealand between 1 and 2 years or 1 complete year, so the value used for year in the modelling was 1. This means that around 75% of the respondents are correctly classified according to complete years but about 12.5% should have been classified with a lower year value and similarly 12.5% with a higher year value.

Under the assumptions of respondents being equally likely to arrive on any day of the year and being surveyed on any day the survey was in the field (after they arrived), we were also able to work out the respondents' average time in Aotearoa New Zealand for each proxy-year value. This "exposure" time was used as the offset in the log-linear model when calculating year-based statistics for groups where members had been in Aotearoa New Zealand less than 1 year; otherwise, it was set at 1.

Table 1 sets out the exposure time and probability of arriving X years ago for different values of proxy-year for the NZHS 2016/2017 and the value taken for year used in modelling. Similar calculations can be done for NZHS 2014/2015 and NZHS 2015/2016 so that proxy-year and year each have a similar meaning across surveys.

Each of the service use variables of interest were treated as a dependent variable with year as the independent variable, modelled categorically, and with confounding variables: sex, prioritised ethnicity, age group, and the New Zealand Deprivation Index (NZDep).

Prioritised ethnicity is set in this order: 1) Māori, 2) Pacific people, 3) Asian, 4) Other, and 5) NZ European. Age, for the purposes of modelling, was grouped into 5-year bands but for brevity is presented in 10-years bands in the tables. The variable NZDep is constructed from census data and indicates the level of deprivation that exists in a small region. Individuals who live in that region were assigned the NZDep for their region. For the purposes of analysis, NZDep has been grouped into quintiles with a value of 1 indicating low deprivation and 5 indicating high deprivation.

The statistics of primary interest were the marginal means for each year from the log-linear models. By running contrasts on the marginal means, we could test a) if there was a linear trend over the first 10 years since arrival, and b) see if the average of the new migrants' estimates over the first 10 years since arrival is equal to the estimate for other New Zealanders. For the sake of brevity, we will call this a test of the average difference between new migrants and other New Zealanders.

Cross tabulations were undertaken on several socio-demographic variables to investigate the characteristics of new migrants, old migrants and those born in Aotearoa New Zealand. Generalised logit models were used with membership in the three migrant groups being the independent variable and each of the socio-economic variables in turn being the dependent variable. P-values for the differences in marginal means between the two migrant groups and the Aotearoa New Zealand-born group were output.

As the total sample contains approximately 41,000 respondents, we consider not only statistical significance but also practical significance. By practical significance, we mean that the difference between new migrants, old migrants and other New Zealanders is sufficiently large to justify consideration in policy decisions and for this purpose we consider an absolute difference of 5% (i.e., 5 percentage points) to be the threshold.

Results

Table 2 presents the socio-demographic characteristics of new migrants, old migrants and Aotearoa New Zealand-born respondents. New migrants tend to be younger, are less likely to live

Table 1: Exposure and probability of arriving X years ago for different values of proxy-year for the New Zealand Health Survey 2016/2017.

Year surveyed: 2016.5 to 2017.5	"Years since arrival" 2017–arrival year	Potential time spent in Aotearoa New Zealand (years)	Average time exposed in "last year" (years)	Probability of being in each time period Time period (years)										Years in Aotearoa New Zealand (for modelling)
				0–0.5	0.5–1	1–1.5	1.5–2	2–2.5	2.5–3	3–3.5	3.5–4	4–4.5	…	
Stated year of arrival														
2017	0	0–0.5	0.17	1										0
2016	1	0–1.5	0.57	0.8603		0.1397								0
2015	2	0.5–2.5	0.98		0.1286	0.7488		0.1226						1
2014	3	1.5–3.5	1				0.1277	0.7511		0.1212				2
2013	4	2.5–4.5	1						0.1278	0.7501		0.1223		3
etc…														

Table 2: Socio-demographic statistic of new migrants, old migrants and Aotearoa New Zealand-born respondents.

	Immigration status							
	New migrants		Old migrants		Born in Aotearoa New Zealand		New vs born	Old vs born
	(n=3,716)		(n=6,102)		(n=31,058)			
	%	95% CI	%	95% CI	%	95% CI	p-value	p-value
Age group								
15–24	22.6	21.0–24.3	8.3	7.3–9.4	19.1	18.8–19.5	0.0003	0.0000
25–34	34.1	32.4–35.8	12.1	11.1–13.2	14.8	14.4–15.1	0.0000	0.0001
35–44	22.6	21.3–24.0	14.6	13.6–15.7	14.6	14.2–14.9	0.0000	0.8816
45–54	11.8	10.6–13.1	21.5	20.4–22.7	16.7	16.4–17.1	0.0000	0.0000
55–64	4.9	4.2–5.8	18.1	17.0–19.3	15.5	15.2–15.8	0.0000	0.0003
65–74	3.0	2.4–3.7	14.0	13.1–15.0	11.2	10.9–11.4	0.0000	0.0000
75+	1.0*	0.7–1.4	11.3	10.6–12.0	8.1	7.9–8.3	0.0000	0.0000
Sex								
Female	50.1	48.4–51.9	51.0	49.6–52.5	51.7	51.2–52.1	0.1321	0.5036
Male	49.9	48.1–51.6	49.0	47.5–50.4	48.3	47.9–48.8	0.1321	0.5036
Prioritised ethnicity (in priority order)								
Māori	0.5*	0.3–0.8	1.1	0.8–1.4	18.0	17.8–18.2	0.0000	0.0000
Pacific	6.5	5.7–7.4	12.7	11.8–13.5	3.1	3.0–3.4	0.0000	0.0000
Asian	49.7	47.6–51.7	28.4	27.1–29.7	1.4	1.2–1.7	0.0000	0.0000
Other	36.1	34.0–38.4	28.3	26.8–29.9	2.8	2.4–3.2	0.0000	0.0000
NZ European	7.2	6.2–8.4	29.5	28.0–31.1	74.6	74.1–75.1	0.0000	0.0000
New Zealand Deprivation Index Quintile								
1***	17.5	15.4–19.7	22.2	20.6–24.0	20.2	19.5–20.8	0.0398	0.0574
2	19.4	17.4–21.5	22.7	21.0–24.5	19.8	19.2–20.5	0.7341	0.0111
3	21.3	19.3–23.6	19.3	17.8–20.9	20.0	19.4–20.6	0.3002	0.5132
4	20.7	18.7–22.8	17.9	16.5–19.4	20.8	20.3–21.4	0.9178	0.0020
5***	21.1	18.7–23.6	17.8	16.5–19.2	19.2	18.5–19.8	0.2058	0.1445
Medical insurance								
Yes	34.2	32.0–36.4	36.2	34.4–38.2	34.6	33.7–35.5	0.7228	0.1209

Table 2 (continued): Socio-demographic statistic of new migrants, old migrants and Aotearoa New Zealand-born respondents.

Type of insurance (for those with medical insurance)								
Compre-hensive**	66.0	62.1–69.7	46.5	43.4–49.7	47.4	45.6–49.2	0.0000	0.6330
Hospital only	26.1	22.8–29.7	42.2	39.0–45.4	43.0	41.1–45.0	0.0000	0.6430
Other	7.9	6.0–10.2	11.3	9.3–13.7	9.6	8.3–11.0	0.1682	0.1536

* Indicates that the relative sampling error of the estimate is between 0.3 and 0.5 and the estimate should be used with caution.
** Covers day-to-day costs such as general practitioner fees and pharmacy charges, as well as private hospital care.
*** 1 represents people living in the least deprived areas and 5 represents people living in the most deprived areas.

in the least deprived areas and are more likely to be of Asian or of Other ethnicity than the Aotearoa New Zealand-born. Old migrants tend to be older, and more likely to be in the lesser deprived categories compared to Aotearoa New Zealand-born. The ethnicity of old migrants is more equally distributed among Asian, European New Zealanders and Other ethnicities, with a higher representation of Pacific people compared with new migrants.

Modelling

The following results are marginal means from log-linear models after adjusting for confounders. For the sake of brevity this will be assumed in the following results.

Last year general practitioner (GP) use

Respondents were asked if they had been to a GP in Aotearoa New Zealand in the last year (see Figure 1a). The orange line represents the changes in this value over time since new migrants arrived. The black dashed line represents the result for other New Zealanders. There are two values for those respondents who had been in Aotearoa New Zealand for less than 1 year—the red dot represents the proportion who had seen a doctor in the time they had been in the country, while the orange dot represents the proportion if it were observed over a year.

Overall, 79.6% (95% confidence interval [CI] 78.9–80.2%) of other New Zealanders had seen a GP in the last year. New migrants looked indistinguishable from other New Zealanders after being in Aotearoa New Zealand for 4 complete years. There was evidence of a linear trend over time for the period 0–10 complete years (p=0.0138) and observed in Figure 1a as an upward trend in years 1–10. Overall, new migrants saw the GP in the prior year less often, giving an average difference with other New Zealanders of 5.0 percentage points (p=0.0001).

Number of GP visits per year

Those respondents who had seen a GP in Aotearoa New Zealand in the last year were asked how many times they have visited a GP in the last year (Figure 1b). In general, new migrants appeared to visit GPs in the prior year slightly less often than other New Zealanders. The latter averaged 3.6 visits (95% CI 3.6–3.7). The average difference was significant with new migrants having 0.3 fewer visits (p=0.0032), but there was no evidence of a linear trend over 0–10 complete years (p= 0.4508) for new migrants.

Cost of last GP visit

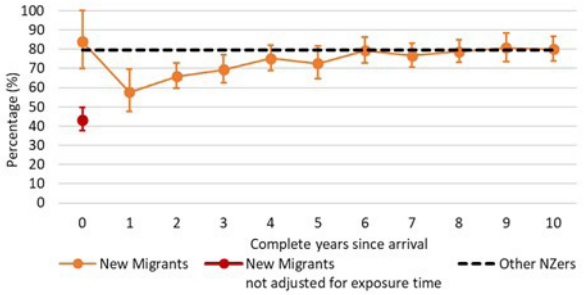
Respondents who had been to a GP in the last year were asked how much their last visit cost (Figure 1c). As this variable is not based on a full year's use of services there is no need to adjust for exposure time in Aotearoa New Zealand. The cost of the last GP visit for other New Zealanders was NZ$34.27 (95% CI $33.78–34.77). New migrants paid considerably more for GP visits initially ($18.74) but, from observation, costs of visits dropped over time to correspond with costs for other New Zealanders after 4 complete years. The data for new migrants were consistent with a falling linear trend over 0–10 complete years (p=0.0000) and the average difference was significant, with new migrants paying $5.74 more (p=0.0000).

