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Slavery in New Zealand: What is the role of the health sector?

Seven things you need to know about men's health

Mesh abdominal wall hernia surgery is safe and effective—the harm New Zealand media has done

The New Zealand Major Trauma Registry: the foundation for a data-driven approach in a contemporary trauma system

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Ten-year experience of splenic trauma in New Zealand: the rise of non-operative management

Yassar Alamri, Dana Moon, Damien Ah Yen, Christopher Wakeman, Tim Eglinton, Frank Frizelle

Splenic injuries have shown a steady increase in the last decade. Rates of surgical intervention have decreased in favour of non-operative techniques. Minimally invasive control of bleeding under radiological guidance was successful in all selected patients with high-grade injuries.

The New Zealand Major Trauma Registry: the foundation for a data-driven approach in a contemporary trauma system

Siobhan Isles, Grant Christey, Ian Civil, Peter Hicks

The establishment of the New Zealand Trauma Registry means that for the first time we have the capability to understand the patterns of trauma and the impact this has on individuals, their family/whanau, and the cost to society. The NZ-MTR is an important tool to support a data-driven approach to trauma. This paper explores how the NZ-MTR was established and its potential to bring us in line with formal systems internationally.

An observational study of how clinicians use cardiovascular risk assessment to inform statin prescribing decisions

Thomas Robinson, Rod Jackson, Susan Wells, Andrew Kerr, Roger Marshall

Ninety percent of New Zealanders who are in the NZ Guidelines target group have had a CVD risk assessment. There is little information on how this information is used by doctors and their patients. The decision to start cholesterol lowering medications (statins) might be driven mainly by cholesterol levels, or (as NZ Guidelines suggest) by a comprehensive assessment of the person's overall risk. This paper suggests that the latter approach is more likely, but that the decision process is complex and takes into account other factors.

Acute abdominal pain—changes in the way we assess it over a decade

Kirsten de Burlet, Anna Lam, Peter Larsen, Elizabeth Dennett

In this study we have reviewed the number of acute admissions for the general surgery department in Wellington Hospital and have focused on patients presenting with abdominal pain. Overall we can state that the number of surgical admissions over the last decade has nearly doubled and more patients are admitted with non-urgent or self-limiting problems. Also, more CT scans are requested for this patient group and a greater proportion of these scans come back negative for acute pathology.

Characteristics of older adults hospitalised following trauma in the Midland region of New Zealand

Katrina O'Leary, Bridget Kool, Grant Christey

This paper was designed to document the incidence of trauma in older adults within the Midland region of New Zealand. The findings show how older adults are injured, where they are injured and what their outcomes are (mortality, hospital length of stay, discharge destination from hospital, surgical procedures).

Mesh abdominal wall hernia surgery is safe and effective—the harm New Zealand media has done

Steven Kelly

Patients in New Zealand have now developed a fear of mesh abdominal wall hernia repair due to inaccurate media reporting. This article outlines the extensive literature that confirms abdominal wall mesh hernia repair is safe and effective. The worsening confidence in the transvaginal mesh prolapse repair should not adversely affect the good results of mesh abdominal wall hernia repair. New Zealand general surgeons are well trained in providing modern hernia surgery.

New Zealand's peak year for wartime mortality burden: the important role of the Battles of Messines and Third Ypres (Passchendaele) in 1917

Nick Wilson, Glyn Harper

At a total of 5,547 deaths among New Zealand's military personnel, the year 1917 was the worst year from a mortality perspective in the country's military history. This year had a third of the deaths in the whole of the First World War for this military population. Major drivers of this mortality burden were the battles of Messines and Third Ypres (Passchendaele) in June and October 1917 respectively. The contribution of disease deaths to the mortality burden was relatively small at 4.5%. Disease deaths were significantly more common in the Northern Hemisphere's winter months, and some may have been related to crowding.

Slavery in New Zealand: What is the role of the health sector?

Paula King, Alison Blaiklock, Christina Stringer, Jay Amaranathan, Margot McLean

Slavery and its adverse health consequences is a serious, complex, and often hidden problem in New Zealand. We have endeavored to raise awareness about this neglected issue and highlight the numerous opportunities for doctors and other health practitioners to be leading advocates for change at government, health system and organisational levels. Responses should be based on the respect, promotion and protection of human rights, and occur within a robust person-centric coordinated government response to addressing slavery in New Zealand.

Seven things you need to know about men's health

G David Baxter, Leon Mabire, Lizhou Liu, Martin J Connolly, Reremoana Theodore, Jill Brunson, Helen Nicholson

Men's health is a conundrum. In New Zealand, men have a lower life expectancy and health status than women, yet New Zealand is described as taking an 'ad-hoc' approach to men's health with no strategy or policies to address these health inequalities.[1] Men's health is any issue that impacts men's quality of life, and requires a gender-orientated response to improve men's health and wellbeing at an individual or population level.[2] The need for gendered healthcare is indisputable: a 2002 Ministry of Health paper reported that in addition to biological differences, much of gender health inequality is a product of social and cultural expectations.[3] What is the current status of men's health in New Zealand and where do opportunities exist for healthcare professionals to address health inequalities?

1. Men's health is about higher and earlier mortality

Between the ages of 50 and 75 years, the overall number of deaths for men is 30% higher than for women;[4] men die at an earlier age than women.[4] While women's health is a useful comparison for men's health issues, men have different health needs: priorities in improving men's health (as a discipline) is to identify these needs and the extent to which men's health can be improved.

2. Heart disease and cancer are the leading causes of death for New Zealand men

The main causes of death for New Zealand men are presented in Figure 1. From the age of 40 years onwards, heart disease and cancer are increasingly common causes of mortality.[4] The prevalence of heart disease and some cancers can be attributed to men's adverse lifestyles, including excessive alcohol intake, lack of exercise and inappropriate diet.[5] Cancer does not discriminate between sexes in overall death rates between age groups. However, for heart disease, a larger number of deaths in women does not occur until the age of 85 years (Figure 2).

Figure 1: Main causes of death for New Zealand men (2013).[4]

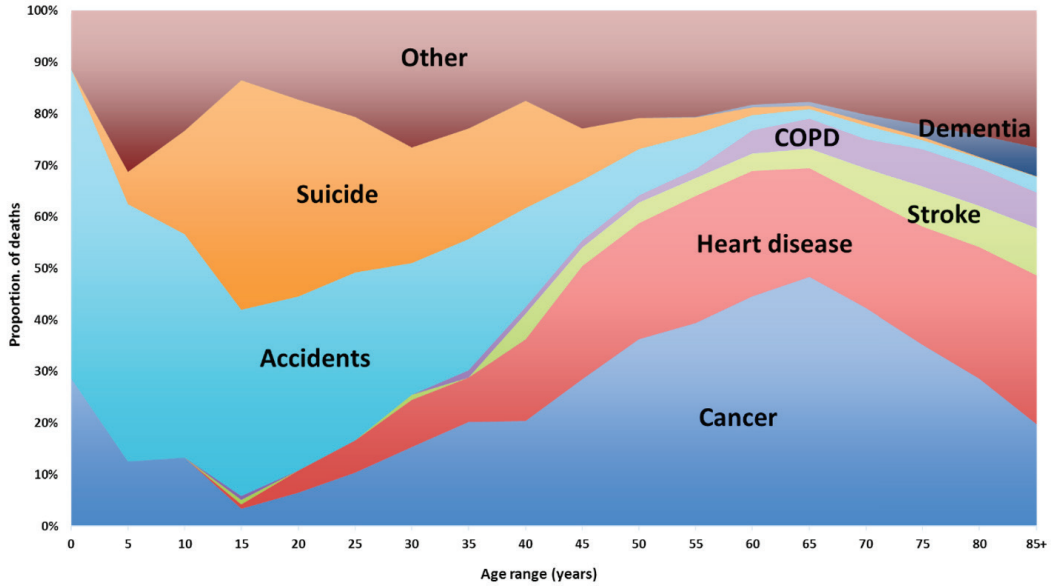
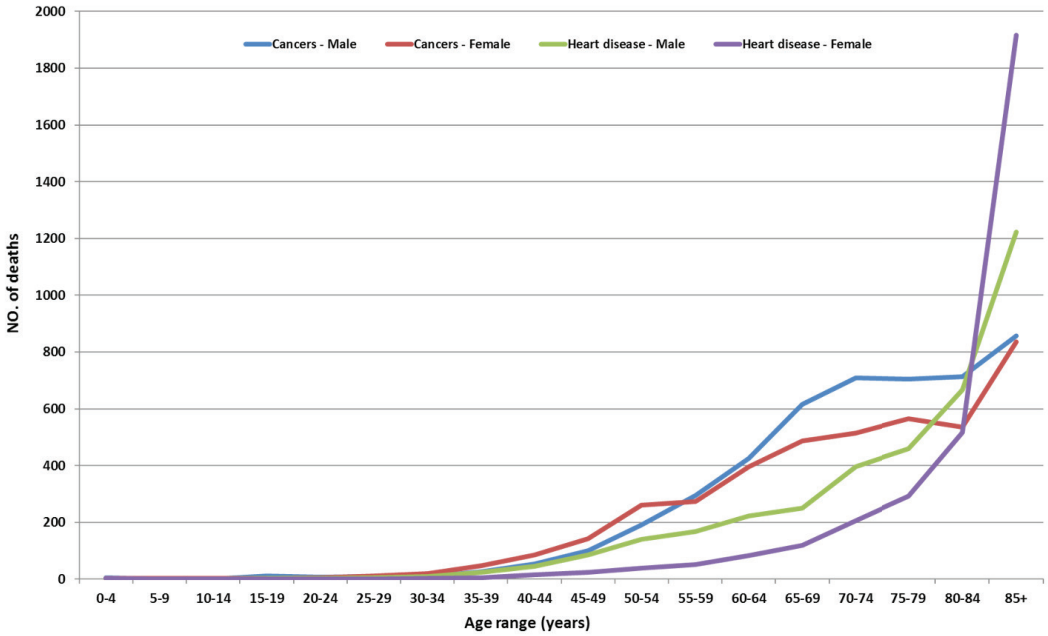


Figure 2: Comparison of mortality rates for heart disease and cancer for New Zealand men and women (2013).[4]



3. Men's health is not *just* about prostate or testicular cancer

Prostate and testicular cancer represent perhaps the unique men's health concerns in this area. Over half of Health Research Council funding allocated to men's health issues since 2010 has been awarded to projects concentrating on prostate or testicular cancer. However, prostate and testicular cancer combined account for just 4.4% of all annual male deaths.[4] Lung cancer accounts for 5.8% of all male deaths each year, followed by colorectal cancer at 4.3%.[4]

Among all cancers, hospitalisation for prostate and testicular cancer is low. The highest hospitalisation rate is reported in skin cancer patients (1.9% of hospitalisations).[7] Colorectal cancer and prostate cancer account for 0.4% of all hospitalisations respectively.[7] Early detection and reliable treatment of skin cancer means that it accounts for only 2% of deaths.

4. Suicide is the leading cause of death for young male teenagers and adults

Between the ages of 15–30 years, suicide is the leading cause of death for men. Men are more likely to choose a violent method of suicide, such as hanging or suffocation.[3] Women are twice as likely to be hospitalised due to attempted suicide, but female mortality rates from suicide are 40% of those of men:[8] 12% of male suicide attempts result in death, compared to just 2% for women.[3] This disparity may arise from higher suicidal intent among men compared with women, who are less intent on dying and may be more amenable to receiving help and support.[9]

5. Men's health in Māori and Pacific Peoples

Life expectancy for Māori and Pacific men is 73 years and 74.5 years, respectively, compared with 80.3 years for non-Māori males.[10] Cancer is the leading cause of death, with the highest mortality rate at the age of 65 for Māori men and 70 years for Pacific.[4] Heart disease is the second leading cause of death, but deaths occur 5–15 years earlier among Māori and Pacific men compared with non-Māori.[4] Diabetes is the third leading cause of death, accounting for 6% of Māori deaths, 8% of Pacific men (with significant increases in deaths occurring from 40 years), compared with just 2.6% of non-Māori deaths.[4] Differences in health outcomes for Māori and Pacific men compared to their counterparts result from a complex combination of factors that include greater exposure to the determinants of ill-health (eg, lower socioeconomic status) and poorer access to and quality of healthcare. Similar to men's

health in general, these mortality rates, and in particular the age of onset of disease, are also affected by health risk factors such as diet and other lifestyle factors.

6. Trauma

The rate of accidents resulting in injury or death is consistent across the age range, and accidents are a significant cause of hospitalisations. In 2013–14, men submitted over 870,000 claims to the Accident Compensation Commission (ACC);[11] accidents result in 59,036 hospitalisations.[7] Men aged between 20–30 years are more likely to be the victims of assault or homicide, whereas from the age of 65 years onwards, tripping or falls are the most common accidents.[7]

7. Research activity in men's health

To map the contemporary literature and explore whether the available research meets the needs of men's health, two researchers (LM and LL) searched the OVID and Scopus databases from 2010 to June 2017. Articles were identified through titles, abstracts and keywords using search terms including 'accident', 'cancer', 'heart disease', 'stroke', 'COPD', 'suicide' and 'dementia'. Results were restricted to those reporting exclusively on 'man', 'men' or 'male'. Searches were further restricted to New Zealand-based publications, researchers and/or participants.

Results of the literature search showed a striking need for research on men's health issues in which the risks are modifiable. For heart disease, stroke, and to a lesser degree of modifiable lifestyle change, cancer, studies of women's health outnumbers men's health by two to one. Topics in which risks are not directly modifiable, accidents and dementia, were well represented in the literature search.

A further search was made of Health Research Council funding since 2010.[6] LM and LL reviewed titles and abstracts of all successful applications to identify sex-specific funding. The search revealed that for every $1 spent exclusively on women's health research, men's health research received $0.06.

Conclusion and implications

Men's health is partly a product of biology, social expectations and systemic discrimination variable of access and quality of care, as well as a consequence of masculinity (a set of male attributes, behaviours and roles): the invulnerable approach to diet and activity,[5] and the 'man up' approach to health.[1] To improve men's health, it is beneficial to raise men's health awareness by enabling men to define what health means to them, improve access to healthcare resources, particularly avoiding environments, terminology or judgments that might be negative about masculinity.[12] Nevertheless, where masculinity entails adverse activities including substance use, risk behaviours and violence, being non-judgemental may be damaging.

ACC statistics reveal that each year around 1.2 million New Zealand men contact with at least one healthcare professional for issues unrelated to chronic disease.[11] This is a key opportunity for healthcare professionals to screen for lifestyle behaviours and promote the healthier lifestyle that would help New Zealand men to live longer, healthier lives. In order to address health inequities, education is necessary but insufficient to improve such practices. Policies that change environments in ways that reduce damaging social determinants of health may be far more effective.

Australia, Ireland and the UK have established men's health forums and released national men's health policies. The approaches to policy development and methodologies used provide a solid foundation for men's health policy development in other countries including New Zealand. We plan to launch a New Zealand National Centre for Men's Health in late 2017; further information will be available at www.otago.ac.nz/mens-health.

Competing interests:
Nil.
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Ten-year experience of splenic trauma in New Zealand: the rise of non-operative management

Yassar Alamri, Dana Moon, Damien Ah Yen, Christopher Wakeman, Tim Eglinton, Frank Frizelle

ABSTRACT

AIM: The aim of this study was to describe the demographics, mechanisms of injury, management and outcomes in patients who suffered splenic trauma in Christchurch, New Zealand.

METHODS: A retrospective study included all splenic injury patients admitted to Christchurch Public Hospital between January 2005 and August 2015.

RESULTS: A total of 238 patients were included, with a median age of 26 years (4–88.7). Of these, 235 patients had blunt injuries. Eighty-nine had high-grade injuries. Yearly admissions of splenic trauma patients have gradually increased. A total of 173 (72.7%) patients were managed with observation; 28 patients (11.8%) had radiological intervention and 37 patients (15.5%) had splenectomy. Patients who died were significantly more likely to be older (median, 46.5 vs 25.2 years, p=0.04) and to have been admitted to ICU (100% vs 32%, p=<0.001).

CONCLUSION: Splenic injuries have shown a steady increase in the last decade. Splenectomy rates have decreased in favour of non-operative techniques. Radiological intervention with splenic artery embolisation was successful in all selected patients with high-grade injuries.

Maintaining splenic function is important because of the spleen's role in immune competence. The spleen reduces infection from encapsulated organisms and alters the risk of developing malignancy as well as mediates its outcome.[1–3] The spleen, however, is injured in up to 45% of blunt abdominal trauma,[4,5] The mortality associated with splenic injuries has been reported to be as high as 7%.[6–8] Much of the early mortality is to be thought to be preventable,[9] if expedient treatment and accurate diagnosis can be achieved. While the incidence of splenic injuries differs according to geographic location and patient ethnicity,[10] the outcome of adult patients with splenic trauma does not vary with the treating hospital's experience.[11]

There is limited published New Zealand data on splenic injuries with only a small retrospective study published in 1999, where a third of the patients received immediate splenectomy and 10% died pre-operatively.[12] Since that time, the experience of non-operative management (NOM) of splenic trauma has increased.

Non-operative management of splenic injuries includes radiological intervention with splenic artery embolisation (SAE)[13] and conservative management. While the uptake of SAE has generally been increasing,[14] many uncertainties surround its optimal use.[15] Some centres utilise SAE routinely as a management option for haemodynamically stable patients with high-grade splenic injuries. Other centres, on the other hand, are much more reserved in their use of SAE, offering it only rarely.[16]

The aim of this study was to describe the characteristics of splenic trauma patients over a 10-year period. Changes in management and outcomes, in particular for high-grade injuries, were assessed including the role of SAE.

Methods

Study setting

This retrospective study included all patients with a splenic injury admitted to Christchurch Public Hospital (CPH) between January 2005 and August 2015.

Patient selection

Case identification was carried out in two steps:

1. All records of all patients undergoing open splenectomy were reviewed.
2. A search of the CPH's picture archiving and communication system (PACS) for computed tomography (CT) was undertaken using a combination of the keywords 'spleen or splenic' and 'trauma, injury, laceration or rupture'.

All patients who had splenic injury were included regardless of age. Patients were classified as 'paediatric' if under 16 years of age on the date of admission; these patients were managed by the paediatric services. Patients 16 years and above, on the other hand, were classified as adult and managed by the adult services.