Barriers to primary healthcare

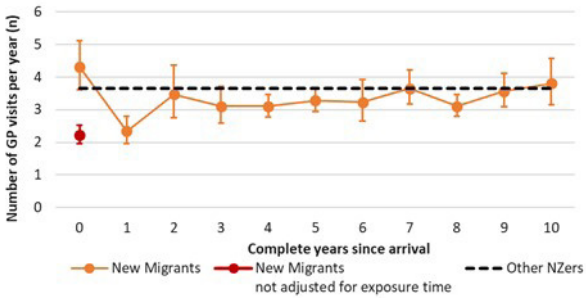
Respondents were asked if they needed to see a GP or go to an after-hours medical centre but

Figure 1: Marginal means from log-linear models, adjusted for confounders, for new migrants over time since arrival and for other New Zealanders.

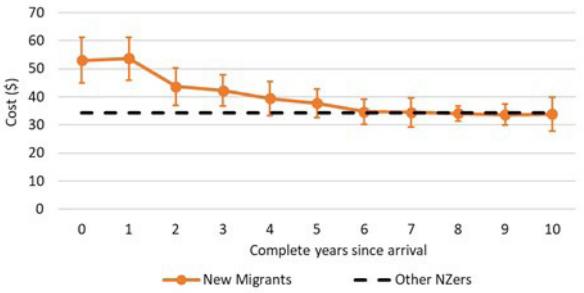
a) Last year GP use.



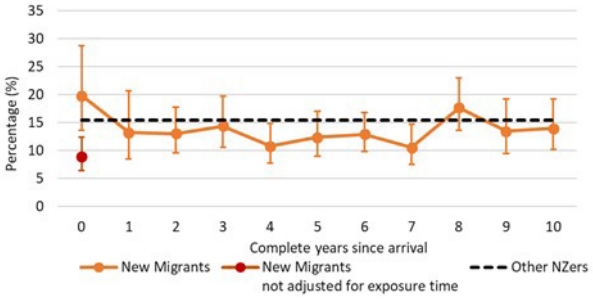
b) Number of GP visits in last year.



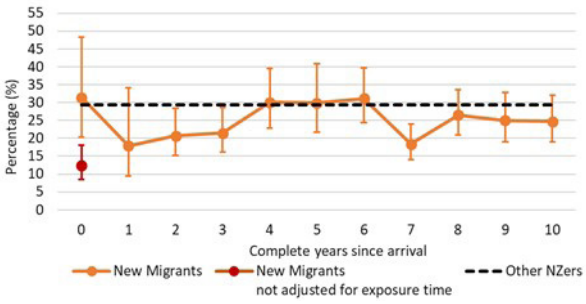
c) Cost of last GP visit.



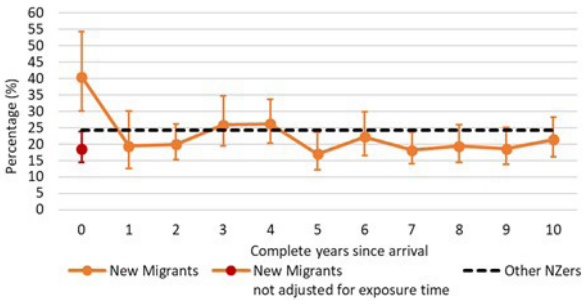
d) Barriers to primary healthcare.



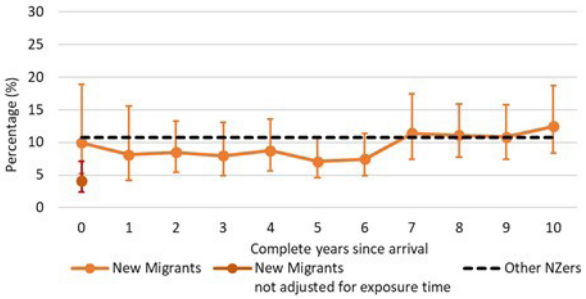
e) Last year practice nurse visits.



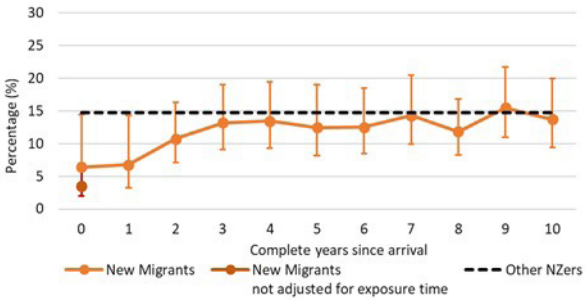
f) Last year pharmacist visit for personal health needs.



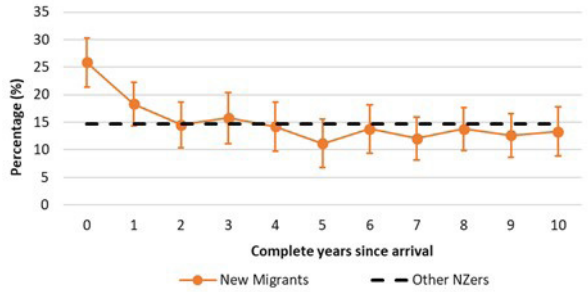
g) Last year use of after-hours medical centres.



h) Last year use of emergency departments.



i) Comprehensive health insurance cover.



did not because of the cost or because there was no available transport (see Figure 1d). From observation, new migrants were, in general, slightly less likely to face one of these barriers. For other New Zealanders, 15.4% (95% CI 14.8–16.0%) said they had encountered at least one of those barriers. For new migrants, there was no linear trend over the 0–10 completed years (p=0.5234). The average difference was not significant (p=0.0687).

Last year practice nurse use

Respondents were asked if they had seen a practice nurse, without seeing a GP, at their visit or appointment in the prior year (see Figure 1e). From observation, new migrants' use of practice nurses' services was highly variable, but when they were different from other New Zealanders they were more likely to have lesser use.

For other New Zealanders, 29.3% (95% CI 28.4–30.2%) said they had seen a practice nurse without seeing a GP at the same visit or appointment in the last year. There was no linear trend over the 0–10 completed years (p=0.8904) for new migrants, but the average difference was significant with new migrants 4.1 percentage points less likely to see a practice nurse (p=0.0038).

Last year pharmacist use

Respondents were asked if they had seen a pharmacist in the last year about their own health (see Figure 1f). From observation, new migrants were more likely to see a pharmacist in their first year in Aotearoa New Zealand but appeared similar to other New Zealanders after that. For other New Zealanders, 24.2% (95% CI 23.3–25.1%) said they had seen a pharmacist in the last year. For new migrants, there was a falling linear trend over the 0–10 completed years (p=0.0047); however, the trend is highly influenced by the first observation at year = 0. The average difference was not significant (p=0.2025).

Last year after-hours medical centres use

Respondents were asked how many times they had used an after-hours medical centre. Those who had one or more visits were deemed to have used an after-hours medical centre in the last year (see Figure 1g). From observation, the pattern for new migrants is to use an after-hours medical centre slightly less than other New Zealanders in general. For the latter, 10.7% (95% CI 10.2–11.2%) said they had visited an after-hours medical centre in the last year. For new migrants there was no linear trend over the 0–10 completed years (p=0.1596) and the average difference was not significant (p=0.0875).

Last year emergency department use

Respondents were asked if they had used a public hospital in the last year and, if so, whether they had used the emergency department (see Figure 1h). The figure shows that new migrants use the emergency department less than other New Zealanders initially and then increase to a similar threshold. For other New Zealanders, 14.7% (95% CI 14.1–15.3%) said they had used an emergency department in the last year. For new migrants there was a rising linear trend over the 0–10 completed years (p= 0.0022) and the average difference was significant with new migrants being 2.8 percentage points less likely to use the emergency department (p=0.0005).

Comprehensive health insurance

Respondents were asked if they had medical insurance and, if so, what type: 1) comprehensive insurance, which was explained as covering day-to-day costs such as GP fees and pharmacy charges, as well as private hospital care, 2) hospital-only coverage, and 3) other. Figure 1i shows the proportion of new migrants with comprehensive insurance since arrival. From observation, new migrants are more likely to have comprehensive insurance initially but decrease to lie just under the

threshold for other New Zealanders. Of the latter, 14.6% (95% CI 14.0–15.2%) said they had comprehensive insurance. For new migrants there was a falling linear trend over the 0–10 completed years (p=0.0000) and the average difference was not significant (p=0.6104).

Discussion

In this analysis, several variables showed a significant statistical difference between new migrants and other New Zealanders, but it is also useful to consider their meaning pragmatically. For last year GP use, nurse use and emergency department use, the absolute difference was 5% or less, and for the variable "number of last year GP visits" the difference is only 0.3 visits. For these cases, there is statistical significance but for practical purposes we would consider the difference insignificant. This leaves only the cost of the last GP visit that is both statistically and practically significant.

There were also variables that showed a significant linear trend over the 0–10 complete years. These five variables were last year use of GPs, pharmacists and emergency departments, as well as cost of last GP appointments, and comprehensive health insurance. For "last year use of GPs", the first point is influential, but the trend is still significant when the first point is removed. For "last year use of pharmacists" and "comprehensive health insurance", our judgement is that the trend is generally flat but that the first point is influential, inflating the estimate of the linear trend over 10 years. The last visit cost of GPs appears to have a strong negative trend.

The first point in the "last year pharmacist visit" graph (Figure 1f) is larger than all the rest of the series and it's reasonable to assume that this is a real effect rather than an anomaly. That new migrants make greater use of pharmacists when they first arrive in Aotearoa New Zealand could be because 1) new migrants may be expecting to be able to buy drugs over the counter at a pharmacy that are only available by prescription, and 2) the pharmacy could be a source of free information that helps them begin navigating the health system. It is worth noting that in 2020, 36% of practising pharmacists in Aotearoa New Zealand were Asian. This may indicate that Asian migrants feel more comfortable initially approaching someone they perceive to have a similar cultural background.[19]

The first point in the "comprehensive health insurance graph" (Figure 1i) is also larger than all the rest of the series and it is likely to be a real effect as some migrant groups are required to come to Aotearoa New Zealand with comprehensive health insurance.