Patients were defined as having a splenic injury if they had evidence at operation or on CT scanning of splenic parenchymal disruption, evidence of recent bleeding or haematoma formation. A high-grade splenic injury was defined as AAST-grade IV or V injuries, or any splenic injury that required emergency open splenectomy due to haemodynamic instability on presentation.

Confirmed cases from the post-operative notes and CT reports were subsequently reviewed more closely. Only patients admitted and managed within the CPH were included. Non-traumatic and iatrogenic insults to the spleen were excluded.

Data collection

Admission and discharge data were collected from the CPH's electronic patient record system. If not stored electronically, physical notes were sought. The group was analysed as a whole then the high-grade injuries were examined separately to inform current management trends and outcomes in this important group.

Statistical analysis

Descriptive statistics were used to analyse the majority of the data while independent-samples Student t-test, Mann-Whitney U test, regression analysis and Kaplan-Meier analysis were utilised for the remainder. Statistical significance was determined if type I error rate was <5%. All analyses were performed using SPSS Statistics® software package (version 22.0.0.0).

Results

An initial sample of 597 possible suitable patients was identified, from which a study population of 238 patients was included, as shown in Figure 1. Of these, 89 patients had high-grade injuries. Results are given for the entire cohort of 238 patients before focusing on the outcomes of the 89 patients with high-grade injuries.

Figure 1: Iatrogenic splenic injury n=7.

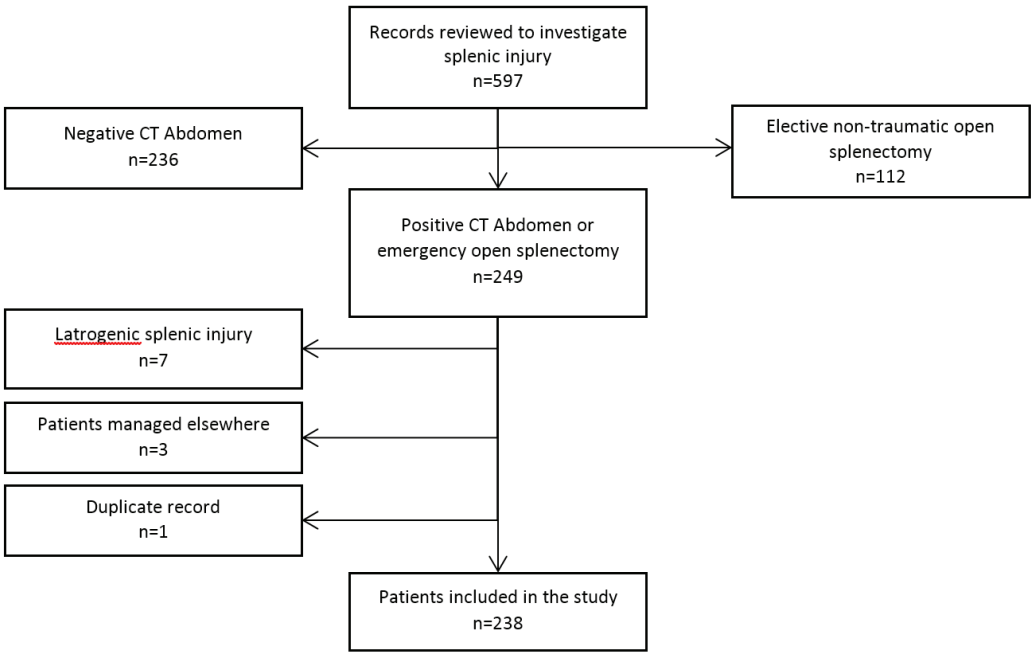

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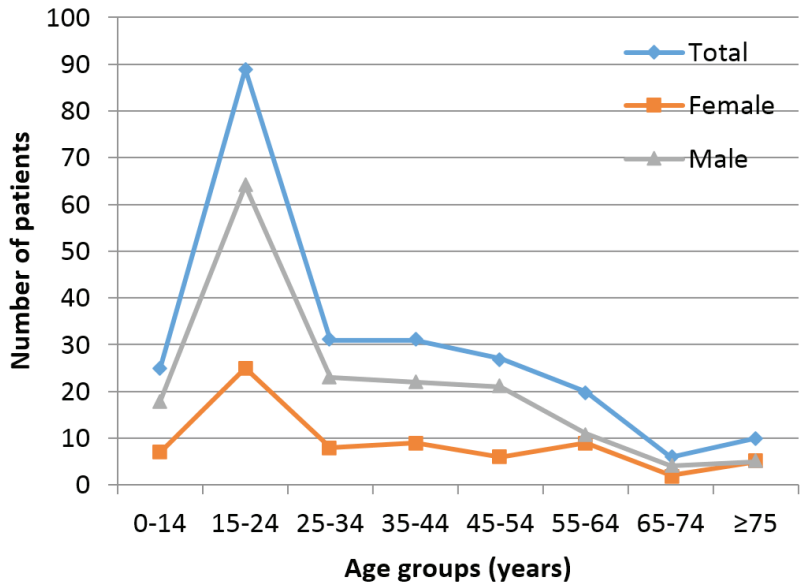
Figure 2: Distribution of splenic injury patients by age and sex.

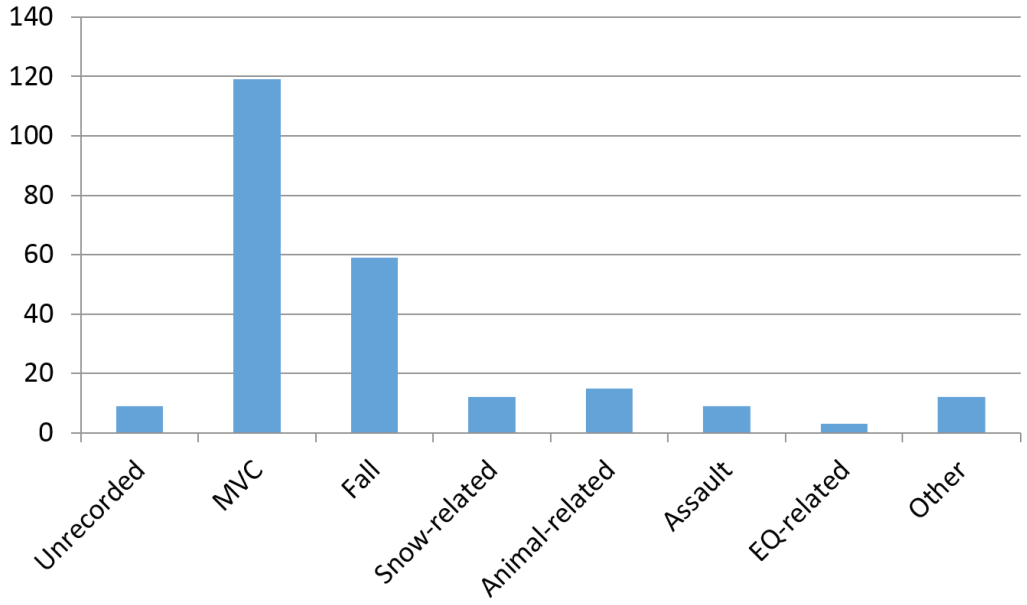


Baseline characteristics of the splenic injury cohort

The median age on admission was 26 years (range, 4–88.7). There were more males (n=169) than females (n=69). The number of patients stratified by age and sex is shown in Figure 2.

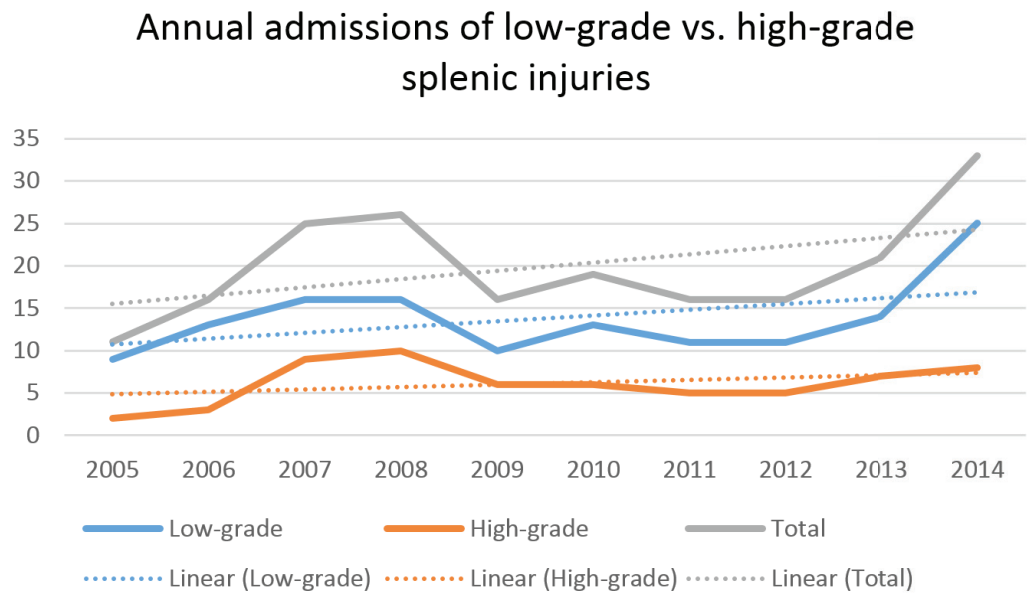
Figure 3 demonstrates the mechanisms of injury. All but three injuries were the result of blunt trauma. The three penetrating injuries consisted of two patients who were assaulted with knives and a third patient in a hunting arrow accident. Three patients' injuries were directly related to the 2011 Christchurch earthquake. Yearly admissions of splenic trauma patients have gradually increased over the decade, peaking in 2014 (see Figure 4).

Figure 3: Mechanisms of trauma causing splenic injuries.



Other refers to a heterogeneous group of patients whose injuries were caused by workplace accidents (n=7), rugby tackles (n=3), hunting arrow (n=1) and skydiving (n=1). MVC = motor-vehicle crash; EQ = earthquake.

Figure 4: Increase in splenic trauma-related admissions between January 2005 and December 2014.

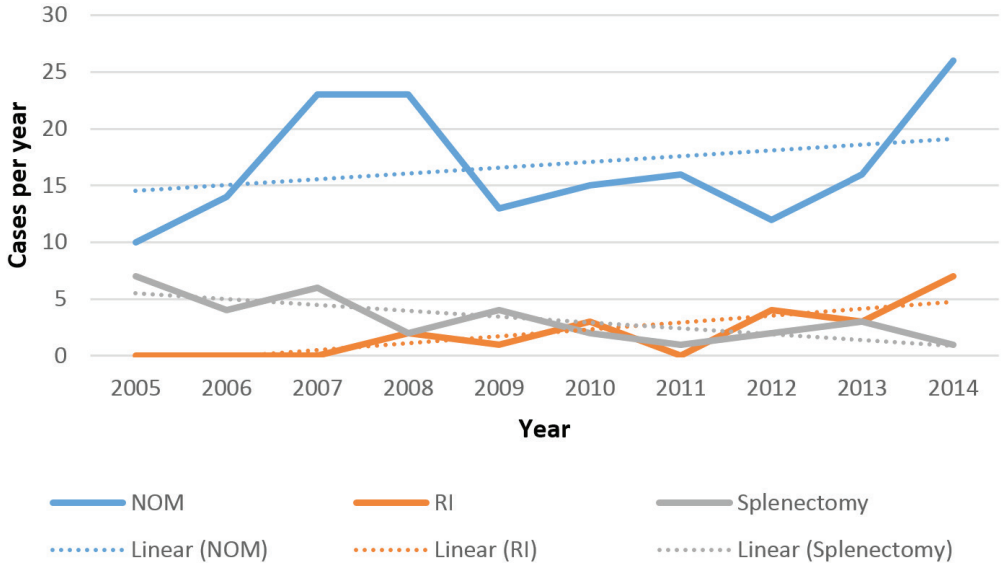


Management and outcomes—all grades

Patients were initially managed and stabilised in accordance to Early Management of Severe Trauma (EMST) guidelines. For patients who had an admission CT (n=215), most (63.4%) had low-grade splenic injuries (grade I=63, grade II=42 and grade III=45). Sixty-five patients had grade IV or V splenic injuries; 23 patients were taken for splenectomy without CT imaging.

Generally, there was a trend, albeit non-significant, to increased NOM over the study period (see Figure 5). The majority of patients in our cohort (173 patients; 72.7%) were managed conservatively, whereas 37 patients (15.5% of all patients) underwent splenectomy. Twenty-eight patients (11.8% of all patients) had SAE, 11 of whom sustained low-grade splenic injuries (all grade III): 10 patients demonstrated active bleeding on CT, while the last patient had

Figure 5: Trends in management of splenic injuries in New Zealand: 2005–2014.



NOM = non-operative management; RI = radiological intervention.

Table 1: Clinical parameters in the three management groups.

	NOM	RI	Splenectomy	p-value
Total (n)	173	28	37	
Adult patients (n)	144	28	36	
Paediatric population (n)	29	0	1	0.006
Adult age (mean, years ± SD)	31.5 (±18.7)	35.5 (±20.2)	41.4 (±18.4)	0.013
Male (%)	72.3	71.4	65.8	0.73
Blood transfusion (%)	44.5	85.7	68.4	<0.0001
Length of stay (median, days)	6.4	9.4	8.0	0.56

NOM = Non-operative management; RI = radiological intervention; SD = standard deviation.

no documented reason for SAE. One patient failed SAE and was successfully re-embolised four days later (see Table 1).

In patients for whom blood transfusion data were available (n=223), 91 (40.8%) received one or more units of packed red blood cells (pRBC) and/or other blood products. In observation patients, the median number of pRBC units transfused was 0 units (range, 0–14), compared with two units (range, 0–42) in patients treated with SAE or splenectomy (p<0.001). The proportion of patients receiving a blood transfusion per year remained unchanged throughout the study period (mean, 40.6%).

The median length of hospital stay was 6.8 days (range, 0–190 days). Eighty-three patients (34.9%) were admitted to ICU during their hospital stay. The median duration of ICU stay was three days (range, 1–32).

Management and outcomes—high grade

A total of 89 patients had high-grade injuries. Since these patients were more likely to have severe physiological compromise than low-grade patients, they were analysed separately for management and outcomes (see Table 2). Of these, 40 patients (44.9%) were managed conservatively. This sub-group was significantly younger than splenectomy patients (p=0.002), but not SAE patients (p=0.20).

Patients treated conservatively were significantly less likely to be transfused compared with patients managed with splenectomy (p=0.001) but not SAE (p=0.30). Similarly, their admission haemoglobin was significantly higher than patients treated with splenectomy (p=0.026) but not SAE (p=0.64).

Table 2: Description of study population demographics.

	Male	Female	p-value
Total number (n)	169	69	
Overall age (median, range)	25 (4–88.7)	27 (5.6–85)	0.41
Paediatric* age (median, range)	13 (4–16)	13 (5.6–15.9)	0.87
Adults age (median, range)	29 (16.3–88.7)	33 (16.2–85)	0.36

*Paediatric population was defined as being less than 16 years of age.

Thirty-two patients were treated with splenectomy. This included 23 (71.9%) patients who were emergently taken to the operating theatre without CT imaging due to haemodynamic instability (all had positive Focused Assessment with Sonography for Trauma scans of the abdomen). Patients managed with splenectomy were significantly more likely to have higher-grade splenic injuries (ie, higher proportion of grade V injuries) compared with patients treated conservatively ($p<0.001$) or with SAE ($p=0.035$). They were also significantly more likely to be admitted to ICU compared with conservative ($p=0.014$) or SAE ($p=0.033$) patients. Their stay in ICU, however, was not different to conservatively managed ($p=0.89$) or SAE ($p=0.76$) patients who were admitted to ICU.

A total of 17 patients underwent SAE. The median delay from admission to SAE was 389 minutes (range, 9 minutes–10 days). Eight patients had proximal SAE, seven had distal SAE, one patient had both and a site was not recorded for one patient. Most SAE were accomplished using coils (58.8%), followed by particle or glue plugs (17.6%) and combination (23.5%).

Splenic artery pseudoaneurysms were present in 29.4% of patients undergoing SAE. During angiography, 52.9% of patients were found to have active bleeding. All SAE were successful. The only complication was splenic infarction in one patient. No patient required subsequent splenectomy. SAE patients had a similar length of hospital stay compared with patients managed conservatively ($p=0.64$) and with splenectomy ($p=0.48$).

Discussion

This large study has shed light on patient demographics, characteristics of trauma and management outcomes of splenic injuries in a large tertiary centre in New Zealand; most patients sustained low-grade splenic injuries as a result of a blunt injury (most commonly an MVC) and were managed conservatively. There has been a steady increase in the number of patients diagnosed with splenic injury—especially low grade—perhaps attributable to better radiological imaging techniques and/or a change in risks to which post-earthquake Christchurch residents are exposed. In addition, there has been an increase in the use of radiological interventions in the management of these patients.

Patient characteristics in this study are similar to those described by Sanders et al's[12] report on adult patients where they reported that MVC was the most common cause of splenic injury. MVC patients in our study were more likely to have sustained less severe injuries and be haemodynamically stable (65.8%), compared with previous older studies.[12] Safety measures in newer motor vehicles and stricter road policies could have contributed to differences in injury severity and/or mechanisms of injury.[17]

There is an ongoing paradigm shift in the management of splenic injuries with a tendency towards NOM.[18] This is clear in the patterns detected in our study, and is a major differentiator between our study (NOM=72%) and Sanders et al's study (NOM=56.2%).[12] While NOM has become the standard of care for haemodynamically stable patients with blunt splenic injury, those with peritonitis or haemodynamic instability still require exploratory laparotomy. The indications for SAE remain more controversial but include: high-grade injuries (grades IV and V), the presence of a contrast blush on CT, a moderate haemoperitoneum or clinical evidence of ongoing splenic bleeding.[19] In the present study, SAE was used successfully in patients with both low- and high-grade injuries with one instance each of splenic infarction and re-embolisation, and no patients requiring splenectomy.

In general, our findings are similar to those from other international series on splenic injuries over a similar time-period. Table 3 summarises findings of our study, compared with Scottish and Taiwanese patients with splenic injuries.

This study is subject to certain limitations and biases. It is retrospective in design. During the decade over which this study spanned, Christchurch experienced several earthquakes and subsequent rebuild; these could have affected the catchment numbers and the risk profile to which residents are exposed. There are also potential issues with the recruitment of the study population. In the absence of a local trauma registry, it is possible that a few patients may have been missed, including those who had

Table 3: Comparing three international studies on splenic injury patients.

	This study	Soo et al[10]	Brady et al[6]
Origin	New Zealand	Taiwan	Scotland
Study period	2005–2015	1997–2008	1992–2002
Sample	238	578	672
Age (mean, years)	33.4	36.7	35.7
Male (%)	70.1	73.2	76.3
MVC (%)	50	32.5	71
LOS (mean, days)	11.4	11.2	8
Splenectomy (%)	16.7	44.6	N/A
Mortality* (%)	8	5	33.5

LOS = length of stay; MVC = motor vehicle crash; N/A = information not available.
*Refers to overall mortality rate to date of data acquisition.

an urgent laparotomy without a CT scan and despite having a splenic injury did not have their spleens excised. However, data from multiple sources were sought in order to corroborate the findings reported, and it is unlikely that a significant number of patients was missed. Multiple injuries often contribute to outcomes in splenic trauma patients. Injury severity scores were not reported in this study, which must be considered when comparing outcomes to other studies. Despite this, our study remains the largest study to be reported on splenic injuries in New Zealand.

Conclusion

Admissions with splenic injury have shown a steady increase in the last decade with young males remaining the group most frequently affected. Splenectomy rates have decreased in favour of non-operative techniques including SAE. While haemodynamic instability and peritonitis mandate splenectomy, SAE may be considered in stable patients with high-grade injuries, contrast extravasation or clinical evidence of ongoing bleeding. In all other blunt splenic injuries, conservative management remains the gold standard.

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Nil.

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The New Zealand Major Trauma Registry: the foundation for a data-driven approach in a contemporary trauma system

Siobhan Isles, Grant Christey, Ian Civil, Peter Hicks

ABSTRACT

AIM: To describe the development of the New Zealand Major Trauma Registry (NZ-MTR) and the initial experiences of its use.

METHOD: The background to the development of the NZ-MTR was reviewed and the processes undertaken to implement a single-instance of a web-based national registry described. A national minimum dataset was defined and utilised. Key structures to support the Registry such as a data governance group were established.

RESULTS: The NZ-MTR was successfully implemented and is the foundation for a new, data-driven model of quality improvement. In its first year of operation over 1,300 patients were entered into the Registry although coverage is not yet universal. Overall incidence is 40.8 major trauma cases/100,000 population. The incidence in the Māori population was 69/100,000 compared with 31/100,000 in the non-Māori population. Case fatality rate was 9%. Three age peaks were observed at 20–24 years, 50–59 years and above 85 years. Road traffic crashes accounted for 50% of all caseload. A significant proportion of major trauma patients (21%) were transferred to one or more hospitals before reaching a definitive care facility.

CONCLUSION: Despite the challenges working across multiple jurisdictions, initiation of a single-instance web-based registry has been achieved. The NZ-MTR enables New Zealand to have a national view of trauma treatment and outcomes for the first time. It will inform quality improvement and injury prevention initiatives and potentially decrease the burden of injury on all New Zealanders.

Abbreviations	
AIS	Abbreviated Injury Score
CT	Computerised Tomography
DHB	District Health Board
GCS	Glasgow Coma Scale
ICD	International Classification of Disease
ISS	Injury Severity Score
INR	International Normalised Ratio
NMDS	National Minimum Dataset for major trauma
NZ-MTR	New Zealand Major Trauma Registry
MTNCN	Major Trauma National Clinical Network

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During her epic career, JK Rowling wrote "From this point forth, we shall be leaving the firm foundation of fact and journeying together through the murky marshes of memory into thickets of wildest guesswork".[1] What JK Rowling did not know was that the trauma system in New Zealand has occupied that murky ground for some time. The time has come to distance ourselves from the magical realm of guesswork and enter a new era of data-driven trauma care provision.

Indeed there is good evidence to suggest that contemporary trauma systems, which are supported by accurate timely data, can reduce preventable levels of mortality, complications and lifelong disability among people who sustain major trauma.[2–4] Trauma registries are used extensively internationally to describe the patterns of trauma, demonstrate changes in patient and system outcomes, and provide data for research.[5,6] Another important function is to provide feedback to hospitals on trauma performance to support improvement in the quality of care and address issues of sub-optimal performance. Contemporaneous data provides useful information to support the effective management of trauma for local, regional and national trauma systems.

Historically in New Zealand and despite previous attempts,[7–10] there has been little investment in a national system of collecting trauma data, even though injury is one of the most significant contributors of health loss across all age groups, but particularly in the young.[11]

However, in 2012 the New Zealand Major Trauma National Clinical Network (the 'Network') was formed. The Network had three initial priorities: to establish a formal national structure, to implement a national registry and to develop consistent guidelines and policies. The Network is funded by the Accident Compensation Corporation (New Zealand's no-fault accident insurer) and the Ministry of Health, and comprises senior clinical, management, funding and research stakeholders.

This paper describes the development of the NZ-MTR and initial experiences of its use.

Method

The context in which the Network operates presents some unique challenges. New Zealand is a population of 4.6 million people, and while the majority (78%) live in the North Island, during the summer months the South Island population can expand significantly above its one million population. Universal health care is provided by 20 district health boards (DHBs) who have legislative autonomy to provide care across community and hospital services and are organised into four regions for selected shared services. There are six major trauma hospitals, including one which provides quaternary paediatric services, and two more which provide specialist burns and/or spinal cord injury services. There are two ambulance services and an extensive air ambulance network.

With the formation of the Network it was accepted that a major trauma registry was a key goal. The intent of the registry was to accurately describe the numbers of major trauma patients admitted to New Zealand hospitals, to measure system performance and enable research. Each of the initial meetings of the Network addressed the way in which this objective could be progressed. A key component of any registry is a concise, relevant and achievable dataset. Similarly, the form of the registry on which the data is to be collected and recorded and the cost of that solution are integral to having a functional registry. These issues were canvassed at length with the sponsors and among the Network to arrive at a solution which was feasible and would meet the requirements set out. Privacy and security of heath-related data is another fundamental element of a registry and these issues were also considered by the Network in association with the Office of the Privacy Commission, a crown-funded independent entity. Finally, access to the data and appropriate use of its elements is very important. Options were explored by the Network and an effective framework established.

National minimum dataset for major trauma

A national minimum dataset[12] (NMDS) for major trauma was developed using the background experience members of the Network had in setting up the Bi-National Minimum Dataset in Australia over 10 years previously. New Zealand-specific requirements were also considered as well as what current and future health information technology solutions may capture. As a result the

Table 1: Summarised data points collected in the New Zealand Major Trauma Registry (NZ-MTR).

Type of information	Data point
Unique identifiers	National Health Index
	Incident number
	Definitive care hospital
Demographic	Age
	Sex
	Ethnicity
	Date of birth
Incident details	Date and time of injury
	Postcode of injury
	Cause of injury
	Intent of injury
	Activity at time of injury
	Place of injury
	Injury description (narrative)
	Safety devices used
Pre-hospital information	Date and time of first observations
	Vital signs (GCS¥, heart rate, systolic blood pressure, respiratory rate)
	Mode of transport from scene
Hospital information	Date and time of first observations
	Vital signs (GCS, heart rate, systolic blood pressure, respiratory rate)
	Vital sign qualifiers
	Inter-hospital mode of transport
	Blood alcohol levels, base excess, INR€
	Date and time of procedures such as CT§, intubation, emergency operative procedures
Outcome	Coding for AIS¤ and ISS±
	Length of time intubated, in intensive care, in hospital
	Diagnosis made after 48 hours
	Discharge location
	Type of death

¥GCS Glasgow Comma Scale, €INR International Normalised Ratio, §CT Computed Tomography, ¤AIS Abbreviated Injury Score, ±ISS Injury Severity Score.

NMDS is closely aligned with the Bi-National Minimum Dataset used for the Australian Trauma Registry.[13] This was intentional to enable benchmarking of performance across a large collection and multiple jurisdictions. Of the 68 fields in the NMDS, 55 are a direct match with the Australian Bi-National NMDS. The New Zealand dataset contains items such as the National Health Index, ethnicity, paediatric weight and type of death, which the Australian dataset does not contain. Conversely, the Australian dataset contains elements such as pre-existing conditions, type of CT scan, blood transfusion and severe complications, which the New Zealand dataset does not contain. The non-matched items are either specific to the New Zealand context or were unlikely to be collected accurately. The data points are summarised in Table 1.

The definition of major trauma used by the Network is the Injury Severity Score (ISS)[14] of 13 or more using the 2008 revision of the 2005 edition of the Abbreviated Injury Scale (AIS).[15] Injury severity scoring is a unique coding system related to physical injury, used ubiquitously in trauma outcome research internationally over the last 40 years. The underlying AIS injury coding system is not a feature of any local information management system and the coding not part of the training of health coding staff in the hospitals. For this reason the trauma registry is a unique repository of heath quality improvement data.

ISS≥13 correlates with one severe or critical injury or two injuries of which one is major (AIS≥3) and one moderate injury (AIS≥2). In keeping with this definition, the NZ-MTR includes patients with major trauma defined by ISS≥13, and includes only those patients suffering physical injury as a result of energy transfer and not internal pathologic processes.

The inclusion and exclusion criteria are outlined in Table 2. While most patients admitted to ICU and many who have urgent torso surgery will have major trauma by anatomic (ISS) criteria, some will not. Criteria for admission to ICU will vary by institution, and priorities for urgent surgery will also depend on institutional factors. While these criteria may have value in defining a group of severely injured patients in a single institution, the same cannot be said for across multiple institutions. For consistency these criteria have not been included as criteria for the definition of major trauma.

Patients who have significant comorbidity and for whom a trivial injury is the final

Table 2: Inclusion and exclusion criteria of the major trauma National Minimum Dataset.

INCLUSIONS All patients of any age admitted to hospital with either: • Injury Severity Score (ISS) ≥13 , based on AIS¤ 2005, Update 2008[14] or • Death following injury (including deaths in emergency department)
The following patients are excluded: **EXCLUSIONS** • Patients with delayed admissions more than seven days after injury • Poisoning or drug ingestion that do not cause injury • Foreign bodies that do not cause injury • Injuries secondary to medical procedures • Isolated neck of femur fracture • Pathology directly resulting in isolated injury • Elderly (≥65 years of age) patients who die with superficial injury only (contusions, abrasions or lacerations) and/or have coexisting disease that precipitates injury or is precipitant to death (eg, stroke, renal failure, heart failure, malignancy). • Hangings • Drowning

¤AIS Abbreviated Injury Score.

common pathway to hospital admission and ultimate demise are not included in the registry. In these patients the management of the injury is largely unrelated to the outcome. The dilutional effect of including many of these patients on the registry would limit the ability to recognise trends and outcomes in patients with anatomically severe injury.

Conversely, if the injury is the cause of death, for example significant bleeding leading to haemorrhagic shock, and the comorbid patient would not have died if not for the injury (regardless of the severity of the injury) the patient is included in the registry.

Technical solution

A variety of solutions was explored, including standalone software in each DHB and use of existing technology platforms with local modifications relevant to the differences in each DHB. These options had major limitations when it came to combining the data. Ultimately a single-instance web-based option based in the Midland Region was chosen, as this software was already operational in this health region and could be extended to a national reach with acceptable cost and complexity. The software used is a web-based version of Collector©, a proprietary trauma software product from Digital Innovations Inc. based in Maryland. Access to the NZ-MTR is via secure portal using the Connected Health infrastructure.[16]

A key feature of the Collector© system is the intuitive Tri-Code function which converts narrative descriptions for injuries into both ICD and AIS codes. Tri-Code uses artificial intelligence software that recognises text and assigns relevant codes where the text matches a valid description. Tri-Code has been found to have excellent agreement with correct coding of AIS severities (weighted kappa 0.83-0.98).[17] Automated coding also eliminates the variability associated with coding calculated by multiple coders as would be the situation in the New Zealand setting. The NZ-MTR utilises 2005 AIS coding (with 2008 updates).

Data collection and assurance

Since 1 July 2015, all North Island hospitals have employed data collectors, however, there has been delay in the South Island Region to appoint these positions due to financial constraints and other challenges. These issues have now been resolved and as of end June 2017 there are data collectors employed in all 22 acute hospitals. Data collectors have been trained in AIS coding and in the use of the NZ-MTR, and are typically registered nurses.

Each hospital uses an extract of acute admissions from the hospital patient administration system to filter for Accident Compensation Corporation eligible patients or patients admitted with 'trauma' diagnoses. An assessment of these patients is conducted to determine whether they have appropriate diagnoses and reach the threshold for inclusion in the registry. Data collection is both prospective (typically in the larger centres which have more resource) and retrospective (typically in smaller centres with part-time resource).

In-hospital deaths are identified in various ways such as mortality extracts from the hospital patient management systems to identify injured patients who have died, and direct notification to data collectors from emergency department and inpatients services.

Quality assurance processes are undertaken in each region every four months to audit for completeness, logic and accuracy. Corrections are sent back to the original data collector to amend. Comprehensive data quality reports are prepared for each region at the end of a cycle, which show the types of errors detected by each data point.

Privacy framework

A comprehensive privacy framework[18] encompassing all aspects of the NZ-MTR, including the technical infrastructure, data collection and data use has been developed and reviewed by the Office of the Privacy Commission. There is information available for patients about the NZ-MTR and patients have the option to opt-off the registry.

Administration and governance structures

The overall framework supporting the NZ-MTR is led by the Network, which has oversight of the National Minimum Dataset, the Privacy Framework and the underlying agreements. A data governance group is established to manage the use of NZ-MTR data and assess requests for data.

The day to day management of the NZ-MTR is contracted to Waikato DHB and operated by the Midland Trauma System on behalf of all other DHBs who fund it with contribution from the Accident Compensation Corporation for the data quality assurance and reporting functions.

No applications have yet been made by external parties to use the NZ-MTR data for research purposes, but when such applications are made they will be assessed by the NZ-MTR Governance Committee against agreed requirements and a decision made.

Incentivising data collection

There are two incentives in place to support the collection and upload of data to the NZ-MTR. The first is the inclusion in the annual planning guidance set out by the Ministry of Health, which requires all DHBs to collect and input the NMDS on all major trauma patients. The second incentive comprises pro-rata regional funding for data collection, which is provided by the Accident Compensation Corporation. The incentive is used regionally for nurse and allied health continuing education in trauma.

Results

Reporting on the NZ-MTR is relatively limited to date, as a result of the short time it has been operational. Monthly reports are provided for internal use to monitor entries to the registry and year to date information on mortality and injury severity scores.

The inaugural annual report for 2015–16[19] was published using data from all North Island DHBs, and excluded the South Island data because of gaps in collection. The findings of this report showed an overall incidence of 40.8 major trauma cases/100,000 population with variation between the regions ranging from 36–48/100,000. The incidence in the Māori population was 69/100,000 compared with 31/100,000 in the non-Māori population. Case fatality rate was a consistent 9% for each region. Three age peaks were observed at 20–24 years, 50–59 years and above 85 years. Road traffic crashes account for 50% of all caseload. A significant proportion of major trauma patients (21%) are transferred to one or more hospitals before reaching a definitive care facility.

Table 3: Summary of NZ-MTR results 2015–16.

Incidence of major trauma	40.8/100,000
Incidence of major trauma by ethnicity	Māori 69/100,000 Non-Māori 31/100,000
Case fatality rate	9%
Cause of injury	Road traffic 52% Falls 28% Other 12% Assault 8%
Age group	Three peaks observed: 20–24 years 50–59 years 85+ years

These findings are consistent with other jurisdictions internationally[20,21] and give us a good level of confidence that the veracity of the NZ-MTR data is within range of what we might expect. The information from this first report may help start to inform an effective approach to injury prevention and areas to improve quality of care.

Discussion

Trauma registries are an essential element in trauma quality improvement and the literature is replete with historical examples of where data contained in a national or regional trauma registry has been the cornerstone to effective outcome improvement.[22] More recently the establishment of trauma registries in Victoria[23] and the UK[24] have been associated with significant quality improvement initiatives.

Based on experiences internationally, the benefits of the NZ-MTR are not expected to be realised for 5–10 years as data over time will enable longitudinal analysis and sufficient data to support statistical findings.[25] Notwithstanding this, the early analysis of data is hinting at its potential and each subsequent year of data will be beneficial in providing an overview of the trauma demographic and experience, and to provide an indication of our clinical performance regarding this group of patients.

The intent of the registry is to foster quality improvement. The initial focus will be on pre-hospital and hospital process

measures such as time to computed tomography scan and emergency surgical procedures because these can be measured. We expect to see a reduction to the percentage of patients transferred to one or more hospitals before reaching a definitive care hospital following the recent introduction of the out-of-hospital destination policies, which identify designated hospitals for major trauma. In time, the information from the NZ-MTR will help inform injury prevention and effective rehabilitation of trauma patients.

To keep the NZ-MTR contemporary, an ongoing review of the National Minimum Dataset is needed to ensure the appropriate balance between the number of data points, the feasibility of collection and recording, and their utility in providing information. Auto-population of specific data elements is being explored, such as using unique identifiers to pull data from pre-hospital and national collections into the NZ-MTR to reduce the burden of data collection and improve data reliability. Testing of feasibility and error rates will be needed to ensure continuation of accuracy and completeness of data. The option of including long-term outcomes for major trauma patients is also a possibility to provide a more comprehensive data collection.

While the principles embedded in the ISS have not changed since 1974, the baseline coding system, AIS, has been updated about every five years. Initially it only dealt with blunt injury but was upgraded in the 1980s to address penetrating mechanisms of injury. In the 1990s and 2000s improving diagnostic precision with CT scans in particular has allowed greater specificity in injury definition, which has been reflected in the coding. Finally, injuries which carried a severe threat to life in the 1980s (AIS4–5) might no longer be so, and the AIS code has to be effectively downgraded. Consideration is needed to understand the implication of these types of changes to the AIS coding and what this means for the NZ-MTR. The Association for the Advancement of Automotive Medicine,[15] which publishes the AIS, has just finalised the 2015 revision of AIS. Whether or not, or at what point, the NZ-MTR should change over the AIS 2015 needs to be determined.

The sustainability of the data collection process is fragile in places. Many resources are on fixed-term contracts and some staff have taken reduced income in the hope their roles will develop. Mechanisms to support a more resilient system should include enabling regions to interrogate their own data through intuitive business intelligence tools, and fostering translational research in hospitals which demonstrate the impact of change.