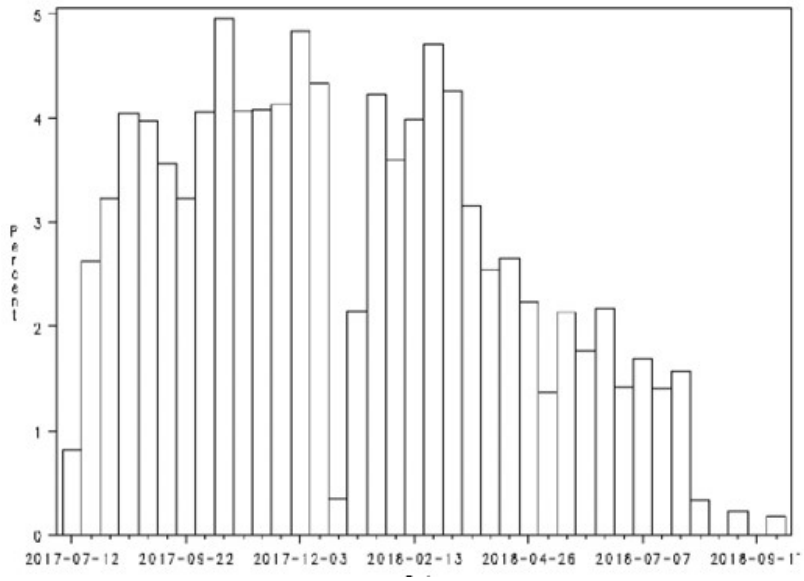
New migrants showed little difference compared to other New Zealanders in the variable "barriers to primary care", where these barriers were cost of service and access to transport. However, there may be other barriers for new migrants that other New Zealanders do not have, such as language barriers, health literacy barriers, different expectations of health services, perceived cultural sensitivity/competence of health providers and lack of knowledge of the Aotearoa New Zealand health system.[11,12]

For the variables we looked at, new migrants appear to use primary healthcare services in a similar manner to other New Zealanders and, where there are differences, new migrants tend to look similar to other New Zealanders relatively quickly. This would seem to be at odds with the "healthy immigrant effect", which would posit that new migrants would use fewer primary healthcare services as they have less need. In earlier work on mortality, modelling showed that newly arrived Asian, Pacific and European/Other immigrants have a pattern of mortality advantage over their Aotearoa New Zealand-born ethnic peers, which dissipated with increasing time spent in Aotearoa New Zealand.[20] However, the pattern was less evident for Pacific people and the relative risks associated with their differing lengths of time in Aotearoa New Zealand were not significantly different when compared to their Aotearoa New Zealand-born ethnic peers.[20] This is consistent with a Canadian systematic review that found duration of stay and country of origin adjusted the strength of the "healthy immigrant effect".[21]

One area where new migrants use primary healthcare services differently is with the cost of GP services. The high cost could be because they may not meet, or do not realise they meet, the eligibility requirements for government-funded healthcare or they may not have the means to shop around for a lower-cost alternatives.[22] In a study that explored the barriers perceived by Asian migrants to navigating the Aotearoa New Zealand health system, eight out of nine participants reported difficulty in finding out about consultation costs.[11]

Having comprehensive health insurance may

Figure 2: Interview dates of respondents in the New Zealand Health Survey 2017/2018 (personal communication: in an email from the Health Survey Team, Ministry of Health, 27 February 2019, on behalf of the Health and Disability Intelligence Group, HDI@moh.govt.nz; now healthsurvey@health.govt.nz).



mean that new migrants choose a primary care service for reasons other than cost. It is worth noting that as the probability of having comprehensive life insurance decreases, the cost of GP visits decreases. However, we do not know why new migrants used these primary healthcare services; it is possible that the initial high cost could be the result of having more expensive needs at that time.

The strength of this analysis is that it is able to draw on a large pool of respondents who are new migrants by combining three large population surveys.

A limitation in this study is that it is cross-sectional rather than longitudinal i.e., we did not follow the same individuals over 10 years. Therefore, the results rely on the assumption that the characteristics of the new migrant group remain relatively consistent over time. A further limitation is that we cannot assume that people who come to Aotearoa New Zealand as new migrants now will act in the same way as those who arrived prior to the borders closing. Compared to the new migrant group in the survey, migrants who arrived in the year ending March 2023 were more likely to be older, mainly due to there being a lower proportion of those aged 15–24 (23% vs 20%, respectively), and a higher proportion were male (50% versus 53%).[5] Comparing ethnicities between survey results and migrants arriving now is more difficult. The survey reported prioritised ethnicity and the March 2023 year-end migration report was based on citizenship and had different ways of grouping people, but among groups where a comparison seemed reasonable, it showed there were similar proportions of Pacific people (7%) who were in the new migrant group in the survey and those with Pacific citizenships (8%) migrating in the year prior, and slightly more Asian peoples (50%) than those with Asian citizenships (47%).[5]

The modelling relied on information taken at the time of the survey. On arrival, new migrants may be more likely to move for work and education, which may mean their NZDep scores may not be as stable compared to other groups. Also, broad categories were used for the ethnic groups. There is the potential that results could change if finer groupings were used.

The most crucial limitation of this analysis is not having access to the exact dates that migrants arrived in Aotearoa New Zealand nor when they were interviewed for the survey, which leads to two sources of error. The variable year that is used in the modelling has some degree of misclassification where for proxy-year values greater than 1, around 12.5% of the year values are under-estimated and a similar amount over-estimated, leaving around 75% correctly classified. However, if any 3-year points are nearly linear then the misclassification for the middle point has little

effect. The other issue is that the time new migrants have spent in Aotearoa New Zealand has to be estimated and this "exposure" has to be applied at the group level.

To investigate this further, the MoH provided a histogram of interview dates for the 2017/2018 survey (see Figure 2). The interview dates look reasonably uniform from mid July to early March, excluding the Christmas and New Year holiday season, and then drop away after that with some interviews after 1 July. If this pattern is replicated in all the surveys analysed here, the assumption of a respondent being equally likely to be interviewed on any day the survey was in the field may not be correct. However, more respondents with observations early in the new year are balanced out by some respondents after 1 July in terms of estimating average exposure.

Conclusion

After considering statistical and practical significance and adjusting for covariates, we found that new migrants in the survey used primary healthcare resources in a similar way to other New Zealanders fairly soon after arriving in Aotearoa New Zealand. They initially paid more for their last visit to a GP than other New Zealanders, but after 4 completed years in Aotearoa New Zealand new migrants paid similar amounts to other New Zealanders.

COMPETING INTERESTS
Nil.

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Opiate prescription after hip and knee arthroplasty: a retrospective cohort study

Bradley S Atkinson, William M Oldfield, Hannah M E Sim, Nemandra A Sandiford

ABSTRACT

AIMS: Excessive opiate analgesia in relation to orthopaedic surgery is associated with morbidity and mortality. Pre-operative use of opiates is associated with higher post-operative use. There is little information about opiate prescribing practices in relation to elective total joint arthroplasty (TJA) in New Zealand rural centres. The aims of this study were to describe opiate use before, immediately after and 1 year after TJA, and to compare prescribing practices with local guidelines.

METHODS: A retrospective cohort study of elective primary hip and knee arthroplasties was conducted between January 2018 and April 2019. Opiate use was evaluated from clinical records and from electronic prescribing records and described in morphine milligram equivalents (MME) with a particular focus on pre-operative and post-operative periods, and use after 1 year.

RESULTS: In the study period, 199 patients underwent 203 joint arthroplasties. Of these, data from 157 patients were analysed. Patient data were not analysed because of unavailable files (N=20), non-elective procedures (N=11), bilateral arthroplasties (N=4), deaths (N=4) and incomplete information (N=3). Pre-operative opiates were used by 92 (59%) patients, of whom 70 (76%) were not using opiates after 1 year. There were 126 (80%) patients who were discharged with opiate prescriptions and the vast majority, 121 (96%), did not receive discharge prescriptions that conformed to local guidelines.

CONCLUSION: Despite undergoing joint arthroplasty, about one quarter of patients who had been prescribed opiates before the operation were still receiving opiates after 1 year. There was poor compliance with local guidelines.

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are two of the most successful operations in orthopaedic surgery.[1–3] They have been shown to reduce pain, improve function and improve quality of life.[1,2,4,5] Some reports suggest that opiate analgesia may be ineffective for chronic non-cancer pain.[6–10] The use of opiate analgesia prior to total joint arthroplasty (TJA) has been associated with suboptimal clinical outcomes, complications and an increased length of stay (LOS) in hospital.[5,6,8,11–18]

To our knowledge, pre- and post-operative opiate use has not been analysed in rural Australasian population patients undergoing TJA.[8,9,12,19–25] Patients in these settings often have difficulty accessing healthcare, present at a later stage of disease and suffer worse outcomes compared to urban patients.[26–30]

Opiate analgesia is known to cause socio-economic harm internationally in association with prescription and non-prescription use.[31] As a result, our centre has guidelines for the prescription of opiate analgesics (Appendix Figure 1).

The primary aim of the study was to describe the use of opiates before, immediately after and 1 year after elective THA and TKA. A secondary aim was to compare prescribing practices following these procedures to local guidelines.

Methods

Study sample

A retrospective cohort study of elective primary THA and TKA was performed between January 2018 and April 2019. Patients were assessed against exclusion criteria using physical and electronic medical records.

Setting

Southland Hospital is a 157-bed secondary-level facility located in Invercargill, Southland, New Zealand. Southland Hospital provides care for a large geographic catchment and more than 100,000 people.

Exclusion criteria

Patients were excluded if they received a non-elective arthroplasty, had unavailable or incomplete records, had a single-stage bilateral arthroplasty or had deceased prior to 1-year follow-up.

Data sources

Data were collected from physical and electronic records. Our facility's electronic record is linked to community prescription dispensing.

Data analysis

Statistical analysis presented in Table 1 was performed using the Student's unpaired *t*-Test. Data analysis was performed using Microsoft Excel software.

Data interpretation

Prescriptions written for use "as required" (PRN) were interpreted as being used at the full dose. Dosages were quantified in morphine milligram equivalents (MME).[32]

Results

Study sample

The flow of patients to achieve the study sample is shown in Figure 1, and 157 patients were included in the analysis.

Characteristics of the study sample, split by whether patients received a THA or TKA and by use of opiates in the pre-operative period, are shown in Table 1. Pre-operative use of opiates was present in 59/90 (66%) of patients who received a THA and 33/67 (49%) who received a TKA.

Changes in opiate use with time

Figures 2 and 3 show the change in opiate use by time period for patients who received a THA and TKA. In both groups there was a similar change with time. In all, 108/157 (69%) were prescribed a higher dose of opiates on discharge than they had used in the 24 hours before discharge. After 1 year, 130/157 (83%) of patients were no longer prescribed opiates.

Opiate prescriptions compared to local guidelines

Opiate prescriptions on discharge compared to local guidelines are shown in Figure 4. In summary, 84/157 (67%) of all discharge prescriptions and 84/126 (67%) of opiate discharge prescriptions did not follow the local guidelines for dosing. In addition, 90/157 of all prescriptions and 90/126 (71%) of opiate prescriptions did not follow the local guidelines for duration of prescription.

Discussion

Opiate analgesics are widely used to manage post-operative pain following orthopaedic procedures including TJA.[9,21,22] Opiates are reported to be an effective analgesic agent for acute post-operative pain; however, they are associated with risks of addiction and overdose.[6,8,10,33] The negative impact of these drugs on patients undergoing orthopaedic surgery has been well documented.[8,11–14] Most reports have been from high-volume urban centres, limiting the generalisability to rural settings.[26–30]

In New Zealand, population-specific barriers to healthcare have been described.[26–30] Observations from urban centres may not be transferrable to rural centres, necessitating an understanding of opiate use in patients undergoing TJA in rural settings.[34] To our knowledge, there have been no published clinical reports examining these issues in patients undergoing elective TJA in rural Australasian centres.[8,9,12,19–25]

Half of TKA patients (49%) and two thirds of THA patients (66%) used opiates pre-operatively, with only 13% and 19% respectively using opiate analgesia 1-year post-operatively.

We have found rates of pre-operative opiate use in a rural population that are two to three times those of the wider New Zealand population prior to TJA.[21] We believe this is an important observation and it suggests rural patients may be at higher risk of suboptimal outcomes when compared to urban cohorts. Anecdotally, access to arthroplasty in our rural centre is limited by long waiting lists, secondary to insufficient access to operating theatres and inpatient beds.

Twenty percent of patients (25/126) who were prescribed opiates continued to use these 1-year post-operatively. This is higher than has been reported in some other cohorts.[8,9,21,24,35] While this study was not designed to assess the indication for ongoing use, the medical record of these patients was reviewed in attempts to identify possible reasons for ongoing opiate use. Seventeen (65%) suffered from arthritis in another joint, four (15%) had ongoing pain in the operated joint, one (4%) had spinal stenosis, one (4%) had advanced cancer and one (4%) underwent another surgical procedure around the time of follow-up. Only one (4%) patient did not have an identifiable reason for ongoing opiate use. Of note, this chart review was performed retrospectively and therefore the reasons for opiate use in these patients are uncertain.

Limitations

This study has several limitations. It was a retrospective design. Using a consecutive non-selected

Figure 1: Selection of patient population.

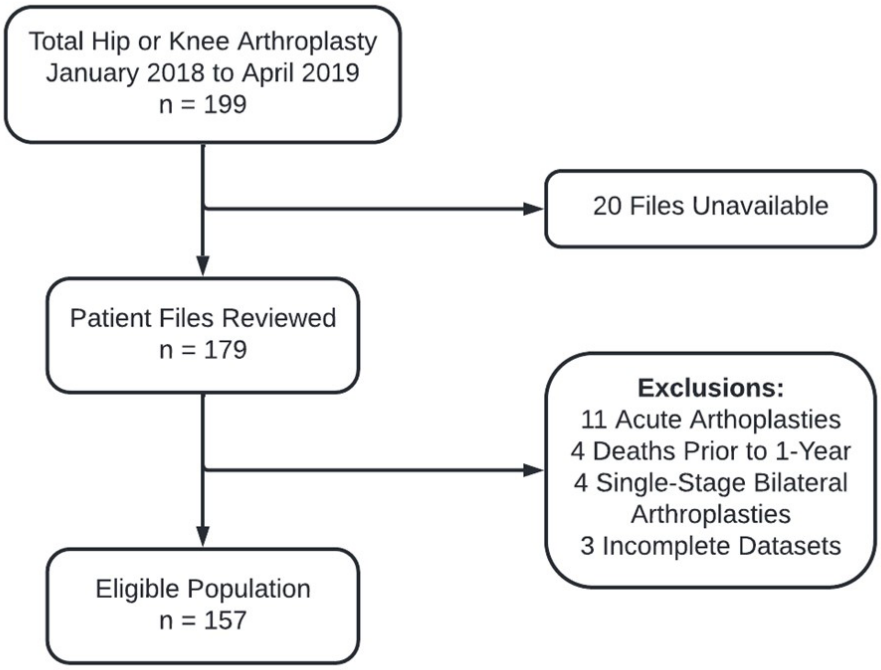


Table 1: Demographics of patients.

Variable	Total hip arthroplasty		P	Total knee arthroplasty		P
	Pre-operative opiate use			Pre-operative opiate use		
	Yes N=59	No N=31		Yes N=33	No N=34	
	Mean (SD)			Mean (SD)		
Age (years)	68 (11.5)	71 (12.5)	0.26	68 (10.8)	70 (8.5)	0.35
BMI (kg/m^2)	32.7 (8.1)	29.5 (4.8)	0.05	33.4 (6.5)	31.6 (4.8)	0.21
	N (%)			N (%)		
Female	36 (61)	14 (45)	0.15	21 (64)	11 (32)	0.01
Left side operation	27 (46)	16 (52)	0.60	17 (52)	17 (50)	0.90
Tobacco smoker	8 (14)	2 (6)	0.31	0 (0)	1 (3)	0.33

Figure 2: Daily opiate use in THA patients by time point.

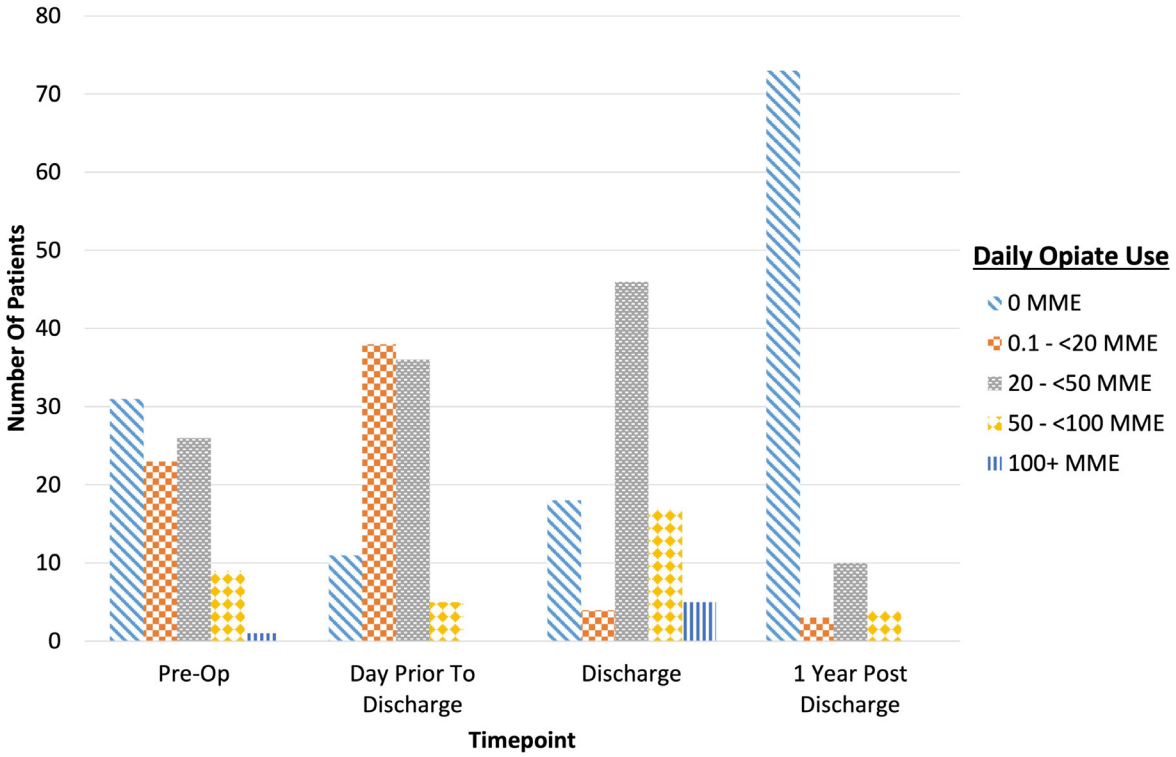


Figure 3: Daily opiate use in TKA patients by time point.