Conclusion

The NZ-MTR is the foundation for understanding the burden of major trauma in New Zealand. For the first time we have a national view of where major trauma happens, who it happens to, how well our health system manages it and the factors that contribute to death and rehabilitation of survivors. Over the next 5–10 years we will continue to build on this foundation to drive a mature, contemporary major trauma system.

The data contained in the NZ-MTR is expected to present possibilities to transform major trauma care in New Zealand and ensure our systems and expectations are consistent with best practice internationally.

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An observational study of how clinicians use cardiovascular risk assessment to inform statin prescribing decisions

Thomas Robinson, Rod Jackson, Susan Wells, Andrew Kerr, Roger Marshall

ABSTRACT

AIM: Cardiovascular disease (CVD) risk assessment is commonly recommended in guidelines, but there is uncertainty about how clinicians use this information. Our objective was to understand how New Zealand primary care clinicians use CVD risk assessment estimates to inform new statin prescribing.

METHODS: We used a cohort of patients seen in primary care who have had a CVD risk estimated on the basis of a New Zealand modified Framingham risk equation. These patients were linked to national pharmaceutical dispensing records to determine new statin use in the following six months. Regression discontinuity and logistic regression analysis, and graphical approaches, were used to explore associations between estimated CVD risk and primary clinicians' decisions to initiate statin treatment.

RESULTS: There were 76,571 patients aged 35 to 75 who were not on a statin, had a first recorded CVD risk assessment between July 2007 and June 2011, and for whom national guidelines recommended management on the basis of estimated CVD risk. Statin dispensing increased with increasing CVD risk. There was no evidence of sudden jumps in the proportions of patients dispensed statins at guideline recommended treatment threshold values of 15% and 20% CVD risk (P=0.314 and 0.731). A logistic regression model using the CVD risk score predicted statin initiation better than models using lipid measures (Area Under the Curve 0.725 versus 0.682). However, further modelling and graphical analysis suggested clinicians were using a range of other information to inform the initiation of statins.

CONCLUSION: New Zealand primary care clinicians' statin prescribing decisions appear to be influenced by patients' predicted CVD risk. However, other factors are associated with increased statin dispensing independent of CVD risk score.

Many international guidelines and national health policies for the prevention of cardiovascular disease (CVD) advocate using estimates of patients' absolute CVD risk, generated from multifactor risk prediction equations, to inform management decisions.[1–6] However, there remains uncertainty about how clinicians use risk assessment scores when they are available.

In New Zealand, treatment based on CVD risk assessment scores was first advocated in 1993.[7] The New Zealand Guidelines Group introduced guidelines for risk assessment and management on the basis of risk in 2003, and these have been widely disseminated and updated regularly.[5,8] Initially, dissemination was via paper charts, but a web-based assessment and decision support tool (PREDICT) was integrated into some general practitioners' electronic practice management systems from 2002.[9] For primary prevention of CVD, guidelines recommend treatment should be informed primarily by a patient's estimated five-year CVD risk, calculated using a modified Framingham Heart Study risk equation.

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The risk factors included in the equation are: age, gender, blood pressure, smoking and diabetes status, and Total/HDL cholesterol ratio. The score is then adjusted to take into account several factors, including ethnic differences in risk that occur in New Zealand, and a family history of premature ischaemic CVD (the 'New Zealand-adjusted Framingham risk score').

Although uptake of CVD risk assessment was initially slow, it has been strongly supported by health care organisations at all levels, and CVD risk assessment is one of New Zealand's six national health targets. By February 2016, 90% of New Zealanders in the target groups had received a CVD risk assessment within the last five years.[10] New Zealand therefore provides the opportunity to study CVD risk assessment in a 'mature' programme.

The aim of this study was to investigate how primary care clinicians use CVD risk scores to inform their treatment decisions. Specifically, we tested the hypotheses that clinicians make decisions on initiating statins based on one, or some, of the following factors:

1. Whether the patient falls above or below the two five-year estimated CVD risk thresholds recommended by guidelines.
2. Absolute CVD risk, but used as a continuous variable.
3. Single risk factors relevant to the medication (ie, lipid measurements).

We hope that this information can inform future policy decisions about how to prevent CVD.

Methods

PREDICT-CVD is the most commonly used CVD risk assessment tool in New Zealand and is available in 35–40% of primary care practices. To calculate estimated five-year CVD risk, clinicians open a CVD risk profile online form that auto-populates with available data from the patient's electronic record. The doctor or nurse completes the risk profile, which is then sent securely to a central server. The patient's estimated New Zealand-adjusted Framingham five-year CVD risk score is immediately returned together with, if requested, guideline-based risk management recommendations.

Whenever PREDICT is used, an electronic risk profile is stored anonymously. With the permission of health providers, this profile is linked to an encrypted National Health Index number (NHI) and made available to University of Auckland researchers.[9] Important recommendations at the time of this study were that people with estimated CVD risk of 15% or more over five years should have lifestyle management, but should be initiated on medications if there were no improvements after three months, and people at a 20% or more risk should normally be initiated on medications at the same time as lifestyle management.

Patients were included in these analyses if they were first risk assessed using PREDICT between 1 July 2007 and 30 June 2011, and met New Zealand Guideline recommendations for risk assessment. We therefore included Māori, Pacific and Indian men aged 35 years and older, other men and Māori, Pacific and Indian women aged 45 years and older, and other women aged 55 years and older.[5] Ethnicity was determined from PREDICT and hospital records and, if more than one ethnicity was recorded, it was prioritised in the following order: Māori, Pacific, Indian and New Zealand European/other.

We excluded patients for whom treatment decisions are not recommended on the basis of the estimated CVD risk. This included people with prior CVD, others defined to be at high clinical risk (ie, people with known genetic lipid disorders, people with diabetic nephropathy), and patients with a single high-risk factor (ie, blood pressure consistently ≥170/100mmHg, total cholesterol ≥8.0mmol/L or a total cholesterol to HDL cholesterol ratio ≥8).[5] Prior CVD was defined as a history of angina or myocardial infarction, stroke, transient ischaemic attack, peripheral vascular disease, percutaneous coronary intervention or coronary artery bypass graft reported by the clinician at the time of the risk assessment. Finally, because we wished to study statin initiation, we exclude patients who had been dispensed a statin in the six months prior to the time of CVD risk assessment.

We used a simple dichotomous outcome; whether the patient was recorded as being dispensed a statin in the six months following the CVD risk assessment.

Dispensing was identified by anonymously linking the PREDICT database to the national Pharmaceutical Collection (PHARMS), using encrypted NHI numbers. PHARMS is a data warehouse that is jointly administered by the Ministry of Health and the Pharmaceutical Management Agency, and collects data on government-subsidised medications dispensed by community pharmacies. In 2009, 96% of dispensing episodes were reliably identifiable by NHI numbers.[11]

To explore the relationship between estimated CVD risk and subsequent statin prescribing we plotted the proportion of patients dispensed a statin in the six months following a CVD risk assessment against levels of estimated CVD risk. If increasing CVD risk were impacting on statin prescribing we would expect to see some form of continuous relationship. If the guideline thresholds were having an important effect on clinician treatment decisions, we expected a sudden jump (or discontinuity) in the proportion of patients dispensed a statin at the thresholds. We explored whether this was the case using a regression discontinuity design. This study design is useful for deciding whether an outcome is caused by an intervention when that intervention is assigned according to a threshold in a continuous assignment variable.[12,13] In this study, the outcome was statin dispensing, the assignment variable was estimated CVD risk and the thresholds were the guideline 15% or 20% five-year CVD risk cut-offs. We plotted the proportion dispensed statins using a localised polynomial plot. The statistical significance of any discontinuity can be tested using either parametric regression models or non-parametric (local linear) regression models.[14] Although regression discontinuity has good internal validity, it is susceptible to misspecification of the modelling of the relationship between the assignment variable and the outcome, so we compared a number of models for consistency.[15,16] For the non-parametric models we used a localised linear regression Stata module by Austin.[17] In the parametric analyses we tested logistic regression models with CVD risk scores included as linear, quadratic and cubic terms, and with interaction with a threshold dummy variable.

To gain an understanding of the other two hypothesised clinician decision making processes (consideration of absolute CVD estimated risk or a focus on single risk factors), we used a combination of graphical methods and logistic regression modelling to examine which factors, or combinations of factors, provided the best explanation of statin dispensing. We again show localised polynomial plots of proportions of people initiated on statins against estimated CVD risk scores, but with the total population split into two subpopulations by binary categorisation of different risk factors. If clinicians were only using the estimated New Zealand-adjusted Framingham risk score to determine treatment, we would not expect these other risk factors to provide additional information on dispensing, and therefore the plots of the two subpopulations would be superimposed.

We also developed four logistic regression models to see which best predicted dispensing using i) New Zealand-adjusted Framingham risk score only, ii) TC/HDL cholesterol ratio only, iii) both New Zealand-adjusted Framingham score and TC/HDL cholesterol ratio, and iv) all the individual risk factors that make up the New Zealand-adjusted Framingham risk score. For each of the four final models we tested a number of different specifications of model to obtain the best model in each case.

In all analyses the best parametric model was chosen by beginning with models, which included CVD risk as a linear, quadratic and cubic power and dropping terms which were not significant (backward elimination). We also compared models using Aikake Information Criteria, area under the curve statistics, and by comparing pairs of models using likelihood ratio tests.

All analyses were done using the Stata 13.1 statistical package (StataCorp, College Station, TX, USA).

The cohort study and research process was approved by the Northern Region Ethics Committee Y in 2003 (AKY/03/12/314) with subsequent annual approval by the National Multi Region Ethics Committee since 2007 (MEC/07/19/EXP).

Results

There were 162,518 people with a first PREDICT CVD risk assessment between 1 July 2007 and 30 June 2011. 14,661 of these patients were 75 years and older and 19,521 were younger than the guideline target groups, leaving 126,336 people. Of these, 30,233 had a reason not to be managed primarily on their estimated CVD risk (18,575 had prior CVD, 3,551 had a genetic lipid disorder or diabetic nephropathy, and 10,106 had a single high-risk factor). Of the remaining 96,103 participants, 76,571 (80%) were not on a statin at baseline, and these were included in the study.

The characteristics of the study group are given in Table 1. Nine percent of patients had an estimated five-year CVD risk of 15% or greater, and 3% a risk score 20% or greater. The majority of participants were European, but there were significant numbers of Māori, Pacific, Indian and other Asians.

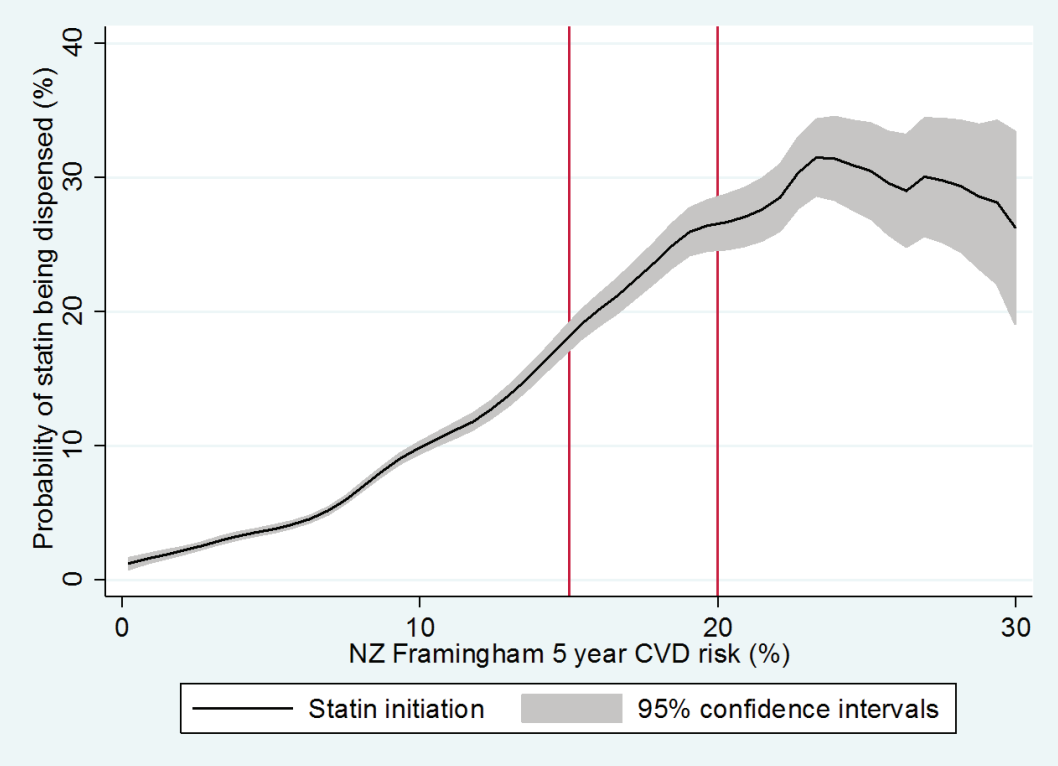
Figure 1 shows the relationship between the New Zealand-adjusted Framingham CVD risk score and statin dispensing in the six months after the CVD risk assessment. Statin use increases with estimated CVD risk, however, but even among the highest risk patients the majority are not treated. There is no apparent sudden stepwise increase initiation of a statin at either 15% or 20% CVD risk thresholds, as might be expected from guideline recommendations.

Regression discontinuity statistical analyses confirmed this impression, although small changes cannot be discounted. Table 2 presents the best parametric and non-parametric models for the two thresholds. For the non-parametric models we found the null effect (ie, no discontinuity) was consistent across models using a wide range of bandwidths (25% to 300% of optimal bandwidth). We fitted parametric models with the two thresholds either included singly or together, and with the relationship between CVD risk and statin prescribing modelled in a number of ways. The best fitting models used CVD risk in either a quadratic or cubic form, but the finding of null effect was not sensitive to any of the models used.

Table 1: Characteristics of the included population at baseline risk assessment.

Category	n	Percent of total (76,517)
Age (years)		
35–44	8,146	11%
45–54	26,827	35%
55–64	27,678	36%
65–74	13,920	18%
Sex		
Male	46,185	60%
Female	30,386	40%
Ethnicity		
Māori	12,325	16%
Pacific	12,737	17%
Indian	6,672	9%
Other Asian	3,950	5%
European & others	39,685	52%
Smoking		
Non-smoker	63,741	83%
Smoker or quit within 12 months	12,830	17%
Diabetes status		
No diabetes	69,792	91%
Diabetes	6,779	9%
Blood pressure		
Less than 140/90mmHg	56,630	74%
Systolic ≥140 or diastolic ≥90mmHg	19,941	26%
Total/HDL cholesterol ratio		
Less than 5	58,643	77%
5 or above	17,928	23%
5-year CVD risk		
<5 %	18,366	24%
5–9.9%	36,925	48%
10–14.9%	13,970	18%
15–19.9%	4,738	6%
20% and above	2,572	3%
Total	**76,571**	**100%**

Figure 1: Probability of being dispensed a statin in the six months after PREDICT risk assessment (total post) for study participants (ie, statin initiation), against estimated CVD risk.



Vertical lines are at the two guideline thresholds.

Table 2: Regression discontinuity analyses of the impact of 15% and 20% risk thresholds on statin initiation in the six months after the risk assessment for those not on a statin at assessment.

	Coef.	Std. Err	95% CI		P value
			Lower	Upper	
15% threshold					
Non-parametric	0.025	0.025	-0.024	0.073	0.314
Parametric (Cubic)	0.107	0.062	-0.014	0.228	0.082
20% threshold					
Non-parametric	0.014	0.041	-0.066	0.095	0.731
Parametric (quadratic)	-0.149	0.077	-0.300	0.002	0.053
15% & 20% thresholds (Parametric - cubic)					
15% threshold	0.096	0.064	-0.030	0.223	0.135
20% threshold	-0.052	0.088	-0.223	0.120	0.555

Figure 2: Plots of probability of statin initiation against CVD risk by category of other risk factors.

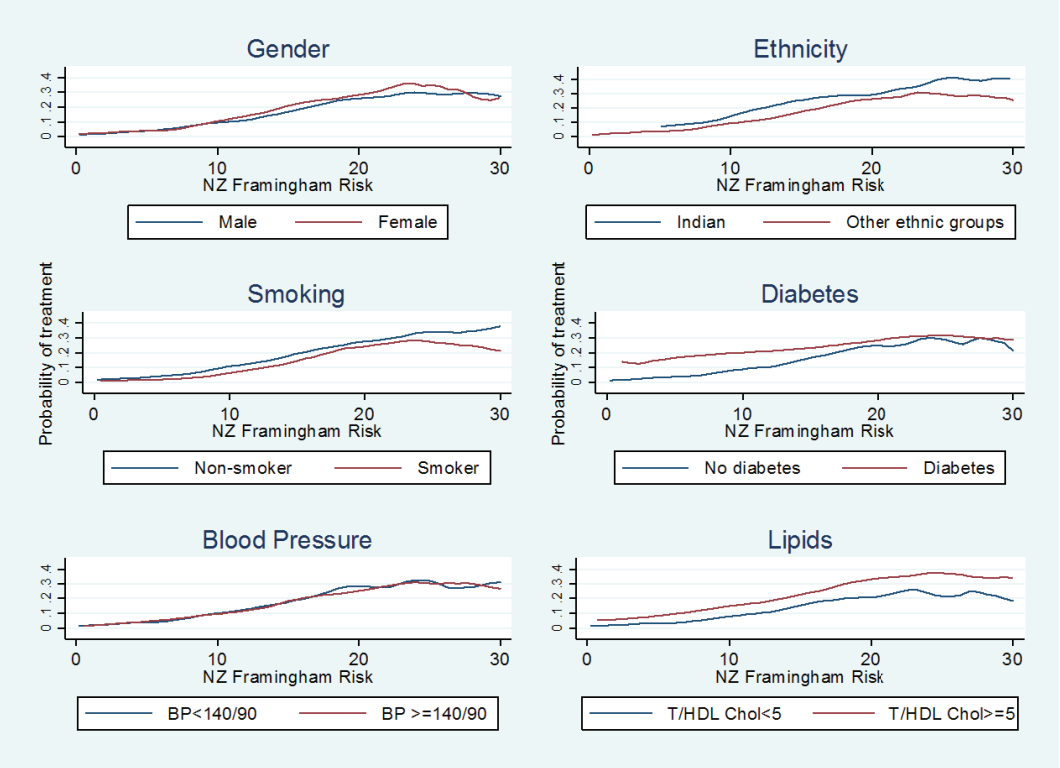


Figure 2 explores whether important risk factors for CVD affect dispensing over and above being included in the CVD risk equations. Local polynomial plots of the risk score against proportion of people initiated on a statin within six months of assessment are shown for people with and without individual risk factors. People with an elevated total/HDL cholesterol ratio are more likely to have a statin initiated at all levels of CVD risk score. People with diabetes are also more likely to have a statin initiated at all levels of the CVD risk score, but particularly so at lower levels of risk. Of other variables examined there is a small positive effect from having Indian ethnicity, and a small negative effect from being a smoker. The blood pressure level and gender had little effect on statin initiation, other than from being included in the New Zealand-adjusted Framingham risk score.

Four different logistic regression models predicting the initiation of statins were developed, as described in the methods section (Appendix). Table 3 shows the model fit measures for the different models. The New Zealand-adjusted Framingham risk score as sole predictor was best fitted with a quadratic model and gave a moderate prediction (AUC of 0.725). This was however, higher than the best model using total/HDL cholesterol ratio as a sole predictor (AUC 0.682). Total/HDL cholesterol ratio was found to be a better predictor than other lipid variables (Total cholesterol and LDL cholesterol, not shown).

Table 3: Fit characteristics for different logistic regression models for predicting statin initiation.

Model	n	Df	AIC	BIC	AUC
New Zealand-adjusted score	76,571	3	39,626	39,654	0.725
TC/HDL ratio	76,571	4	41,078	41,115	0.682
Combined New Zealand-adjusted score & Lipids	76,571	5	38,698	38,744	0.749
Risk factors individually	76,571	10	38,239	38,331	0.767

Abbreviations: *Df*—degrees of freedom; AIC—Akaike Information Criteria; BIC—Bayesian Information Criteria, AUC—Area Under the Curve.

The best model we could fit for predicting statin initiation used all the individual risk factors that are included in the New Zealand-adjusted Framingham risk equation (but did not include the CVD risk score). This had better discrimination and measures of fit than did the New Zealand Framingham risk equation model.

Conclusion

We have used a large observational cohort to try to gain an understanding of primary care clinicians' decisions to prescribe statins after a first CVD risk assessment, estimated using the New Zealand-adjusted Framingham risk score. We believe that while these processes are clearly complex, we can make some statements about the hypotheses stated in the introduction. Firstly, clinicians appear to be using some estimation of patients' overall CVD risk in preference to only lipid levels to decide on statin treatment. The models that include multiple risk factors, either individually or as a summary CVD risk score, predict new statin dispensing better than the model with only total/HDL cholesterol ratio.

It is noteworthy that statin dispensing appears to be influenced by several specific risk factors over and above their contribution to the risk score calculation. Individual risk factors, particularly higher TC/HDL cholesterol ratios, having diabetes, and Indian ethnicity are associated with increased likelihood of treatment at all levels of the risk score. The finding that smokers are less likely to be initiated on statins than non-smokers is unexpected. However, it is possible that clinicians, in discussion with their patients, initially focus on smoking cessation to lower risk, and this delays statin initiation. It is not possible to be certain from this whether clinicians are using the risk score and adjusting it according to their interpretation of risk and discussions with their patients, or are simply making their own assessment of all the individual risk factors. However, it seems unlikely that clinicians are going to the trouble of calculating CVD risk and then not using the information.

Finally, there is no evidence that guideline thresholds are substantially impacting on treatment. Rather, clinicians appear to be using the guiding principle of national guidelines, that the intensity of risk management should be proportional to the estimated CVD risk, rather than the recommended thresholds, to inform their decisions.

There is a limited international literature on how clinicians use CVD risk scores in practice. A number of studies have used CVD risk assessments presented to physicians as clinical vignettes. Some of these have found that treatment is more influenced by individual risk factors than by estimated CVD risk scores.[18–20] However, others suggest that the provision of CVD risk scores leads to more guideline concordant prescribing of medications.[21,22] In contrast to our study, a recently published Australian observational study found that there was little evidence of general practitioners using CVD risk scores to determine when to prescribe lipid lowering medications.[23] This difference may reflect the fact that Australian pharmaceutical subsidies are available on the basis of single risk factors and New Zealand's long and strong policy support for CVD risk assessment. It seems very likely that clinician use of CVD risk scores will be highly dependent on local the health system and professional context.

This study has a number of potential weaknesses. Firstly, we use dispensing of statins as our sole treatment outcome. For some patients the 'treatment' may have been lifestyle changes including dietary change or a smoking cessation intervention, which we have not measured. So it is possible that a more complete assessment of treatment initiated by risk assessment would show different patterns. Following patients for 9 or 12 months may have allowed more time for statins to be dispensed and shown a different pattern. However, a previous study of these patients have shown much smaller changes in proportions dispensed statins after six months.[11] Secondly, the outcome measured is dispensing, which is determined by both clinician and patient behaviour, and we cannot determine the role of each. The higher rates of dispensing of statins to people of Indian ethnicity, for example, may be due to higher rates of adherence. Certainly as an outcome measure of clinician behaviour the use of dispensing data leads to a degree of outcome misclassification. However, a New Zealand study found that 92% of people first prescribed

simvastatin had it dispensed within seven days and therefore misclassification is likely to be small.[24] Thirdly, the methods used for testing hypothesised causal links are observational rather than experimental. While it is possible to design experiments where clinicians were randomly given access to different sets of clinical information, it is difficult to see how they would be feasible or ethical. Nevertheless, observational methods are always susceptible to internal validity problems. Given the wide range of information available to clinicians for decision making, it could be argued that this process is too complex to be deciphered using even complete and objective observational data.

Finally, the PREDICT data has inherent limitations for exploring how clinicians and patients assess CVD risk and subsequently make treatment decisions. Firstly, data is only available on decisions where a PREDICT risk assessment is made. It would have been very useful to have a comparison group available where similar data on individual risk factors and outcomes was available, but an absolute CVD risk assessment had not been estimated. A much richer set of information on factors that may have influenced decision making would also have been ideal. Despite these limitations PREDICT does provide a very rich set of data for studying the management of CVD risk.

The conclusions of the study rely heavily on complex statistical models that are not easily confirmable by the reader. We hope that the graphical information will provide a more intuitive approach that supports the conclusions provided by the modelling.

The study also has several important strengths. Firstly, it is a study of primary care clinicians' use of absolute CVD risk assessment in a country where this approach to managing primary CVD prevention has been best practice for a considerable time and has strong organisation support. Secondly, it reports on actual behaviour rather than hypothetical behaviour as in clinical vignette studies,[18–22] and may have stronger generalisability. Thirdly, it is a large study including over 76,000 first CVD first assessments, and therefore has sufficient power to investigate hypothesised decision-making processes. Furthermore, the PREDICT tool has facilitated nearly complete (99%) valid risk factor data collection for key variables due to compulsory fields required to calculate CVD risk and built-in range and validity checks at the point of data entry.

We believe that this study provides some useful lessons for organisations implementing absolute CVD risk assessment programmes. While a threshold may provide useful guidance, the reality for clinicians is a complex array of information on a patient that will modify decisions based upon CVD risk. Treatment decisions are made in consultation with a patient, who will bring other information and values to the decision. In New Zealand, the next version of the CVD risk management guidelines are being developed and it is likely that the current thresholds will be replaced by risk score ranges within which treatment should be discussed with patients based upon their individual circumstances. This is perhaps a better reflection of clinical reality and is consistent with the principle underpinning the New Zealand risk-based guidelines, which has always been that the intensity of interventions should be proportional to the estimated CVD risk.

Appendix

	Model			
	NZ-adjusted risk score	**TC/HDL ratio**	**Combined risk score and lipids**	**Risk factors individually**
Variables				
CVD risk estimate	0.274		0.234	
CVD risk estimate squared	-0.005		-0.004	
TC/HDL ratio		-0.433	0.547	0.928
TC/HDL ratio squared		0.253	-0.197*	-0.036
TC/HDL ratio cubed		-0.020		
Age				0.125
Age squared				-0.001
Female				-0.099*
Indian				0.746
Systolic BP				0.017
Diabetes				1.329
Diabetes *CVD risk estimate				
Smoker				0.358
Constant	-4.500	-3.688	-6.206	-12.891
Fit characteristics				
AUC	0.725	0.682	0.749	0.767
AIC	39,626	41,078	38,698	38,239
BIC	39,654	4,115	38,744	38,331

Table logistic regression models of statin initiation in the six months after risk assessment.
*P<0.05, otherwise P<0.001.

Competing interests:
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Acute abdominal pain—changes in the way we assess it over a decade

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ABSTRACT

AIMS: Acute abdominal pain accounts for 5–10% of all emergency department visits. Rapid and accurate diagnosis is critical to ensure optimal outcomes. In the last decade, increased use of CT scans and the introduction of surgical short stay units has changed the way this group of patients is managed. The aim of this study was to evaluate the effects of these changes on patient management.

METHODS: A retrospective clinical study was undertaken including all patients admitted with abdominal pain under general surgery in the years 2004, 2009 and 2014. Two hundred from each of the three years were randomly selected and their care was reviewed.

RESULTS: During the study period, more patients were admitted under general surgery, from 1,462 in 2004 to 2,737 in 2014 (P=0.001). There was an increase in the proportion of patients admitted with non-surgical abdominal pain (25% in 2004 vs 34% in 2014, P=0.035). More computed tomography (CT) scans were performed (26.0% in 2004 vs 45.0% in 2014, P=0.001).

CONCLUSIONS: More patients were admitted under general surgery with abdominal pain and a greater proportion of these patients were admitted with non-surgical problems. Use of CT scans increased during the study period.

Acute abdominal pain accounts for 5–10% of all presentations to the emergency department (ED) and can be caused by a variety of diseases ranging from mild and self-limiting, to life threatening.[1] Rapid and accurate diagnosis is of vital importance to start treatment as soon as possible to ensure the best possible outcome.[2] On the other hand, early recognition of patients with self-limiting problems is a priority in order to optimise use of limited healthcare resources.

The use of computed tomography (CT) to aid diagnosis in patients presenting with abdominal pain has increased over the years.[2–4] The increase in the use of this diagnostic tool has downsides. Imaging can lead to higher costs and delay in diagnosis due to long waiting times for imaging, and risks include contrast allergies, contrast-induced nephropathy and ionising radiation exposure.

More recent changes introduced to increase efficiency in diagnosing acute presentations include the 4–6 hour targets for ED worldwide and the implementation of acute surgical units (ASU).[5–7] The latter are often consultant lead with dedicated emergency theatre time and a thorough handover system.[8–10]

Although the above mentioned implementations have the aim to improve the diagnostic process for patients presenting with acute abdominal pain and to reduce the number of complications and length of stay, there seems to be ongoing inefficiency within the diagnostic process. The aim of this study was to review the diagnostic process and the use of additional imaging for patients presenting with acute abdominal pain over the last decade.

Methods

Wellington Regional Hospital serves a population between 270,700–296,700 over the study period, with tertiary services being provided to a population of approximately 500,000.[11] We retrospectively reviewed the

number of acute surgical admissions for the years 2004, 2009 and 2014. Patients were categorised depending on the presenting complaints of abdominal pain, perianal/pilonidal abscess, other abscess/skin infection and other (including post-operative complications, hernia and gastrointestinal bleeding), and their admission numbers were reviewed over the study period.

Of the patients presenting with acute abdominal pain (less than five days of pain at the time of presentation), 200 were randomly selected (by computer randomisation) from each of the three years, thereby creating three groups of 200 patients each. Patients with recurrent abdominal pain, a post-operative complication or under the age of 16 years were excluded.

Data was collected for the selected patients from theatre databases, ED and admission notes, discharge letters and radiology reports. From all these sources patient characteristics and comorbidities were obtained. The times and dates of ED presentations, admissions, any imaging, operations and discharge information were collected, thus information was obtained about the clinical pathway for the patient, from differential diagnosis to final diagnosis. Information about the final diagnosis was obtained from discharge letters, radiology or theatre reports and post-discharge clinic letters.

During the study period, several changes were made at Wellington Regional

Hospital designed to improve patient safety, admission efficiency and early diagnosis. In 2005, access to theatre after 23:00 was reduced, becoming accessible only for life- or limb-threatening emergency surgery. In July 2009, the six-hour rule in ED was implemented, to encourage early referral or discharge and to reduce ED waiting times, and in July 2013 an ASU was opened, which included a consultant lead acute service with improved access to emergency theatre and dedicated slots for imaging (one CT scan and two ultrasound scan slots, Monday–Friday).

The data were analysed using SPSS® software (SPSS 23, Chicago, Illinois, USA). Data is expressed as mean and standard deviation (SD) for normally distributed continuous data, median (range) for non-parametric data and count (%) for discrete data. Continuous data was compared between groups using One-Way ANOVA for normally distributed data and Kruskal-Wallis test for nonparametric data. Chi square tests were used for discrete data. A p value of <0.05 was considered statistically significant.

Results

The Wellington population increased in size by 9.6% from 2004 to 2014,[11] ED presentations increased by 54.2% over the same period and the number of acute surgical admissions increased by 87.2% (Table 1). Surgical admissions were categorised, and in each year the majority of the acute surgical admissions were patients presenting with abdominal pain.

Table 1: Population and admission characteristics.

Year	**2004**	**2009**	**2014**
Population estimate Wellington CCDHB region	270,700	285,300	296,700
Number of ED presentations	39,639	50,473	61,113
Total number of surgical admissions	1,462	1,975	2,737
Number of surgical admissions per 100,000 inhabitants	540	692	922
Reason for admission (%)			
Abdominal pain	1,108 (75.8)	1,420 (71.9)	1,928 (70.4)
Anal/peri-anal abscess	100 (6.8)	131 (6.6)	133 (4.9)
Other abscess/local infection	161 (11.0)	138 (7.0)	170 (6.2)
Other	93 (6.4)	286 (14.5)	506 (18.5)

Note: Other includes: post-operative complications, hernia, bleeding per rectum, etc.

Table 2: Patient characteristics.

	2004 (N=200)	2009 (N=200)	2014 (N=200)	*p* value
Age (mean, [SD])	48.9 [21.4]	49.6 [22.7]	49.4 [23.8]	0.951
Gender (%)				
Female	119 (59.5%)	121 (60.5%)	119 (59.5%)	0.973
Ethnicity (%)				
NZ European	157 (78.5%)	137 (68.5%)	160 (80.0%)	0.126
Māori	18 (9.0%)	26 (13.0%)	18 (9.0%)	
Pacific	9 (4.5%)	14 (7.0%)	6 (3.0%)	
Asian	13 (6.5%)	13 (6.5%)	12 (6.0%)	
Other	3 (1.5%)	10 (5.0%)	4 (2.0%)	
Referrer				
ED	113 (56.5%)	129 (64.5%)	126 (63%)	0.218
Diabetes				
Yes (%)	16 (8.0%)	15 (7.5%)	18 (9.0%)	0.856
Heart disease				
Yes (%)	38 (19%)	31 (15.5%)	33 (16.5%)	0.626
COPD				
Yes (%)	8 (4.0%)	5 (2.5%)	7 (4.5%)	0.696
CKI				
Yes (%)	9 (4.5%)	9 (4.5%)	11 (5.5%)	0.859
Previous abdominal surgery				
Yes (%)	68 (34.0%)	71 (35.5%)	86 (43.0%)	0.150

Note: Abbreviations: NZ = New Zealand, ED = emergency department, COPD = Chronic Obstructive Pulmonary Disorder, CKI = Chronic Kidney Injury.

Comparing the groups of 200 patients with acute abdominal presentations of each year, the mean age of the patients was similar at approximately 49 years; almost 60% of the study population was female and the majority had the New Zealand/European ethnicity (Table 2). The majority of the patients were referred via the ED (61.3%). Significant comorbidities were uncommon, but of these, previous abdominal surgery was the most recorded (24.5%).

Median time from ED presentation to surgical admission was significantly different across the three groups, at nine hours in 2009 compared to four and three hours in 2004 and 2014 respectively (Table 3). No differences were observed between mean haemoglobin (Hb) and white cell count (WCC) levels, but mean C-reactive protein (CRP) levels were lower in 2014 compared to 2004 and 2009 (p=0.013). The number of patients who had a CRP level measured increased from 103 in 2004 to 189 in 2014.

The use of abdominal x-rays decreased across the study period, 133 (66.5%) in 2004, 111 (55.5%) in 2009 and 97 (48.5%) in 2014, (p=0.001). The number of patients undergoing ultrasound scans (USS) did not differ between the three groups, but the time from presentation to scan was statistically significant, shorter in 2014 compared to 2004 and 2009 (p=0.048). The proportion of the patients receiving a CT scan increased significantly between 2004 and 2014 (from 26.0% in 2004 to 45.0% in 2014, p=<0.001), while time to CT scan reduced (p=0.001). During the study period, an increased percentage of the CT scans were reported as negative for acute abdominal pathology, this was 31 (34.4%) in 2014, compared to 7 (10.1%) in 2009 and 9 (17.3%) in 2004 (p=<0.001).

Table 3: Patient work-up and theatre.

	2004 (N=200)	2009 (N=200)	2014 (N=200)	*p* value
Time to admission (median (range))	4.0 (0–17.0)	9.0 (1.0–35.0)	3.0 (0–14.0)	<0.001
Blood test (mean [SD])				
Hb	136.9 [22.7]	138.5 [18.4]	138.1 [23.7]	0.731
WCC	11.9 [4.6]	12.0 [5.2]	11.2 [4.5]	0.199
CRP	53.1 [72.9]	56.6 [72.0]	35.9 [57.5]	0.013*
USS (%)	64 (32.0)	62 (31.0)	57 (28.5)	0.614
Hours to USS (mean [SD])	23.0 [15.6]	27.5 [23.7]	19.2 [12.7]	0.048*
CT scan (%)	52 (26.0)	69 (34.5)	90 (45.0)	<0.001*
Hours to CT scan (mean [SD])	34.9 [35.0]	20.3 [18.7]	17.2 [29.0]	0.001*
Theatre (%)	84 (42.0)	65 (32.5)	69 (34.5)	0.075
Hours to theatre (median (range))	11.0 (1.0–456.0)	18.0 (2.0–309.0)	20.0 (2.0–369.0)	0.014*

Note: Abbreviations: Hb = Haemoglobin (g/L), WCC = White Cell Count (10^9/L), CRP = C-Reactive Protein (mg/L), USS = ultra sounds scan, CT scan = Computed Tomography scan.