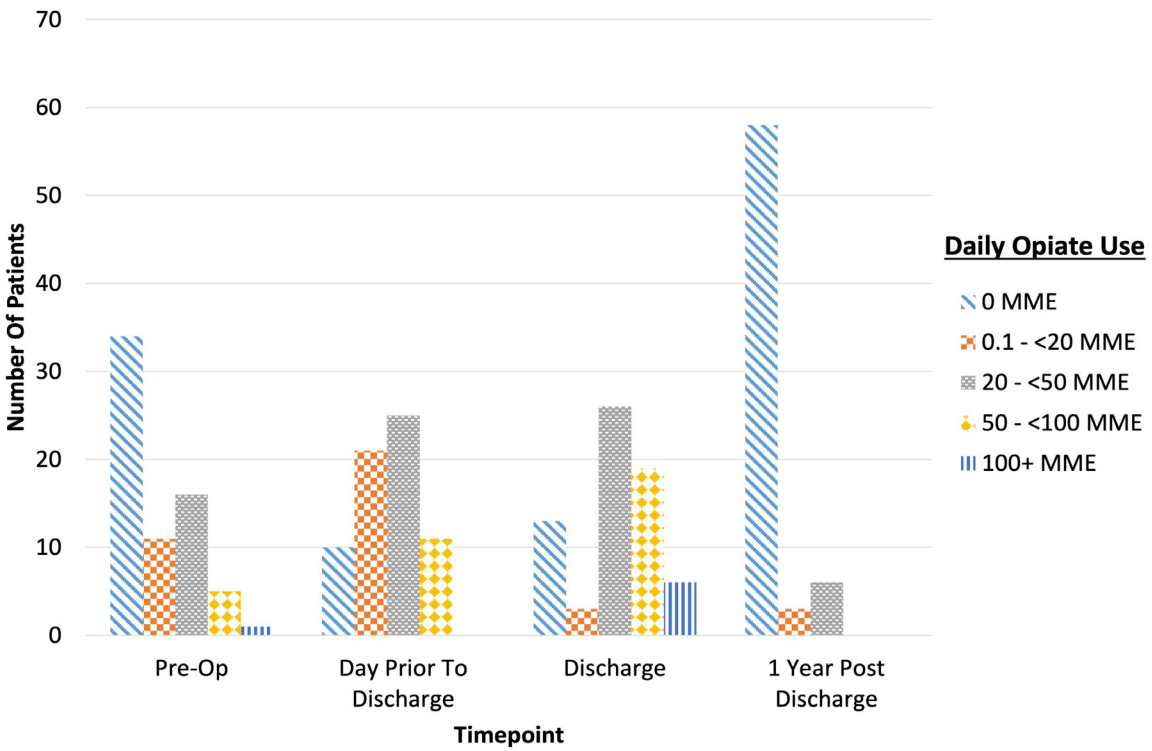
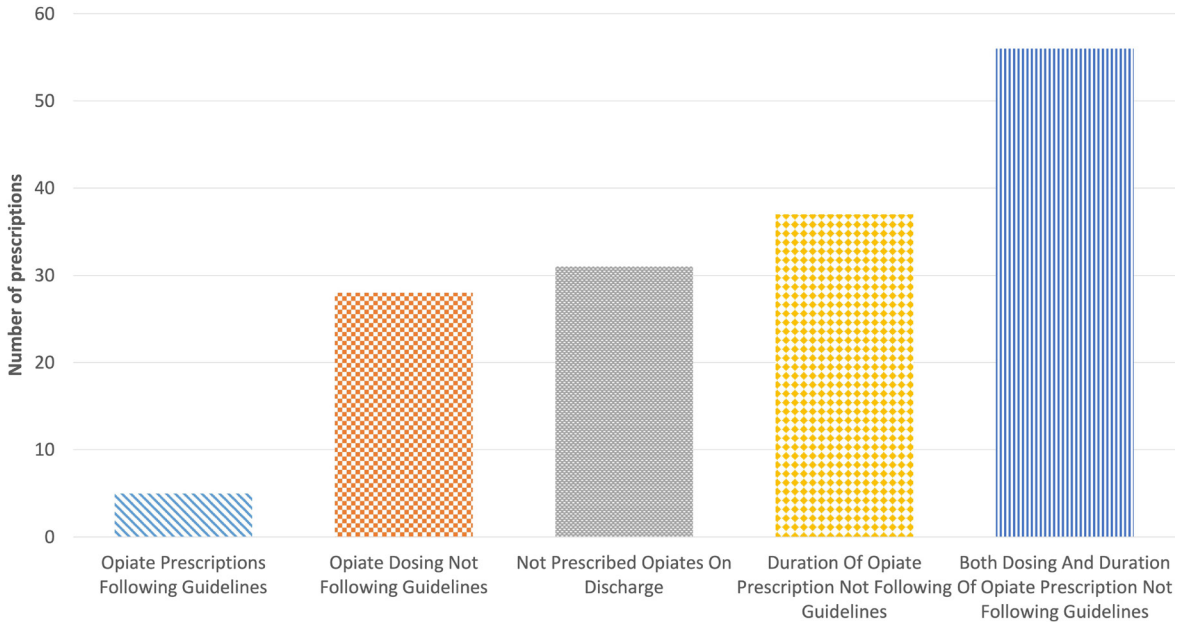


Figure 4: Opiate prescriptions compared to local guidelines.



patient cohort aimed at assessing the patterns of opiate use, the sample size was relatively small but accurately reflects the demographics of the patient population that is managed in rural centres of New Zealand. Although some statistically significant associations were identified, multiple statistical tests were performed and these may be spurious due to Type I error inflation. For comparisons that were not statistically significant, the small sample size may have also increased Type II error where important associations may not have been identified. As such, this study was not designed to assess the contribution of other comorbidities to the use of opiates in this population, nor was it capable of assessing associated complications. The cohort is unlikely to be generalisable to urban centres given the disparity in healthcare provision between rural and urban populations.

Conclusion

Both pre-operative opiate use and post-operative opiate prescribing exceeded expectations. Rates of pre-operative opiate use in rural patients undergoing THA or TKA are 2–3 times those reported in urban New Zealand settings. Prescriptions practices in our centre commonly deviate from guidelines and increased oversight of junior staff is required to foster safe prescribing practices. Further research in this field should review disparities in access to TJA, the timing of presentation, stage of disease, comorbidities and the time between presentation surgery.

COMPETING INTERESTS
The authors declare no relevant competing interests.

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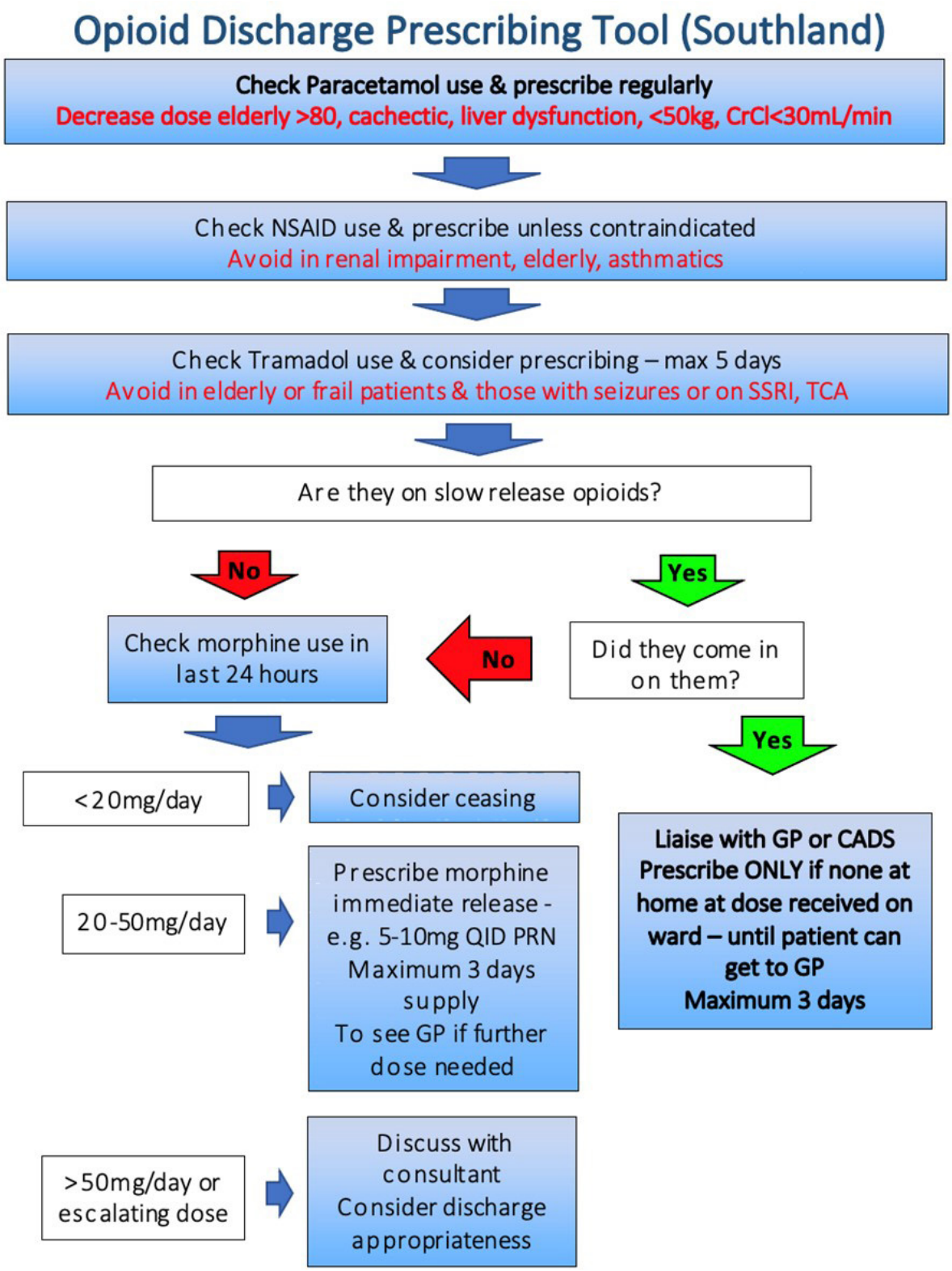
Appendix

Appendix Figure 1



ACC and treatment injuries: is it time to rethink injury causation?

Albert Andrew

ABSTRACT

In Aotearoa New Zealand, personal injuries resulting from medical treatment are covered under the *Accident Compensation Act 2001.* However, before victims of medical injury can receive cover and compensation, they must first satisfy several legal tests. Much criticism and legal action have surrounded the interpretation and application of these legal tests, primarily because of its focus lying on injury causation instead of supporting the incapacitated. This article examines the issues present within the current legislative framework for treatment injury coverage and proposes a potential solution to address the underlying problem.

In Aotearoa New Zealand, victims of personal injury caused by medical treatment are eligible to receive state-funded compensation under a no-fault accident compensation scheme (ACC scheme). However, before victims can obtain comprehensive cover and compensation, they must first satisfy several legal tests outlined in the *Accident Compensation Act 2001* (*AC Act*). The imposition of these statutory tests on the medically injured has not only drawn persistent criticism for the inequitable and preferential treatment of certain victims of injury but also led to a system that prioritises disputes over supporting victims adversely affected by medical treatment.[1–3] According to the Accident Compensation Corporation (ACC) website—the Crown entity responsible for administering the ACC scheme—approximately 37% of treatment injury claims are declined, while only 2% of non-treatment injury claims are rejected.[4,5] This disparity in injury coverage rates has ultimately led to many victims with treatment-related injuries receiving no state assistance despite suffering injuries that result in the same level of incapacity as those with non-treatment-related injuries.