There was a trend towards a reduction of the proportion of patients presenting with acute abdominal pain that received an operation between 2004 and 2014 from 84 (42.0%) in 2004 to 69 (34.5%) patients in 2014 (p=0.075). Time from ED presentation to theatre increased during the study period, from a median of 11 hours in 2004 to 20 hours in 2014 (p=0.014).

Of the patients receiving an operation, 60.0% had an appendicectomy. The proportion of negative appendicectomies did not differ between the three groups, eight in 2004 (13.6%), 10 in 2009 (22.2%) and five in 2014 (12.2%) (p=0.542).

Non-surgical diagnosis included all patients with non-specific abdominal pain, constipation and gastroenteritis. In 2004, fewer patients had an NSD (23.5%), compared to 2009 (25.0%) and 2014 (33.0%), p=0.035. Table 4 summarises the final diagnosis of all patients included in the study; there was no significant difference in the final diagnoses between the three groups. Patients with final diagnosis NSD, but who had an operation, were patients with a negative laparoscopy.

Overall length of stay (LOS) was shortened in 2014 with a mean of 3.2 days compared to 2004 (4.1 days) and 2009 (4.8 days) (p=0.015).

Discussion

Over the study period, both the number of and rate of admissions under general surgery increased, with acute abdominal presentations being the most common reason for admission. There was an increased use of CT scans for patients presenting with abdominal pain associated with a higher percentage of these scans being negative for acute pathology. Furthermore, more patients were admitted with a non-surgical diagnosis.

During the study period, an increasing proportion of patients received a CT scan to aid with diagnosis. However, this increase was also associated with an increase in the number of negative scans. A number of studies have published results with high sensitivities and specificities for CT scanning in the diagnosis of patients with acute, non-traumatic abdominal pain.[2,12] This increase in diagnostic accuracy, however, has not been associated with a decrease in complication rates or length of stay for this patient group.[2,13] Furthermore, CT scans are costly and can delay early diagnosis and length of stay if a CT scan cannot be arranged within a helpful timeframe.[14] The described challenge implies that there is a balance between necessary

Table 4: Final diagnosis.

	2004 (N=200)		2009 (N=200)		2014 (N=200)	
	Non-operative	**Operative**	**Non-operative**	**Operative**	**Non-operative**	**Operative**
NSD	39 (33.6)	8 (9.5)	40 (29.6)	10 (15.4)	61 (46.6)	5 (7.2)
Appendicitis	0 (0)	51 (60.7)	2 (1.5)	35 (53.8)	3 (2.3)	36 (52.2)
Diverticulitis						
Uncomplicated	10 (8.6)	1 (1.2)	17 (1.5)	0 (0)	14 (10.7)	0 (0)
Complicated	2 (1.7)	3 (3.6)	2 (1.5)	0 (0)	1 (0.8)	2 (2.9)
Pancreatitis	12 (10.3)	0 (0)	18 (13.3)	0 (0)	11 (8.4)	3 (4.3)
Choledocholithiasis	12 (10.3)	1 (1.2)	10 (7.4)	0 (0)	11 (8.4)	0 (0)
Cholecystitis	7 (6.0)	5 (6.0)	8 (5.9)	2 (3.1)	11 (8.4)	4 (5.8)
SBO	18 (15.5)	3 (8.8)	18 (13.3)	1 (1.5)	8 (6.1)	4 (5.8)
LBO	4 (3.4)	6 (7.1)	2 (1.5)	4 (6.2)	2 (1.5)	2 (2.9)
Bowel ischaemia	0 (0)	3 (3.6)	0 (0)	3 (4.6)	0 (0)	1 (1.4)
Peptic/duodenal ulcer	0 (0)	0 (0)	1 (0.7)	3 (4.6)	1 (0.8)	2 (2.9)
Other	2 (10.3)	3 (3.6)	17 (12.6)	7 (10.8)	8 (6.1)	10 (14.5)
Total	**116 (100)**	**84 (100)**	**135 (100)**	**65 (100)**	**131 (100)**	**69 (100)**

Note: Abbreviations: NSD = non-surgical diagnosis, SBO = small bowel obstruction, LBO = large bowel obstruction
Other includes: Patients with a final diagnosis covered by other specialties (gynaecology, urology, gastroenterology and vascular), epiploic appendagitis, torted epiploic appendage or omentum, gastric volvulus in a hiatus hernia, newly diagnosed cancer not causing obstruction, etc.

and unnecessary CT scans and raises the question what percentage of negative scans is considered acceptable.

Four- and six-hour rules or targets have been implemented worldwide to reduce ED waiting times and to improve hospital flow. A number of centres have published their results and conclude that patient safety is not compromised by these rules and that they do not cause an increase in imaging.[5,15] However, in the current study we have observed a significant increase in surgical admissions, and it is possible that this is at least in part a negative consequence of implementation of the six-hour rule. Furthermore, there was a significant increase in the proportion of patients with a final non-surgical diagnosis who had been admitted under general surgery. Gastroenteritis, non-specific abdominal pain and constipation were included in this group, and these are all conditions that generally do not require admission. Further work is needed to understand what factors are driving the increased admission of patients to general surgery, and particularly the increased proportion of these patients with non-surgical problems.

An ASU was implemented in Wellington Regional Hospital in 2013 to facilitate early assessment and diagnosis of patients referred via ED and the general practitioner (GP). Patients referred via the GP could present straight to ASU and would thereby reduce pressure on the ED. Even though the implementation of ASU assured combined improved access to theatre and additional imaging, this study shows that time to theatre increased rather than decreased between 2004 and 2014 (median of 11 hours in 2004 to 20 hours 2014, p=0.014). Time to US and CT scan on the other hand decreased significantly (p=0.048 and p=0.001 respectively). Length of stay (mean 3.2 days) in the 2014 group, post-introduction of the ASU is comparable to previous published results.[8]

Limitations of our study are in the retrospective design and the different time periods of the three groups. Although the major implementations such as the six-hour ED rule and the ASU have been contributing to our current diagnostic pathway, other unidentified changes during the study period may have contributed as well. Bias may have been introduced as there is always a difference between surgical consultants in managing patients presenting with acute abdominal pain; this should have been minimised by the random selection of the patients. This random selection should also have minimised any selection bias.

Over the last decade, the number of acute surgical admissions has increased. There is an increase in the use of CT scans, but more of these are negative for any pathology. Furthermore, a greater proportion of patients admitted under general surgery have a non-surgical diagnosis. These observations suggest that there is need to carefully assess the processes by which patients are admitted and investigated.

Competing interests:
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Characteristics of older adults hospitalised following trauma in the Midland region of New Zealand

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ABSTRACT

AIM: To describe the epidemiology of injuries sustained by older adult trauma patients admitted to hospitals in the Midland region (population 886,000) of New Zealand.

METHODS: A review of older adult (≥65 years) trauma cases from the Midland Trauma Registry for the three-year period January 2012 to December 2014 was conducted. Demographics, mechanism of injury, severity of injuries, processes of care and outcomes were analysed.

RESULTS: Older adults accounted for 14% (2,278/15,700) of all injury cases captured by the registry during the study period (average annualised incidence 585/100,000 population). The majority of injuries (90%) were minor in nature (ISS 0-12) and 65% resulted from unintentional falls. Falls was the most common mechanism in the major trauma group (38%), followed closely by road traffic crash (30%). Home was the leading place of injury (56%), followed by road/street/highway (15%). Injury rates were significantly higher among non-Māori than Māori.

CONCLUSION: These findings illustrate the growing volumes and changing epidemiology of both major and minor trauma affecting older persons hospitalised following trauma in one of the four health regions of New Zealand. There is a need to prepare for an increase in demand for trauma services to meet the needs of an ageing population in New Zealand.

New Zealand, like most developed nations is experiencing a demographic transition to an older age structure.[1] Currently, adults over 65 years old comprise around 13% of New Zealand's total population; this is predicted to increase to 17% by 2021, equating to an additional 236,500 older adults residing in New Zealand.[2] Older adults have reduced physiological and structural capacity to cope with injury, therefore relatively minor injuries may have more serious consequences than in younger patients.[3,4] This is compounded by the presence of multiple comorbidities often found within this age group.[3,5–9] It is important for those involved in the provision of clinical care and injury prevention in older persons to have a clear understanding of the patterns of injury and trends in incidence so that programmes to reduce the impact of trauma can be carefully targeted to groups at risk. The current study is the first in New Zealand to provide such detail on older persons of all injury severities admitted across one of the four health regions of New Zealand.

The incidence of trauma in this age group is increasing globally.[3–5,9] US data suggest older adult disability, and physical, sensory and cognitive limitations have declined in recent decades.[10] In addition, the activity levels in this age group appear to be increasing. A Canadian study exploring physical activity among adults over a 20-year period using national health survey data, found the prevalence of active older adults had increased from 24% in 1995 to 31% in 2000.[11] These findings may indicate a potentially more active older population

which could lead to a change in pattern of mechanism of injury in this age group.[12,13] Regardless of the mechanism of injury, an ageing population will result in an increase in the volume of trauma-related injury among older adults, placing significant pressure on scarce healthcare resources.

The Midland Trauma System (MTS) was established in 2010 to coordinate improvements in the quality of trauma care delivery within the Midland region (population 889,541) of New Zealand.[14,15] The MTS trauma registry captures data on selected trauma patients admitted to six hospitals in the region. Approximately 6,000 trauma patients are admitted to hospital in the region annually, and of these 14% are older adults. Older adult injury represents a significant health burden on patients, the community and the health system that may be amenable to evidence-based interventions.[16] The Midland region of New Zealand has a high number of people living in rural areas, high deprivation and Māori compared with New Zealand as a whole.[17,18]

The aim of this research is to describe the epidemiology of injuries, process of care and outcomes in older adult trauma patients admitted to Midland region hospitals and who are captured by the Midland Trauma Registry. This information will be used to guide trauma quality improvement and injury prevention efforts.

Methods

A retrospective review of anonymised, prospectively-collected MTS registry data for the period 1 January 2012 to 31 December 2014 was conducted. Inclusion criteria for the study were: patients aged ≥65 years admitted to a Midland base hospital as a result of, and within seven days of an injury; and resident in the Midland region. Consistent with trauma registries internationally, patients were excluded if they sustained insufficiency or periprosthetic fractures, exertional injuries, hanging/drowning/asphyxiation without evidence of external force, poisoning, ingested foreign body, injury as a direct result of pre-existing medical conditions or late effects of injury, or the injury occurred more than seven days prior to admission.[14] Event episodes were the unit of analysis. For example, in situations where a patient was transferred to other hospital/hospitals in the region for the same injury event, this was counted as a single event and the event assigned to the first MTS hospital where the patient was treated. Length of stay was inclusive of the total days admitted to all hospitals for the index event.

Variables examined included: patient demographic characteristics, injury event information, in-hospital management, type and severity of injuries, length of stay and discharge destination. The classification of the nature of injuries is consistent with the Abbreviated Injury Scale (AIS, 2005/08), a tool designed to rank injury severity.[19] The Injury Severity Score (ISS) numerically describes the overall severity of injury, and is calculated from the three most severely injured body regions as scored by the AIS.[20] Minor trauma is classified as (ISS 1-12) and major trauma as (ISS 13-75).[20]

Ethnicity information was obtained from the patients' unique national health identifier (National Health Index number [NHI]) or directly from the patients themselves. Mechanisms of injury were categorised using the International Classification of Disease (ICD-10AM 6th Edition) external cause codes.[21]

Microsoft Excel (Excel 2010) and Minitab (Minitab Inc., 2010) were used for the analyses. Descriptive statistics for continuous variables were informed by using medians and confidence intervals. The Chi^2 test was used to detect differences in proportions for non-normal distributions. P values were used to determine the result significance.

Ethical approval was not required for this study as the analyses involved the use of anonymised secondary data. The study adhered to the MTS Data Use Policy. Access to the trauma registry data was approved by the MTS Strategic Group.

Results

During the three-year study period, older adults accounted for 14% (2,278/15,700) of all traumatic injury events captured by the MTS registry and that occurred among those living in the region (Table 1).

Table 1: Characteristics of older adult (≥65 years) injured patients by Injury Severity Score (ISS), Midland region, 2012–2014 (n=2,278).[¥]

Variable	Total n (%)	Minor trauma (ISS≤12) n (%)	Major trauma (ISS>12) n (%)
Total events	2,278 (100.0%)	2,070 (90.0%)	208 (10.0%)
Age group (in years)			
65–69	636 (27.9%)	574 (27.7%)	62 (29.8%)
70–74	476 (20.9%)	431 (28.8%)	45 (30.8%)
75–79	373 (16.4%)	335 (14.8%)	38 (22.0%)
80–84	328 (14.4%)	300 (10.7%)	28 (10.3%)
85+	465 (20.4%)	430 (17.2%)	35 (14.4%)
Gender			
Female	1,275 (56.0%)	1,203 (58.1%)	72 (34.6%)
Male	1,003 (44.0%)	867 (41.9%)	136 (65.4%)
Ethnicity			
Māori	128 (5.6%)	110 (5.4%)	18 (8.7%)
Non-Māori	2,150 (94.4%)	1,960 (94.7%)	190 (91.3%)
Employment status			
Retired	1,856 (81.5%)	1,709 (95.3%)	147 (70.7%)
Employed	325 (14.3%)	277 (13.4%)	48 (23.1%)
Beneficiary	10 (0.4%)	8 (0.9%)	2 (1.0%)
Domestic	9 (0.4%)	9 (0.5%)	0 (0.0%)
Other*	78 (3.4%)	67 (3.5%)	11 (5.3%)
Domicile region			
Waikato	851 (100.0%)	775 (91.1%)	76 (8.9%)
Bay of Plenty	913 (100.0%)	836 (91.6%)	77 (8.4%)
Taranaki	246 (100.0%)	228 (92.7%)	18 (7.3%)
Lakes	155 (100.0%)	141 (91.0%)	14 (9.0%)
Midland Other[ŧ]	113 (100.0%)	90 (79.6%)	23 (20.4%)

[¥]Inclusive of Midland region residents only.
*Unemployed/not stated/student/other.
[ŧ]Tairawhiti DHB not included, full 2012–2014 dataset not available.

The majority of those presenting with major trauma were males (65.4%), in the 70 to 74 years age group (30.8%), and of non-Māori ethnicity (91.3%). The majority of patients (99%) lived in the Midland region at the time of injury. More than one-fifth (23.1%) of those who sustained major trauma were employed. For the period reviewed, there were on average two older adults admitted per day in the region for trauma-related injuries. The average annualised incidence of injury events in this age group was 585/100,000 population (95% CI 539–634/100,000) (Table 2).

Table 2: Average annualised incidence per 100,000 of trauma events in older persons in the Midland region 2012–2014*[¥] (Incidence per 100,000, 95% Confidence Intervals).

Overall	Age groups						Frequency totals
	65–69 years	70–74 years	75–79 years	80–84 years	≥85 years	All ages (≥65 years)	
	494 (452–540)	479 (438–523)	538 (494–583)	643 (595–695)	1,069 (1,007–1,135)	585 (539–634)	2,165
Gender							
Female	435 (396–478)	463 (423–507)	589 (543–639)	748 (696–804)	1,129 (1,065–1,197)	608 (562–658)	1,216
Male	557 (512–605)	499 (457–545)	481 (440–526)	509 (467–555)	949 (890–1,011)	557 (512–605)	949
Ethnicity							
Māori	462 (422–506)	418 (380–460)	475 (434–518)	474 (433–519)	635 (588–687)	460 (420–504)	124
Non-Māori	497 (455–543)	486 (445–531)	543 (499–591)	631 (584–682)	1,080 (1,018–1,146)	594 (548–644)	2041
Domicile[ŧ]							
Waikato	496 (454–542)	487 (446–532)	452 (412–296)	615 (568–666)	808 (754–866)	537 (493–584)	851
Bay of Plenty	520 (477–567)	516 (473–563)	761 (709–817)	954 (895–1,017)	1,911 (1,827–1,999)	789 (735–846)	913
Taranaki	480 (439–525)	439 (400–482)	437 (398–480)	388 (351–429)	613 (566–664)	467 (427–511)	246
Lakes	436 (397–479)	406 (368–448)	358 (323–397)	180 (156–208)	202 (176–232)	358 (323–397)	155

*Census 2013 Population, excludes Tairawhiti DHB.
[¥]Age and Ethnicity matched.
[ŧ]Patient District Health Board Domicile Census 2013 Population matched.

Incidence was significantly higher in females than males (608/100,000 cf. 557/100,000 population), and among the oldest older adults (85 years and over 1,069/100,000 population). The incidence of older adult injury admissions among females increased with age; in contrast, the rate among males had a u-shaped distribution (Table 2). Overall, non-Māori had significantly higher rates of injury than Māori (594/100,000 cf. 460/100,000 population). Geographically, overall rates were significantly higher in the Bay of Plenty region (789/100,000). The majority of older adult trauma patients were retired (81%); however, 14% were still actively engaged in employment.

The yearly volume of older adult trauma patients in this study increased significantly from 509/100,000 (n=628) in 2012 to 648/100,000 (n=800) in 2014 (p=0.014).

Blunt trauma accounted for 98% of all trauma-related admissions and almost all of the major trauma cases.

The majority of injuries were unintentional (99%) (Table 3). Overall, falls were the leading cause of injuries (65.3%), and among minor trauma admissions (67.9%). Transport-related incidents (road traffic crashes, pedestrian and pedal cycle incidents) were the second leading cause of injury overall (16.0%), but were more prominent among major trauma events (42.8%). Home was

Table 3: Injury circumstances of older adult (≥65 years) trauma patients by minor (ISS≤12) or major (≥ISS 13), Midland region, 2012–2014.