The main aim of this viewpoint is to explore the drivers behind the disparities in injury coverage rates experienced by treatment injured claimants. An examination of the current treatment injury provisions under the *AC Act* illustrates that the criteria for treatment injury cover is ambiguous and arbitrary. Furthermore, an analysis of the treatment injury claim review process reveals its unjust and dysfunctional nature. The author concludes that addressing the aforementioned concerns requires a legislative revision of the treatment injury provision, coupled with the establishment of an independent, fair and transparent review process. This article also provides a potential example illustrating what such a reform might look like.

Overview of the treatment injury claim process

This section provides a brief summary of the treatment injury claim process.

When a patient sustains an injury while receiving treatment from a registered health/medical professional, they become eligible to lodge a treatment injury claim. All treatment injury claims must be lodged with ACC through a registered health provider.[6] After receiving a treatment injury claim, ACC will appoint a specialist cover assessor, who is a registered health professional (not necessarily a doctor), to assess the merits of the claim.[7] The primary objective of this assessment is to ensure that the patient's personal injuries satisfy the legal criteria for treatment injury cover as outlined in the *AC Act*.

Subject to legislative exceptions, a person in New Zealand injured as a result of medical treatment is entitled to cover and compensation, provided their injury was "caused" by the treatment given or sought.[8] This requirement is often referred to as the "causation test". Here, the assessor must be satisfied that, on the balance of probabilities, the injury was more likely than not caused by the medical treatment.

An exception to cover is made, however, for injuries that are *"a necessary part, or ordinary consequence"* of treatment, or "*wholly or substantially caused by a person's underlying health condition*", or "*solely attributable to a resource allocation*

decision", or "i*s a result of a person unreasonably withholding or delaying their consent to undergo treatment*".[9–12] The inclusion of several legislative exceptions in determining causation has led to much scholarly and legal action because the inherent effect of these exceptions is to preclude injured patients from receiving cover. While proving causation is straightforward in certain isolated situations, such as when a surgeon amputates the wrong leg, it becomes contentious in most other cases.

If ACC approves the patient's treatment injury claim, the patient can apply for entitlements/compensation. Conversely, if the patient's claim is denied, then the patient has the option to challenge the initial decision, leading to an independent review. This challenge must occur within 3 months of the initial decision. An independent reviewer will re-evaluate the case, allowing both parties to present additional evidence in support of their case. If the initial decision stands, the patient may appeal to the District Court for a rehearing. Generally, this serves as the final stage for dispute resolution, with the right to appeal to higher Courts reserved for exceptional cases.

The issue: an arbitrary claim boundary test and dysfunctional review process

Before delving into discussions regarding the key issues of the current treatment injury regime, including the arbitrary line drawing, unfairness and dysfunction plaguing the legislative "causation test" and its subsequent review process, it is essential to first explore the legislative history and rationale that underpin the statute's conception. Knowledge surrounding the scheme's historical context provides a strong illustration as to why legislative reform is needed.

New Zealand's accident compensation scheme was enacted following the recommendations of the 1967 *Royal Commission into Workers' Compensation in New Zealand*, more commonly referred to as the *Woodhouse Report*.[13] The *Report* identified numerous deficiencies in the common law system for compensating personal injury by accident, including the high administrative costs associated with litigation and the existing available redresses for injury being "a form of lottery".[14,15] The solution proposed by the Commission to address these deficiencies was to replace the common law action for injury compensation with a fully comprehensive, no-fault system that focussed on prevention, rehabilitation and compensation.[14]

At the core of this no-fault regime is the principle of community responsibility, built upon the idea that "a*s a modern society benefits from productive work of its citizens, so should society accept responsibility for those willing to work but prevented from doing so by physical incapacity*".[15] This principle imposes a societal obligation to reciprocate and compensate anyone injured, irrespective of the cause, in acknowledgment of their past contributions to society. However, it is evident that over the last 57 years there have been no successful efforts to fully embrace this vision.

The current no-fault compensation regime for treatment injuries faces two critical issues: firstly, the manner in which ACC opportunistically exploits the ambiguous legislative wording to use the "causation test" as a selective boundary to exclude treatment injury claims; secondly, challenging ACC's claim decisions is marked by a glaring lack of transparency and fairness. The absence of a robust framework for monitoring and accountability of injury claim decisions exacerbates the challenges faced by claimants, ultimately undermining the integrity of the system.

Difficulties in establishing causation often arise from ACC's interpretation and application of the exclusion tests outlined in section 32(1)(c) and section 32(2)(a) of the statue, namely the "ordinary consequence" and "wholly or substantially" tests.[9,10] This means that, under current law, ACC would not cover a personal injury caused by medical treatment if the injury is considered an "ordinary consequence" of the treatment or is "wholly or substantially" caused by an individual's underlying health condition.

However, the legislation does not define the terms "ordinary consequence" and "wholly or substantially", thereby giving ACC substantial discretion to arbitrarily determine instances in which claimants have satisfied one or more of the above exclusion tests and are, therefore, excluded from receiving treatment injury cover. The imprecise language used in the exclusion clauses permits ACC to engage in opportunistic and subjective assessments when establishing the proof of causation. Therefore, ACC can choose to selectively emphasise certain evidence while ignoring or lessening the weight of other evidence. Accordingly, this variation leads to different standards of causation under different circumstances, potentially resulting in inconsistent interpretations among different decision makers.

A 2017 report published by Acclaim Otago and

the Legal Issues Centre at the University of Otago, which looked into the complexities of obtaining injury cover, found that whenever ACC receives a claim that requires proof of causation, it often approaches it with scepticism, imposing a high evidentiary standard that must be satisfied before an injured person can access cover and entitlements.[16] While adopting such a pessimistic view may seem absurd, it is not too unreasonable to hold this position, especially when taking into account ACC's efforts to lower costs associated with medical treatment injury claims and past scandals involving ACC employees receiving financial bonuses for denying claims.[17,18] It is essential to clarify that the author does not allege that ACC staff and its associates are acting in bad faith; rather, it's systemic institutional practices and policies that have led ACC to adopt an unfair and restrictive interpretation of the treatment injury provisions.

A common theme observed in numerous legal cases pertaining to the denial of treatment injury cover is ACC's consistent reliance on an argument that revolves around the idea that a person's injury may result from a variety of factors, including the uncertain aetiology of the patient's condition, its multifactorial nature or the plurality of possible explanations for the condition.[19,20] The ambiguity in the treatment injury provision enables ACC to assert that the inherent complexities in determining causation makes it challenging to attribute the injury solely to the treatment in question. Consequently, this opens the door for a broad range of factors to be considered as contributing causes. The recent decision in *YZ v Accident Compensation Corp* (*YZ*) illustrates the difficulties in attributing an injury solely to a specific treatment.[21]

In *YZ*, a patient lodged a compensation claim with ACC for erectile dysfunction (ED), which he alleged was a treatment injury resulting from the use of a chemotherapy drug called Vincristine. However, ACC argued that several other significant factors, including his age and medical history, played a substantial role in the development of his ED, independently of the chemotherapy drug, and thus made him ineligible for coverage. The patient appealed to the District Court but was unsuccessful in overturning ACC's decision. Despite producing medical evidence in the form of journal articles and other similar research material indicating a probable link between the treatment and ED, the Court deemed that these sources of medical information were not "*evidence which can be relied upon to prove the existence of a particular medical condition*".[22]

Figures released under the *Official Information Act* revealed that out of all the treatment injury claims lodged between 1 July 2011 to 30 June 2021, 49,154 claims were declined.[1] Among these, 2,715 claims were later challenged through the independent review process.[1] The District Courts made an additional 209 decisions, affirming ACC's decision in 152 of those cases.[1] While only a small fraction of declined claims were challenged during that period, this does not necessarily imply that ACC made the correct decisions in the majority of cases, nor does it indicate the robustness of the review process. A 2015 independent review of the ACC dispute resolution process revealed that, due to the complexity of the legislation and ACC's procedures, many claimants found the appeal process and the legal aspects associated with their case difficult to understand.[23] The complexity of this process could be a reason why a significant number of initially declined claims were not later challenged through the review process.

A closer inspection of the claim review process further reveals the barriers faced by injured patients in accessing justice for their grievances with ACC. As a Crown entity, ACC has an abundance of resources at its disposal and thus maintains a significant tactical advantage in accessing and presenting additional evidence during the appeal process.[16] There is little to no incentive for ACC to facilitate patients' access to evidence because, if patients cannot produce new circumstantial evidence to contest the initial decision, the reviewer or Court will reject the appeal. Legal precedents, as set in *YZ*, highlight the necessity for patients to substantiate their claims by seeking the expertise of a medical professional, which can be financially challenging, particularly for patients from low socio-economic backgrounds. Furthermore, due to the limited availability of legal aid, many patients who choose to take their case to Court are forced to represent themselves in a complex legal case against a well-resourced Crown entity with substantial legal expertise.[16,19] Even if patients succeed in overturning ACC's initial decision, they are still burdened with the costs and stresses of litigation. Undoubtedly, such a process wastes valuable time and resources that could have been better utilised for the injured patient's rehabilitation and treatment.

Option for reform

This section suggests a revision of the treatment

injury provision to address the previously mentioned concerns.

In an ideal world, treatment injury cover should be unrestricted, reflecting the principle of community responsibility. However, adopting such a change would not be politically achievable without implementing legislative mechanisms to limit coverage due to concerns over fiscal irresponsibility.

Revising the existing treatment injury provision must achieve two primary objectives. First and foremost, the revised provision should establish a clear legal basis for the scope of claims, specifically avoiding the use of imprecise tests to determine the proof of causation. Secondly, the current system prompts a crucial question: why should ACC be the arbiter of deciding causation issues when its views may inherently favour its own interests? Therefore, any reform should institute a shift in decision-making authority to independent and impartial assessors who are not influenced by legislative pressures or financial incentives.

Such reform could look like the following:

32 Treatment injury

1. A person has cover for treatment injury if—
   a. the personal injury is suffered by a person—
   - (i) seeking treatment from 1 or more registered health professionals; or
   - (ii) receiving treatment from, or at the direction of, 1 or more registered health professionals; or
   - (iii) referred to in subsection (7).

2. Cover under subsection (1)(a) does not apply if—
   a. in the opinion of an ***independent panel*** of registered health professionals that is relevant to the person's care, the personal injury is solely attributable to a person's underlying health condition; or
   b. in the opinion of an ***independent panel*** of registered health professionals that is relevant to the person's care, the personal injury is a ***predictable risk*** of harm resulting from the treatment in question.

Note: Other subsections under section 32 are omitted because they do not require revisions.

6 Interpretation

1. In this Act, unless the context otherwise requires,—

independent panel means—

a. a panel consisting of registered health professionals appointed by the Health and Disability Commissioner.

predictable risk means—

a. Any adverse outcome arising from a medical intervention with diagnostic or therapeutic purpose that is intended or within the expected and likely range of treatment outcomes.

The suggested proposal, albeit with certain limitations, generally offers coverage for injuries resulting from treatment. Exceptions arise only in instances where there is compelling evidence indicating that the injury stems exclusively from the underlying health condition of the patient or is a foreseeable outcome of the treatment. This amendment uses plain language to prevent ambiguity. In cases where interpretation might be unclear, the legislation provides guidance for clarification. Thus, this reform requires assessors to apply an objective test in delineating the boundaries of coverage, eliminating arbitrary decision making.

Importantly, eligibility for cover is to be determined by an expert panel of health professionals relevant to the claimant's injury and appointed by the Human and Disability Commissioner (HDC), thereby transferring this authority away from ACC. This ensures an impartial evaluation free from any conflicts of interest, as these medical experts operate independently and remain uninfluenced by financial or legislative pressures that could compromise the decision-making process. Moreover, utilising a panel to make coverage determinations enhances the robustness of the decision-making process. It allows for a more comprehensive and multidisciplinary evaluation of the patient's condition, drawing on the collective expertise and perspectives of multiple health professionals. ACC would still handle the processing of claims, but it would no longer hold the authority to accept or reject treatment injury claims.

It's important to note that the proposed reform mentioned earlier does not provide fully comprehensive coverage. There will still be cases where patients might not meet the criteria for coverage. However, by establishing clear coverage boundaries and implementing a more objective claim determination process, the author believes that this approach would enable more medically injured claimants to qualify for cover. This would, in turn, ensure that their coverage is on par with that of accidental non-treatment related injuries, reflecting the principle of community responsibility while also maintaining a fiscally feasible compensation system.

In cases where disputes arise from a patient's disagreement with the panel's judgment, a transparent and fair review process is crucial. This becomes especially important for the patient, who may be at a disadvantage in terms of knowledge and bargaining power. Recognising the need for a robust review process to investigate and address complaints, the current investigative powers of the HDC would also need to be expanded. This allows the Commissioner to intervene, listen to patient complaints and work with patients to achieve a fair and satisfactory resolution. In this expanded role, the HDC can further investigate the patient's complaints, including the ability to commission an expert medical report to obtain another perspective on the merits of the patient's claim. Most significantly, all of this is achieved without placing an extra financial burden on the patient or subjecting them to the stress of litigation. The end result is a more equitable, transparent and fair mechanism for dispute resolution.

Conclusion

While the ACC scheme has been lauded as a radical and inspirational approach to dealing with personal injury, its failure to provide adequate cover and compensation for all injured New Zealanders has resulted in countless disputes, eroded public trust and confidence and exacerbated perceptions of injustice. The abuses within the current system, stemming from arbitrary line drawing and a dysfunctional review process, have resulted in a regime that is inconsistent with the foundational principles upon which the no-fault compensation scheme was built on—an abandonment that has become increasingly apparent over time.

COMPETING INTERESTS
There are no potential conflicts of interests.

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A foodborne outbreak of Group A streptococcus: an under-recognised method of spread

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ABSTRACT

Foodborne transmission of Group A *Streptococcus* (GAS) is a rare cause of pharyngitis outbreaks. This report details a GAS outbreak in New Zealand that was associated with a foodborne route of transmission. This outbreak was relevant in the New Zealand context given the high incidence of rheumatic fever (RF).

Foodborne transmission of Group A *Streptococcus* (GAS) is an uncommon but reported cause of pharyngitis outbreaks.[1–6] This mode of transmission is often overlooked due to the more common droplet transmission of GAS.[2]

An outbreak of GAS cases associated with a single event was reported to the Auckland Regional Public Health Service on 9 December 2019. There were approximately 100 attendees at this event, an "open day" function for a public service provider that took place on 29 November 2019. It was reported that many of the people who attended the event had become unwell within 1 to 2 days with a rapid onset of illness that included symptoms of fever, sore throat, headache, myalgia, lethargy, anorexia, malaise, vomiting and diarrhoea. Of those, multiple went on to test positive for GAS via a throat swab.

Food was provided at the function. The majority of the food was prepared by staff members onsite, with other plates being brought in from home.

Methods

There were around 100 attendees at the open day. This is an approximate number, as there was no set guest list for the event and attendees were able to bring family members/friends along. The number was identified with the assistance of multiple attendees.

Unwell cases were identified through a survey that was sent to attendees. This included questions about whether they had become unwell after the event, who attended the event with them, what symptoms they experienced, whether they had seen their family doctor about this and if any of their household contacts had been unwell. See Appendix 1 for a copy of the questions asked. Staff from Auckland Regional Public Health Service followed up the cases that reported being unwell and ascertained whether they had been swabbed for GAS, and if so, what the result was and if this was treated with antibiotics. Unwell household contacts of cases identified in the survey were asked similar questions to those in the survey.

A confirmed case was defined as any person who attended the function or who was a contact of an attendee and had symptoms of a fever and sore throat or gastrointestinal symptoms **AND** a positive throat swab for GAS. These swabs were taken by healthcare professionals who used a bacterial swab to take samples from the patient's oropharynx. These were then sent to a laboratory and cultured. A small number of positive samples were sent for M protein (emm) typing, which analyses the sequence of a portion of the emm gene that dictates the M serotype.

A probable case was defined as any person who attended the function or was a contact of an attendee and had symptoms of a fever and sore throat or gastrointestinal symptoms but without a positive throat swab. This included those who were swab-negative but symptomatic.

Results

There were 18 confirmed cases, and 30 probable cases of GAS. Of the confirmed cases, 14 attended the event, and 4 were contacts of attendees. Of the probable cases, 20 cases attended the event, and 10 were contacts. Not all probable cases were swabbed during their acute illness.

The index case was identified as an individual who subsequently reported being unwell 2 days prior to the event with a sore throat and malaise. This individual was identified as the only person who had been unwell before the event. Three days after the event, the index case sought medical attention for a toe infection. Their toe was swabbed and was positive for GAS (S*treptococcus pyogenes*). This infection was treated with a course of antibiotics (augmentin). The index case had lesions on their hands at the time of the event; while these had not been swabbed, from their symptoms and recent history, they would likely have been caused by GAS. They did not have a throat swab performed at this time.

The index case had worked preparing food (salads, meat, eggs, potatoes) the day before the event. This food was left without refrigeration overnight. In an outbreak, it would be expected that all positive samples would have the same emm serotype. M protein (emm) typing was performed on three of the positive throat swabs from attendees. These were all positive for a common gene—emm12 GAS.

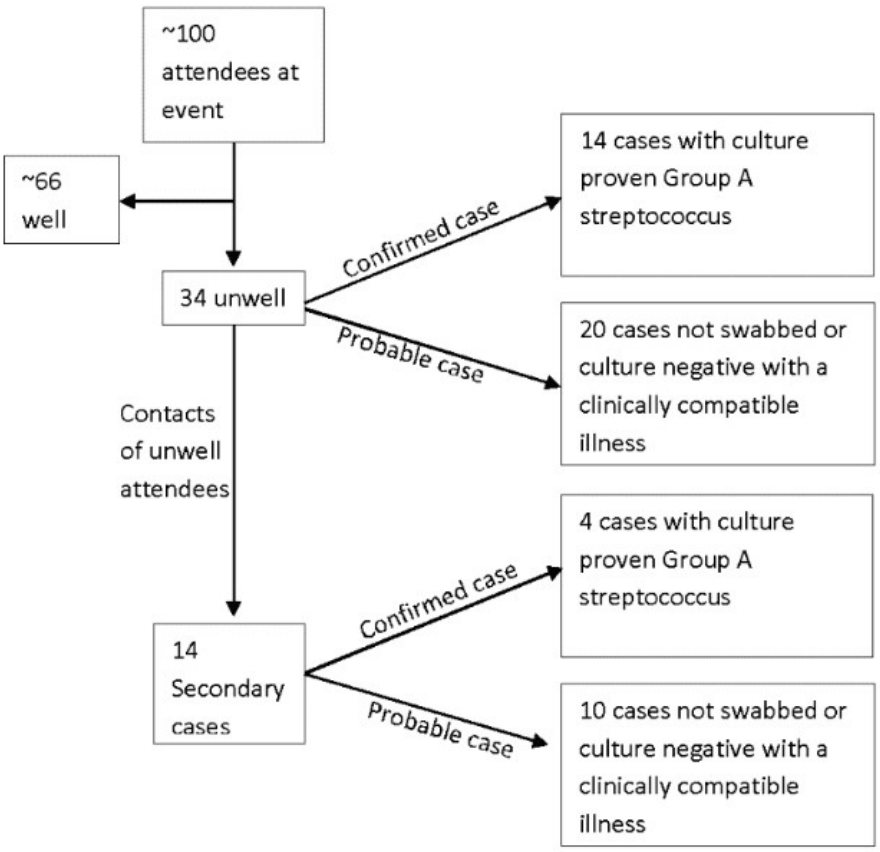
The attack rate was ~14% among attendees for confirmed GAS cases and ~34% (34/~100) including all confirmed and probable cases.

Discussion

From the outset this outbreak was investigated as a probable foodborne outbreak for several reasons. Firstly, most if not all attendees ate food at the event, and it is very unlikely that all attendees who became unwell (34% of attendees) were in close enough contact with the index case for droplet spread to occur.