Variable	Totals	Minor trauma (ISS 0-12)	Major trauma (ISS≥13-75)
	n=2,278 n (%)	n=2,070 n (%)	n=208 n (%)
Injury intent			
Unintentional	2,254 (99.0%)	2,051 (99.2%)	203 (97.6%)
Intentional	22 (1.0%)	17 (0.8%)	5 (2.4%)
Cause of injury			
Fall	1,487 (65.3%)	1,405 (67.9%)	82 (39.4%)
Transport related*	365 (16.0%)	276 (13.3%)	89 (42.8%)
Machinery	125 (5.5%)	122 (5.9%)	3 (1.4%)
Struck	143 (6.3%)	129 (6.2%)	14 (6.7%)
Burns	19 (0.8%)	19 (0.9%)	0 (0.0%)
Other	139 (6.1%)	119 (5.7%)	20 (9.6%)
Total number of body regions injured (n=3,244)			
Head or neck	335 (10.3%)	212 (7.9%)	123 (22.0%)
Face	113 (3.5%)	76 (2.8%)	37 (6.6)
Chest	324 (10.0%)	199 (7.4%)	125 (22.4%)
Abdomen or pelvic contents	116 (3.6%)	62 (2.3%)	54 (9.7%)
Extremities or pelvic girdle	1,420 (43.8%)	1,318 (49.1%)	102 (18.2%)
External	936 (28.9%)	818 (30.5%)	118 (21.1%)
Arrival day of week			
Monday to Thursday	1,332 (58.5%)	1,215 (58.7%)	117 (56.3%)
Friday to Sunday	946 (41.5%)	855 (41.3%)	91 (43.8%)
Arrival time of day (n=2,277)**			
0600–1759	1,675 (73.6%)	1,525 (73.7%)	150 (72.1%)
1800–0559	602 (26.4%)	544 (26.3%)	58 (27.9%)
Overall length of stay (days)			
<10	1,834 (80.5%)	1,690 (81.6%)	144 (69.2%)
10–20	343 (15.1%)	299 (14.4%)	44 (21.2%)
>20	101 (4.4%)	81 (3.9%)	20 (9.6%)
Discharge destination from the last trauma care facility (n=2,277)**			
Home	1,454 (63.9%)	1,387 (67.0%)	67 (32.2%)
Rehabilitation	273 (12.0%)	222 (10.7%)	51 (24.5%)
Convalescence or acute care facility	380 (16.7%)	332 (16.0%)	48 (23.1%)
Rest home/residential	79 (3.5%)	73 (3.5%)	6 (2.9%)
Morgue	61 (2.7%)	28 (1.4%)	33 (15.9%)
Other	30 (1.3%)	28 (1.4%)	3 (1.4%)

*Motor vehicle and motorcycle crashes, pedestrian and pedal cycle incidents.
**Time of arrival was unavailable for one patient.

the most common place of injury (56.6%), followed by road/street/highway/footpath (19.8%). Among minor injury cases, home was the most common place of injury (59%), and road/street/highway/footpath (42.8%) for major injuries.

Overall, the extremities (including pelvic girdle) were the most common areas injured (43%) (Table 3). Among the major trauma group, the head/neck and chest were the most commonly injured body regions (22% each region). Overall, external injuries accounted for the second highest volume of injuries (28%) regardless of ISS, and facial injuries the least. Over one-third (37%) of patients had injuries in more than one body region. Fifty-eight percent of patients required surgery, however, overall only 2.9% required an ICU stay.

Over the three-year study period a total of 61 patients died (case fatality rate=2.7%). The population mortality rate per year was 0.016% (20/123,413).

The majority of older adult trauma admissions to Midland DHBs occurred during autumn (March/April/May). The majority of trauma events (58.5%) among older adults occurred during the weekdays (Monday to Thursday), and this pattern was similar regardless of the severity of injury (Table 3). Around three-quarters (73.5%) of those admitted to hospital arrived between the hours of 6am and 6pm, irrespective of severity.

The majority of patients (97%) did not require an ICU admission during their hospital stay (Table 3). Among the major trauma group, 3.4% of patients required an ICU stay of 10 or more days, compared to 0.1% of minor trauma patients. Just over half (57%) of patients underwent a surgical procedure (minor trauma cases 58.3 %, major trauma 54.3%). Just over 80% of patients had a total hospital stay of less than 10 days (median 5 days, IQR 2–9 days), 9.6% of major trauma patients stayed for 20 days or longer compared with only 3.9% of minor trauma cases. The majority (63%) of older adult trauma admissions were discharged home from the acute setting. However, only 32% of major trauma patients were discharged home, with this group more than twice as likely to go to a rehabilitation facility compared to those with minor injuries (24% vs 10%).

Discussion

This study explored the characteristics of older adult trauma events resulting in hospital admissions within the Midland region of New Zealand. This study has revealed the growing incidence and considerable variation in the patterns and volumes of injury across the Midland region. Higher rates of injury occurred in non-Māori, females and older adults (≥85 years). There was geographic variation in the incidence of older adult injury across the Midland region, with the Bay of Plenty region having the highest incidence of older adult trauma, and also the highest proportion of major trauma. Head/neck/thorax injuries predominated within the major trauma group. More than half (58%) of older adults admitted with injuries required a surgical procedure. Of those patients admitted, the majority (64%) were discharged home and only 12% were discharged to a rehabilitation facility. The majority of patients (81%) had a hospital stay of less than 10 days; however, 15% were in hospital for between 10 and 200 days.

The study findings have confirmed the dominant role falls play as a leading mechanism of injury among older adults.[6,7,9,22] Continued evidence-based primary prevention efforts are required to reduce falls among older adults[23,24] From a secondary prevention perspective, most hospitals have initiated fractured neck of femur (NOF) pathways. Research by Kosy et al found the introduction of a fast-track NOF pathway decreased time to theatre and length of hospital stay, improved pain management and mobility post-surgery.[25] Published injury-related literature for this age group is dominated by the epidemiology of falls and their associated contribution to morbidity and mortality.[3,6–9] Around one-third of older adults fall annually; this increases to over 50% by 80 years of age.[26] New Zealand's national injury compensation agency (the Accident Compensation Corporation [ACC]) estimates half of all claims for people aged over 65 years are as a result of falls that account for 75% of hospital admissions in this age group.[26]

Road traffic crashes were the second leading cause of major trauma among older adults in this study. This is consistent with previous published research from Sharma et al[9] The New Zealand Transport Agency

(NZTA) has a series of workshops under the 'Staying Safe' initiative that have been designed to maintain older adult driving safety.[27] The workshops provide a comprehensive guide to the older adults own safety when driving, through a series of modules designed to increase awareness of the effects of ageing and driving and self-assessment of driving skills. Programmes designed to maintain safety in older adult driving such as those provided by NZTA could be promoted.

Injuries to the chest, closely followed by head/neck regions were the most frequently injured among major trauma patients in this study, which reflected findings from other published studies.[9,24] Similar to Aitken and Burmeister et al, this study found that home was the most common discharge destination of older adults with an ISS <15.[16]

Across the three-year period, for those aged less than 65 years there were a total of 13,403 events and 43 patients died (case fatality rate 0.3%). For those aged over 64 years, the case fatality rate was 2.7%, and of those who died, 56% were aged 80+ years. The mortality rate in the present study for older adults was more than eight times the mortality rate for those aged under 65 years captured by the Midland Registry for the same the period (2.7% cf. 0.32%). A range of factors have been identified that may in part explain the higher mortality rate from trauma among older adults, including high injury severity scores, high Abbreviated Injury Scale scores, low Glasgow Coma Scale scores, comorbidities, haemodynamic compromise and diminished ability for systemic compensation.[3,6–8]

Limitations

The strengths of this study are the use of prospectively-collected data from a population-based trauma registry that records patients of all injury severities from a population that is broadly representative of the New Zealand public,[15] therefore making the findings more widely translatable. The study findings need to be considered in light of some limitations. The study is inclusive of those patient admissions included in the MTS registry and therefore may not be representative of all older adult trauma events that result in admission to hospital. The presence or absence of comorbidities, or other risk factors such as haemodynamic status or Glasgow Coma Scale, that are known to contribute to injury-related morbidity and mortality in older adults[3,6–8] were not included in these analyses. The current study did not examine the role comorbidities may play on recovery from injury. A study by Freedman et al found that early referral to an inpatient geriatrician team for complex comorbidity management within and a model of shared care with the trauma team, led to a reduction in times to surgery, shorter lengths of stay, fewer complications such as thromboembolism, delirium, cardiac and infection.[10]

Conclusion

This study has revealed the patterns of injury and the changing epidemiology of both major and minor trauma in older persons in the Midland region in New Zealand. Trauma volumes are increasing and By 2061, the numbers of people aged over 65 years residing in New Zealand is projected to increase by 25% (totalling approximately 1.5 million persons).[1] The study has also shown high rates of injury occurring in non-Māori, females and older adults (≥85 years), and revealed the considerable geographic variation in patient types and volumes between health districts; the first study of its kind to do so in New Zealand. This variation indicates that health services should remain cognisant of the variations in demographic profiles, ethnicities and behaviours that are characteristic of individual districts.

This information can be used to build better prevention, treatment and rehabilitation services as lifestyles and expectations change and the impact of this high-risk group on health services and the community in New Zealand changes and grows.

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Mesh abdominal wall hernia surgery is safe and effective—the harm New Zealand media has done

Steven Kelly

ABSTRACT

Patients in New Zealand have now developed a fear of mesh abdominal wall hernia repair due to inaccurate media reporting. This article outlines the extensive literature that confirms abdominal wall mesh hernia repair is safe and effective. The worsening confidence in the transvaginal mesh prolapse repair should not adversely affect the good results of mesh abdominal wall hernia repair. New Zealand general surgeons are well trained in providing modern hernia surgery.

An abdominal wall hernia is a weakness or defect in the abdominal wall that allows abdominal organs to protrude through. For the purpose of this paper the term abdominal wall hernia will include ventral abdominal and groin hernia. Hernias sometimes cause no symptoms, however, many will cause symptoms including pain, bowel obstruction or bowel ischaemia. Hernias can significantly reduce quality of life and even cause death. For patients with significant symptoms, treatment is required as hernias don't get better by themselves and generally they will enlarge and deteriorate over time.[1]

Surgical repair is the only effective treatment for hernias. The two main techniques are simple suture repair of the defect versus closing the defect with mesh reinforcement. Suture repair has been available since anaesthesia was invented in the 1800s.[2] However, with the introduction of simple suture hernia repair it quickly became apparent that hernia recurrence with this technique was frequent. This then led to hernia repair with tissue reinforcement using mesh. The earliest mesh repair was in 1900, where a silver wire mesh was used. During the following 117 years, there has been a continuous improvement in mesh technology. Synthetic meshes were developed after World War II. Over the last 20 years, mesh abdominal wall reinforcement has become the international accepted standard of care.[3] Modern hernia mesh is purpose designed and has become very sophisticated.

In a 2002 Cochrane systematic review of mesh versus non-mesh groin hernia repair, there was no difference in complications between groups.[4] There was a suggestion that patients in the mesh repair group had an earlier return to normal activities and they had less persistent pain. Due to a New Zealand patient fear of groin hernia mesh surgery, patients are now requesting sutured groin hernia repair as an alternative. The best non-mesh sutured open groin hernia repair is the Shouldice procedure. This is a four-layer suture repair under tension using either polypropylene or stainless steel suture. The best available evidence comparing the Shouldice procedure to mesh groin hernia repair reveals no difference in postoperative complications or chronic pain between the two different procedures. However, the hernia recurrence rate was almost four times higher in the Shouldice

group.[5] On the basis of the current available evidence the European hernia society has recommended that mesh should be the first choice for inguinal hernia repair.[3]

In a recent systematic review and meta-analysis of primary and incisional ventral hernia repair, mesh reduced hernia recurrence by 50 to 75% compared to suture repair.[6] It has been shown on a population-wide analysis that hernia recurrence increases linearly with time beyond five years.[7] For incisional hernia, recurrence rates after suture hernia repair are up to 63% at 10 years. This rate of failure is unacceptable not only from a futility point of view but also in terms of financial waste of precious healthcare money.

In 2004, the long-term results of a randomised control trial of sutured versus mesh incisional hernia repair was reported from the Netherlands.[8] One hundred and eighty-one patients with incisional hernias were randomised to either suture or mesh hernia repair. The 10-year cumulative rate of hernia recurrence was 63% for suture repair and 32% for mesh repair ($P<0.001$). There was no statistical difference in complications between the groups. Abdominal pain was more frequent in patients who had suture repair. The authors of this study concluded that suture hernia repair should be abandoned.

In the last 15 years, there has been a rapid transformation in the progress of hernia surgery. There is now worldwide a significant expansion in hernia research, innovative techniques and a focus on patient-related outcomes. Complex hernias that 10 years ago were considered inoperable can now be reliably repaired with dramatic improvements in patient quality of life. Even for complex massive hernias, recurrence rates of 4.7% are being achieved with acceptable morbidity.[9] From a biological point of view there are good reasons why suture hernia repair fails, particularly for larger ventral abdominal wall hernias. There is strong evidence for a genetic inheritance of hernia development.[10] Patients with incisional and groin hernias have been shown to have weakened connective tissues. The strength of these tissues is due to collagen. However, in patients with hernias there is a dominance of weaker and poorly connected collagen III rather than the stronger collagen I fibres. Also, these patients have a greater degradation of these collagen fibres due to an excess of matrix metalloproteinases.[11] Therefore it is unreasonable to expect weakened tissues that have failed and created a hernia to adequately heal when sutured together.

The New Zealand media have over previous years, done great harm to the reputation of mesh abdominal wall and groin hernia repair. They have published multiple articles claiming that mesh is unsafe and unproven. That is simply not true. Patients whom require abdominal wall hernia repair are now fearful of mesh.New Zealand general surgeons are well trained in modern hernia surgery and the management of complications. Hernia repair can involve a complex analysis of risks and benefits of different management options. Patients should discuss issues around mesh with their general surgeon and consent for surgery should be based on shared decision making.

It is very important for the public to understand that transvaginal mesh repair has a different risk profile compared to abdominal wall mesh repair. Transvaginal mesh is placed into the vaginal wall in an attempt to treat pelvic organ prolapse. Transvaginal mesh was introduced into the US in 2005 with no clinical efficacy and safety data.[12] It was initially presumed to be as safe as abdominal wall hernia mesh repair. However, over time there were increasing reports of significant problems with this mesh technique, including mesh erosion, chronic pain, mesh infection and dyspareunia. From 2011, many of these mesh products were removed from sale by device companies. Many patients then began class action lawsuits against the device companies. There now remains on the market some new lightweight permanent transvaginal meshes. Controversy still remains among experts in regard to assessing the risk/benefit profile of these meshes and how they should be utilised. One opinion is that they can be used for recurrent prolapse. The opposite opinion from a recent Cochrane systematic review is that the mesh should only be used at the discretion of an ethics committee.[13] In 2014, a private petition was sent to the Health Committee, requesting an independent

inquiry into the safety of surgical mesh in New Zealand. ACC then undertook a retrospective audit review of treatment injury surgical mesh claims from 1 July 2005 to 30 June 2014.[14] Over this time period there were 181 abdominal wall hernia repair claims and 131 transvaginal mesh claims. Data from Medsafe showed there were 56,508 mesh devices sold in New Zealand during the same time frame. The calculated percentage of complications for each procedure that resulted in a treatment injury claim was 0.6% for abdominal wall hernia and 3.3% for transvaginal mesh. Although it is possible that not all complications resulted in a treatment injury claim, two conclusions can be drawn. The New Zealand complication rate for abdominal wall hernia repair is low and numerically the complication rate was 5.5 times more likely with a transvaginal repair.

It is time for the New Zealand media to accurately report on hernia mesh and to undo the harm that has been done. The public needs to be informed that mesh for abdominal wall hernia repair is safe and effective.

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New Zealand's peak year for wartime mortality burden: the important role of the Battles of Messines and Third Ypres (Passchendaele) in 1917

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ABSTRACT

At a total of 5,547 deaths among New Zealand's military personnel, the year 1917 was the worst year from a mortality perspective in the country's military history. This year had a third of the deaths in the whole of the First World War for this military population. Major drivers of this mortality burden were the Battles of Messines and Third Ypres (Passchendaele) in June and October 1917 respectively. The contribution of disease deaths to the mortality burden was relatively small at 4.5%. Disease deaths were significantly more common in the Northern Hemisphere's winter months (p=0.007), and some may have been related to crowding.

The 5,547 deaths among New Zealand military personnel in 1917 was more than for any other year of the First World War. Indeed, a third of the deaths in the whole war occurred in this year (33.2% of the total up to the day the war ended [5,547/16,703][1]). It was also nearly half (46.5%) of all the deaths among New Zealand military personnel in the Second World War [5,547/11,928[2]]. The total also far exceeds the 1,896 deaths for all of the 56 sudden mass fatality events with 10 or more fatalities between 1900 and 2015 occurring in New Zealand territory.[3]

When considering the average age of these military personnel (28 years[4]) and an average life span for soldiers who survived the war of around 71 years,[4] we calculate a total loss of 239,000 years-of-life from these 5,547 premature deaths. In today's terms this would also be a massive loss of 'human capital', ie, with one way to value this loss being to use the valuation of a healthy-year-of-life in terms of per capita GDP.[5] For New Zealand, with a current per capita GDP at around NZ$45,000, this would give a monetarised loss of NZ$10.8 billion from these 5,547 premature deaths. But these statistics don't capture such aspects as the loss of the fathers of young families, multiple sons in the same family dying and the greater economic dependence of families on individual workers at this time in history (ie, the relative importance of manual labour in the agricultural economy and the relative lack of government-run social welfare systems).

Injury deaths

Our analysis of deaths recorded in the Roll of Honour shows that injury deaths from combat predominated (at 92.8%, Table 1). Most injury deaths in this year (and each year of the war) involved outright death: 'killed in action' (KIA). The next major category was 'died of wounds' (DOW), whereby the victim was medically assessed while still alive and then died subsequently (potentially up to weeks/months later). The proportion of injury deaths that were in this

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category did not trend downward over the last three years of the war (27.0% in 1916; 25.6% in 1917 and 28.8% in 1918).[1] This was despite every year of the war seeing substantial medical and surgical advances. Indeed, there were such developments as better organisation of medical and surgical services, growing use of transfusions and much better splints.[6–8] These developments collectively resulted in documented survival improvements for a range of different types of injury.[6] However, there were many other factors that would have impacted on these ratios, eg, the varying levels and speed of evacuation, the changing nature of military tactics and weaponry[9] and theatre-specific issues (such as the extent of wounds being contaminated by mud in settings such as Passchendaele).

We now consider three specific aspects of the mortality burden in 1917: two major battles and deaths from disease.

The Battle of Messines

Three specific battles generated much of the mortality burden in 1917: the Battle of Messines in June 1917 and the two battles of Ypres in October 1917. The Battle of Messines was widely regarded as a tactical victory for the Allies, and the New Zealand Division achieved all its objectives.[10] Field Marshal Douglas Haig described it as "the most successful attack yet carried out under my orders".[10] Nevertheless, the month of June when the battle occurred contributed to 24.3% of all the injury deaths for that year in New Zealand military personnel (KIA plus DOW was 1,253 deaths out of 5,147 for the year, Table 2). This was the month when the proportion of death from wounds out of all injury deaths was second lowest at 24.7% (Table 2). That is, the injury death toll was largely being driven by sudden death on the battlefield.