Secondly, foodborne outbreaks of GAS due to food preparation by a subject with infected hand wounds, although infrequent, are well described in the literature.[3–4] One case report describes an outbreak of 72 cases of GAS in a rural correctional centre in Australia that was associated with food contamination by a food handler with infected

Figure 1: Confirmed and probable cases of GAS in event attendees and their contacts.



hand wounds.[4] In the outbreak reported here the index case had infected hand wounds, and a subsequently positive *Streptococcus pyogenes* culture result from a foot wound 3 days after the event, raising the possibility that the hand wounds were caused by the same bacteria.

Thirdly, there was a short incubation period, with the majority (23/34=68%) of cases that attended the event becoming unwell within 2 days after the event. There is evidence that foodborne outbreaks of GAS are associated with a shorter incubation period than outbreaks caused by respiratory transmission.[3]

Many GAS foodborne outbreaks have been associated with salad consumption.[1,3,4] Salads are often implicated in foodborne transmission as they require significant hand contact during preparation.[4] The index case reported here was involved in the preparation of a salad. While the index case used gloves to prepare the food, it is unclear if they had gloves on for the whole time of food preparation. Furthermore, this salad was left unrefrigerated overnight. This is an unsafe food hygiene practice and would have allowed the food to warm up, and therefore for GAS to multiply. The warming of food has been implicated in the majority of reported outbreaks.[4] It follows that the majority of outbreaks occur in warmer months.[4] The outbreak reported here occurred in summer in New Zealand.

The reason why this outbreak is particularly significant in the New Zealand context is due to the high prevalence of rheumatic fever (RF)/heart disease. In 2022, the rate of first episode RF hospitalisations in the age group 5–14 years was 8.8/100,000.[7] Therefore, New Zealand is considered to have a moderate–high risk population for RF (a low-risk population is defined as an incidence <2/100,000 per year in school aged children [5–14 years old]).[8] In New Zealand, GAS throat infections in those who fall in a high-risk group for RF are treated aggressively to prevent subsequent rheumatic heart disease.[9] Recent research shows that preceding Group A *Streptococcal* skin infections can also lead to acute RF.[10] High-risk groups include people of Māori or Pacific ethnicity, aged 3–35 years, or living in crowded circumstances or in lower socio-economic areas of the North Island of New Zealand.[9] If a throat swab is unable to be taken and followed up on in primary care, the recommendation is to treat those at high risk with a clinically compatible illness to Group A strep throat empirically with antibiotics.[9] All the cases in this outbreak fell into a "high-risk" group for the development of RF/heart disease. This may be why some cases who became unwell were not swabbed for GAS and were empirically treated. Given the high-risk population that attended the open day, it was very important for Auckland Regional Public Health Service to identify all unwell cases and their contacts, and to ensure that they received medical attention +/- antibiotics.

Conclusion

This report outlines an interesting outbreak of foodborne transmission of GAS. Foodborne transmission should be considered as a possible cause when assessing outbreaks of GAS. Not all probable cases were swabbed during their acute illness. Hence, the number of confirmed cases is likely to be an underrepresentation. This report emphasises the importance of good food hygiene, hand washing and staying home when you are unwell to prevent further outbreaks.[3–4] This was a particularly significant outbreak due to the high rate of RF in New Zealand, and the implications of untreated GAS pharyngitis in high-risk populations that were affected in this outbreak.

COMPETING INTERESTS
Nil.

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Asthma

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By E. H. Williams, M.B. (*continued from 19 January issue*)

My interest was first aroused in this subject by numerous cases of infantile eczema, these infants in many cases subsequently developing asthma as they reached the age of three or upwards. If in my remarks I may appear to stray somewhat from the subject laid down for discussion, namely, asthma, it is because the whole subject of allergy and anaphylaxis is peculiarly well demonstrated in children; and, as we know, children are excellent subjects in which to study processes. Asthma, therefore, is inseparable very often from eczema, urticaria, food allergy, and protein susceptibility generally.

We know that foreign proteins to which patients may be sensitised are various, but can be grouped in four classes—foods, pollens, animal emanations, and bacteria; and though I suggested the exclusion of the last-named, I would retain those cases with an associated secondary bronchitis in which a specific anti-bacterial vaccine should be used in addition to the pollen vaccine or peptone.

In infants the offending substance is practically always a food, and that a milk protein. Even breast-fed infants may be sensitised by a protein derived by the mother's food. In children, from three to twelve, foods may still be the chief factor, but pollens, animal dusts, and bacteria become gradually more important.

I have observed the following manifestations in children:—Eczema of the infant replaced by asthma in childhood, the asthmatic attacks characterised by bronchial constriction as seen in the anaphylactic guinea-pig; acute gastro-enteritis from food protein similar to that observed in experimental anaphylactic rabbits; cases of acute collapse and threatened death in some susceptible children after their first egg; cases of such acute bronchial spasm that laryngeal obstruction has been suspected.

I should like to refer to the so-called ritual of skin testing. A writer in the *British Medical Journal* rather unkindly refers to the ceremony of skin-testing as having a profound effect upon a patient's mind, and to this alone may perhaps be attributed any success that has attended the inquiry into the specific protein. While I have confined my treatment almost entirely to the non-specific peptonic method, I have found it extremely valuable very often to do a series of skin tests first. I have a fairly comprehensive list of powdered proteins which I procured in America and which I saw used in *Chandler Walker's* laboratory.

Here is a case which illustrates the value of these tests: A boy of nine was under my care in the Dunedin Hospital for eczema and asthma, both of long standing. He improved under peptone injections, but was not satisfactory. I did a series of tests and found a very positive reaction for egg white—this we already knew—but also for potato and for horse protein. We therefore cut out these foods and removed all horsehair from his bed, with the result that he was discharged free from asthma and eczema.

PEPTONE TREATMENT.—In giving peptone I have endeavoured from the beginning to avoid the mistake made by *Auld*, I think, in his earlier cases of giving too large an initial dose, say 2 to 3 grains, and so precipitating an alarming attack of asthma. I have therefore begun with one-thirtieth to one-twentieth of a grain and doubled the dose every four or five days until two to three grains has been reached. This dose may be repeated weekly. In this way I have had only mild local reactions, and have certainly had some gratifying results. At the same time I am anxious to hear of the experience of others with perhaps superior methods of dosage. I have used the subcutaneous route throughout. The Medical School laboratory put up the peptone in 1c.c. phials of strengths of half, one, two and a-half, and five grains per drachm. *Auld* used *Witte's* peptone originally, but has lately advised a mixture of three parts *Armour's* peptone siccum and one part of *Witte's*. He has done this because the former contains less proteoses and is less toxic. It may be only a coincidence, but I have fancied I have got better results from *Witte's* alone. I will give you some points in cases that have come my way. My first experience of the subject was about seven years ago in an eczematous baby for whom I ordered

small doses of egg albumin, about half a drachm, to see what would happen. Such violent swelling of lips and tongue occurred at once that the matron of the home was very unwilling to repeat the experiment. This child subsequently developed asthma at the age of three.

The alarming effects of egg are well known. Here is a case: I was called urgently to an infant for whom albumin water had been ordered for gastro-enteritis. The child was collapsed and death-like in a few minutes after taking the albumin. On a previous occasion the same thing had caused profuse urticaria.

To link this case up with our subject I give another case: A boy of three whom I had attended for acute eczema when eight months old, and who had since had violent retching whenever given an egg, was admitted to hospital with dyspnoea cyanosis and a chest full of moist sounds—a marked bronchiolitis. He had been wheezy off and on for some months, but this was his first bad attack of asthma. He responded at once to atropin.

Two other cases were admitted within a few weeks. In both laryngeal diptheria was suspected, and in one tracheotomy was performed. I saw the latter after operation and found the same condition of bronchiolitis, and the tracheotomy had given very little relief. (Both of these cases responded to atropin.) The parents of this case definitely connected the attack with the eating of a small quantity of egg. Just as a damaged alimentary mucous membrane may render an infant with gastro-enteritis liable to food proteins entering the circulation in large quantities, so a damaged nasal or bronchial mucous membrane is often the starting-point of asthmatic attacks. This may explain the connection between an attack of pertussis or pneumonia and a subsequent asthma.

Here is a case showing this and combining skin, alimentary, and pulmonary signs: Girl three and a-half, eczema till fourteen months, pneumonia, then attacks of bronchitis every few weeks, with choking, wheezing, vomiting, pain in stomach. Another: Boy of nine, attacks of bronchitis and asthma for some years, generally beginning with sickness and vomiting; attacks date from pertussis at two years; patch of eczema on lower lip every winter; in good health since peptone injections.

Girl of six, given whole milk at five months (*c.f.*, whole milk and flood of protein); eczema at eight months, pertussis at sixteen months, followed by attacks of bronchial catarrh and wheezing. At eighteen months an egg caused urticaria and collapse; even icing off a cake increased eczema markedly. When five years old asthma occurred in spring and summer. Like many other cases, this child improved physically and gained weight as result of peptone treatment, and her asthma had practically disappeared when I last heard. Her skin tests were positive to egg, Timothy, and rye—the spring pollens.

The next case was the first one I treated with peptone, and the result was so striking that my interest was stimulated at the outset. A girl of two and a-half, eczema at two months, at eleven months pneumonia, followed by asthmatic attacks each winter, and during which she had to sit up in bed. Eczema and asthma in the mother. Peptone completely cured her, and now, three years later, she is quite free from asthma or any pulmonary disability.

A suggestion of neurosis can hardly be read into any of these cases, much as it may be suspected in the case of adults.

As *Dr. Eardly Fenwick* will speak upon the subject of asthma as seen in older subjects, I will not refer to adults except in two cases.

One was a girl with the curious antipathy to cats and horses—to be near either meant streaming eyes and sneezing. Skin tests with ten proteins gave a double plus reaction to cat hair and horse protein only.

The other, a hay asthmatic who was unable to be near flowers or grasses any spring. She gave a double plus to Timothy and rye. She began to experience relief after her fourth peptone injection. I followed the peptone series with the prescribed doses of *Mulford's* pollen vaccine (spring), and she was at once able to garden and smell flowers without inconvenience for the first time in six years. She was almost as well the following summer.