Third Ypres—Broodseinde and First Passchendaele

This battle first involved a militarily successful attack on 4 October on Gravenstafel Spur by New Zealand personnel (the Battle of Broodseinde)—though with 486 deaths recorded in the Roll of Honour for this day (KIA=451, DOW=35). But on the day of the next major attack (12 October) the death toll reached 846 (KIA=807, DOW=39 in the Roll of Honour), and with 138 dying from wounds in the following week.[11] This day, 12 October 1917, is the worst single mass-fatality day in New Zealand's history. The nearest equivalent occurring on New Zealand's territory is the Hawke's Bay earthquake of 1931 at an estimated 258 deaths,[3] albeit with some of these deaths occurring in subsequent days as a result of injuries.

This battle resulted in the month of October, having 37.0% of all injury deaths for 1917 among New Zealand personnel (KIA=1,506, DOW=399, total=1,905/5,147, Table 2). This was the month when the proportion of death from wounds out of all injury deaths was the lowest at 20.9% (Table 2). The high ratio of those killed to those with non-fatal wounds at 1:1.5 was also relatively exceptional (Table 2).

On 18 October the New Zealanders were relieved by Canadian troops and on 6 November these Canadian troops captured the ruins of Passchendaele village.[11] This took the Canadians three separate attacks and it cost them around 13,000 casualties, of which over 4,000 were killed in action.[11] Hence there was some military advantage achieved—albeit at enormous cost. But the high mortality burden of the 12 October battle appears to be an avoidable mistake by military leadership. The offensive on that day failed completely with this being due to heavy rain and the inability of the artillery to destroy the barbed wire and concrete pillboxes that comprised the German defences. The poor decision not to delay the offensive was made by Field Marshal Douglas Haig and was against the advice of most of his army commanders. Theorist and historian Major General JFC Fuller believed that Haig's decision to continue with a "tactically impossible battle" was "inexcusable".[11,12] But this failed offensive was also partly due to others, eg, the "ineptitude" of Major General Alexander Godley's staff.[13,14] Yet another reason the 12 October battle failed so badly was that the Germans knew it was coming. They could see the preparations for the attack being made, and also a British deserter on the night before the attack told them of its exact start time.[11]

The 12 October action at Passchendaele also demonstrated another ongoing problem with military leadership around tactics: the persistence with infantry charges in the face

of the enemy's machine guns and artillery. There is evidence that such patterns of charges occurred in multiple attacks during 1917, as shown in a famous painting of an actual British attack in late 1917, which resulted in heavy casualties: "Over the Top" by John Nash (http://www.iwm.org.uk/collections/item/object/20015).

Table 1: Causes and characteristics of deaths in 1917 among New Zealand military personnel (from Wilson et al[1] and new analyses done for this article from the Roll of Honour and online military files).

Characteristic	Number	Percentage	Other details/Comment
Killed in action (KIA)	3,831	69.1%	These two categories (ie, combat-related deaths) accounted for 92.8% of the total deaths.
Died of wounds (DOW)	1,316	23.7%	
Accident	41	0.7%	
Other injury (drowned, suicide, executed)	8	0.1%	
Died of disease (DOD)	250	4.5%	
Section 2 or Section 3*	101	1.8%	Probably mainly disease deaths, see the main text.
Total	**5,547**	**100%**	
Disease deaths in the Northern Hemisphere by four-month grouping (n=224)			
Winter months (December 1916 to March 1917)	93	41.5%	The risk of death in this harsh winter season[11] was significantly raised compared to the other months: Risk ratio=1.20 (95%CI: 1.07–1.58, p=0.007).
April to July 1917	63	28.1%	
August to November 1917	68	30.4%	
Total	**224**	**100%**	
Specific diseases (random 20% sample of 50 out of 250 disease deaths)**			
Pneumonia/bronchitis	16	32.0%	
Tuberculosis	8	16.0%	
Dysentery or typhoid	4	8.0%	
Meningitis	4	8.0%	
Cancer	4	8.0%	
Suicide	2	4.0%	Technically these are injury deaths but were classified as DOD in the records.
Not determined	2	4.0%	These military files were "restricted access", possibly reflecting death from suicide.
Other	10	20.0%	
Total	**50**	**100%**	

*"Section 2" was for those "who died after discharge from the NZ Expeditionary Force (NZEF) from wounds inflicted or disease contracted while on active service." "Section 3" were for "those who died from accident occurring or disease contracted, while training or attached to the NZEF in New Zealand."
**Randomly selected "DOD" deaths from the Roll of Honour with examination of the full free access online military files at the Archway website (http://archway.archives.govt.nz/).

Table 2: Cause of death by month in 1917 among New Zealand military personnel and comparisons with the non-fatally wounded (analyses from the Roll of Honour and data on the wounded from Carbery[15]).

Month/key event	KIA [A]	DOW [B]	[B]/[A+B] (%)	DOD	Other deaths*	Total deaths	Total non-fatal wounded	Ratio injury deaths [A+B] to non-fatal wounded
January	34	33	49.3%	24	10	101	246	1:3.7
February	107	38	26.2%	26	7	178	166	1:1.1
March	52	29	35.8%	21	12	114	273	1:3.4
April	35	27	43.5%	13	14	89	217	1:3.5
May	78	29	27.1%	28	11	146	402	1:3.8
June (Battle of Messines)	943	310	24.7%	16	9	1,278	4,110	1:3.3
July	179	68	27.5%	15	8	270	1,112	1:4.5
August	248	112	31.1%	18	13	391	1,614	1:4.5
September	37	32	46.4%	14	27	110	427	1:6.2
October (Broodseinde & First Passchendaele)	1,506	399	20.9%	30	13	1,948	2,904	1:1.5
November	219	105	32.4%	15	11	350	2,039	1:6.3
December	393	134	25.4%	30	15	572	1,249	1:2.4
Total	**3,831**	**1316**	**25.6% (average)**	**250**	**150**	**5,547**	**14,759**	**1:2.9 (average)**

*Includes deaths from accidents, other injuries and the categories of "Section 2" and "Section 3" (see Table 1).
For acronyms, see Table 1.

The burden of disease

There were an estimated 250 deaths from disease (4.5% of all the deaths in 1917, Table 1), which was higher than that of the preceding year (at 171 for 1916[1]), but the true number of disease-related deaths in 1917 was probably even higher. For example, if all the less well-classified deaths (ie, Section 2 and Section 3 deaths, see Table 1) were from disease, then the percentage would be 6.3% [351/5,547]). In a 20% random sample of the disease deaths, the dominant cause of these was pneumonia/bronchitis (32%), followed by tuberculosis (16%) (Table 1). Of the disease deaths occurring in the North Hemisphere, such deaths were statistically significantly more common in the Northern Hemisphere's winter months (p=0.007, Table 1). This particular winter was reported as being a particularly severe one.[11] Combined with this was that the water table in Flanders is only just below ground level and so the cold was combined with near-constant wet conditions in front line positions.

The extent to which any fraction of these disease deaths were preventable with knowledge of the day is speculative. Nevertheless, we note that some of the diseases causing death are known to be related to crowding (eg, pneumonia, meningitis, tuberculosis and measles). Furthermore, crowding and poor living conditions was almost certainly a likely factor in disease deaths earlier in the war at the military camp in Trentham, Upper Hutt in 1915.[16,10] Also, crowding has been implicated in the high mortality from a pandemic influenza outbreak on a New Zealand troopship (*HMNZT Tahiti*) in the last year of the war, 1918.[17] However, 1917 did not see events such as the large outbreak of dysentery (which is related to both crowding and hygiene) seen in the Gallipoli campaign in 1915.[18]

In conclusion, the year 1917 was the worst year from a mortality perspective in the country's military history. This very heavy mortality burden was partly driven by three major battles, with a relatively small role played by disease.

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Slavery in New Zealand: What is the role of the health sector?

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ABSTRACT

Contemporary forms of slavery and associated adverse health effects are a serious, complex and often neglected issue within the New Zealand health sector. Slavery in New Zealand has most recently been associated with the fishing and horticulture industries. However, victims may be found in a number of other industry sectors, including the health and aged-care sectors, or outside of the labour market such as in forced, early (underage) and servile forms of marriage. Victims of slavery are at increased risk of acute and chronic health problems, injuries from dangerous working and living conditions, and physical and sexual abuse. These issues are compounded by restricted access to high-quality healthcare. Slavery is a violation of many human rights, including the right to health. New Zealand has obligations under international law to ensure that all victims of slavery have access to adequate physical and psychological care. The health sector has opportunities to identify, intervene and protect victims. This requires doctors and other health practitioners to demonstrate their leadership, knowledge and commitment towards addressing slavery and its health consequences in ways that are effective and do not cause further harm. Key recommendations for a safe approach towards identifying and managing people in situations of slavery include building rapport, and culturally competent practice with an empathetic non-judgmental approach. We also recommend that health organisations and regulatory and professional bodies develop culturally competent guidelines to respond safely to those identified in situations of slavery. These responses should be based on the respect, promotion and protection of human rights, and occur within a robust person-centric coordinated government response to addressing slavery in New Zealand.

Contemporary forms of slavery and accompanying serious health consequences exist in New Zealand today.[1–5] The International Labour Organization estimates there are 40.3 million victims of slavery worldwide.[6] While there are no official figures specifically for New Zealand, New Zealand was first described in the US State Department Trafficking in Persons (TIP) Report in 2004 as a destination country for people trafficked for sexual exploitation.[7] Subsequent TIP reports and current research findings have identified a range of industry sectors in which exploitation is occurring, including: dairy, horticulture, construction, fishing, hospitality, domestic work as well as the health, and aged-care sectors.[1,5] More recently there have been reports of slavery involving forced, early (underage) and servile forms of marriage.[2,3]

Slavery is a violation of many human rights, including the right to health. New Zealand has obligations under international law to ensure that all victims of slavery have access to adequate physical and psychological care.[2,8] Victims suffer serious health consequences, including increased risk of acute and chronic health problems, injuries from dangerous working and living conditions, and physical and sexual abuse.[3,4,9–11] They also face considerable barriers to accessing healthcare and support services.[2–4,12]

The health sector has opportunities to identify, intervene and protect victims.[9,10,13] This requires doctors and other health practitioners to demonstrate their leadership, knowledge and commitment towards addressing slavery and its health consequences, in ways that are effective and do not cause further harm.

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In this article, we first provide a definition of slavery in the contemporary context before discussing scenarios where slavery is likely to occur within New Zealand. We then describe the associated adverse health effects and highlight the opportunities for doctors and health practitioners to address slavery and its health consequences at system, organisational and practitioner levels.

Definition of slavery in the contemporary context

Whereas historical slavery involved the legal ownership of a person, and has long been forbidden in law, contemporary forms of slavery imply the commodification of a person such that their situation is similar to that of the historical definition. The 1926 Slavery Convention defines slavery as, "the status or condition of a person over whom any or all of the powers attaching to the rights of ownership are exercised".[14] Its 1956 Supplementary Convention states that such institutions and practices of debt bondage, serfdom, servile forms of marriage and the exploitation of the labour of children are all similar to slavery.[15] The United Nations Human Rights Council's mandate of the Special Rapporteur on contemporary forms of slavery includes the aforementioned issues, but also forced labour, human trafficking, children in slavery and slavery-like conditions, sexual slavery and forced and early marriages.[8]

Contemporary slavery is complex. It may include people voluntarily entering into an employment agreement and from that point becoming a victim because they lack the agency to exit from an exploitative situation. Or, they may become a victim due to unreasonable debts imposed on them by recruitment agents.[4,5,16] It may be difficult to define the point when unacceptable work conditions and limited choices driven by poverty progress to slavery, or determine the degree of coercion or loss of agency for people in situations of forced, early and servile forms of marriage.[2,3,8,11]

Legislation to address slavery in New Zealand is limited in that it does not define slavery in the contemporary context. However, certain forms such as human trafficking are now included under the Crimes Act 1961, which previously defined human trafficking narrowly as the use of coercion or deception to arrange or attempt to arrange the entry of a person into New Zealand or another state.[17] Trafficking that took place internally was not recognised until the enactment of the Organised Crime and Anti-Corruption Legislation Bill in 2015, which amended Section 98D of the Crimes Act. Human trafficking was then redefined for the purpose of exploitation that does not just require transnational movement of persons. It involves the, "means to cause, or to have caused, that person, by an act of deception or coercion, to be involved in (a) prostitution or other sexual services (b) slavery, practices similar to slavery, servitude, forced labour or other forced services (c) the removal of organs".[18] What this revised definition does not include however, is the provision for making the sex trafficking of children (regardless of deception or coercion) a crime in New Zealand.

Using the international definitions aforementioned, slavery is occurring within New Zealand. It has been most recently described in the fishing and horticulture industries.[4,5] It is also found among a number of other industry sectors,[1,5] as well as outside the labour market, for example in forced, early and servile forms of marriage.[2,3] Doctors and other health practitioners can thus be expected to encounter patients who are in living in slavery in New Zealand.

Slavery in New Zealand and its health consequences

Evidence in New Zealand comes from academic research, court and media reports, and submissions to Parliament. Research into the fishing industry identified migrant fishers on many South Korean foreign charter vessels as being subjected to economic exploitation and severe physical and sexual abuse.[4] In 2016, New Zealand had its first human trafficking conviction. Fijian workers were coerced and deceived to work in the horticulture industry where they were promised well-paying jobs and work permits. The actuality was vastly different with one worker earning as little as $25 for three weeks' work.[5] More recent research has identified disturbing cases of exploitation in different industry sectors, including the health and aged-care sectors.[5] The reality is that exploitation remains largely hidden.

The introduction of the Prostitution Reform Act 2003 (PRA) increased protections for sex workers, including access to the Employment Relations Authority, having implications not only for preventing economic exploitation but for improving workplace health and safety.[19] However, the PRA explicitly excludes those on temporary visas, including international students[20,21] so those working illegally in the industry are not offered the same protections. They are vulnerable to exploitation and adverse health consequences due to this lack of protection. Women trafficked into sex work are less likely to use health and social services than non-trafficked sex workers.[22] Therefore, those who are at more risk of being exploited (including underage sex workers) face considerable barriers to accessing high-quality healthcare.[22,23]

Slavery includes forced marriage, when marriage is forced on people without full and free consent, where duress exists due to the use of coercion, threats or deception. Forced marriage is distinct from that of arranged marriage (where the involved individuals have the right to say no), common in many cultures.[2,11] 'Full and free' consent should be viewed in the context of power imbalances between the individuals understood to be consenting, and those seeking their consent. Forced marriages can include early and servile forms of marriage, and have been reported in the literature to occur within some Asian, Middle Eastern and African diaspora communities in New Zealand.[2,3]

Some women brought into New Zealand on the temporary Culturally Arranged Marriage Visitor Visa are reported to be at risk of forced, early and servile forms of marriage where ongoing immigration sponsorship can be used as a tool of abuse.[3] The added dynamics of dowry abuse compound the issue.[2,3] Women have ended up being 'indebted' for having being brought to New Zealand and are required to 'pay this debt off' through forced labour on farms/other work areas in addition to domestic servitude. They may have no access to financial means, poor access to healthcare and other support services, and are prevented from applying for permanent residency for several years.[3] Women may be frightened to report their situation to statutory agencies due to fear of 'honour-based' violence, or deportation.[2,3] Stigmatisation of divorced women and single mothers in communities within home countries is an added factor that keeps women in exploitative abusive relationships.[3] Forced, early and servile forms of marriage come with increased risks of domestic violence, rape, sexually transmitted infections and unwanted pregnancy.[2,3,11] Evidence suggests that those who have been forced into marriage may present to health services with self-harm, eating disorders or suicidal tendencies,[24] and that people with mental illness or intellectual and learning disabilities may be at increased risk.[25]

In New Zealand, pursuant to section 32 of the New Zealand Public Health and Disability Act 2000, the Minister of Health established a narrow definition of eligibility for non-New Zealand citizens/residents accessing health and disability services, limiting access to those persons who are 'proven' victims of human trafficking. This essentially excludes access to high-quality healthcare for people (including children) who are victims of forced, early and servile forms of marriages, and other forms of slavery occurring in New Zealand.[26]

Persons of any ethnicity may be in situations of slavery in New Zealand. Victims are at increased risk of acute and chronic health problems, including physical, psychological and sexual violence; injuries from dangerous working and living conditions; malnutrition; mental health problems, including depression, anxiety and post-traumatic stress disorder; communicable diseases including HIV/AIDS, tuberculosis and sexually transmitted infections; and unwanted pregnancy, forced and unsafe abortions.[2–4,9–11] Restricted access to healthcare compounds the issue.[2–4,12,20,22,23]

Possible presentations to health services in New Zealand

There are opportunities across the health sector to identify and intervene to improve health outcomes for victims of slavery in New Zealand. Contact may occur at any entry point, including emergency departments or general practice, public health services, outpatient services, mental health services, counseling or psychotherapy services, maternity and child health services, and sexual health services.

Victims may or may not be able to present to health services due to control by the person exploiting them.[3,4,27] Practitioners need to know how to identify victims who may present with other primary issues. For instance, a person may be prevented from accessing healthcare at the time of a health crisis related to their exploitation, however, they may be allowed to access routine care such as general practice visits or outpatient clinic appointments. Practitioners may therefore see victims who present for routine care such as contraception but not as the result of associated illness or injury, including intimate partner violence. They may seek help for their situation either directly or indirectly, such as presenting with medically unexplained symptoms at times of distress or increased risk of harm. The presenting complaint may not identify the person as being a victim of slavery but there may be other elements that are red flags.[27]

Research from New Zealand pertaining to victims from the fishing industry has highlighted they may be identified by the nature of their injuries and incongruities in their history and/or demeanour. [4] There may also be an implicit or explicit sense of urgency to return to the vessel or to have injuries/illness 'signed off' to allow the person to return to work. Other red flags may include, for example, not knowing one's home address or how to get home, and a paucity of personal identification.[27]

However, no one red flag has adequate predictive value to 'make the diagnosis of slavery' and there are no validated screening tools in this area. Unsurprisingly, only a small percentage of practitioners report confidence in identifying victims of slavery in the contemporary context, and there are widespread misconceptions regarding the definition and how victims may present.[10,27]

Given the nature of the situations in which they are held, it is highly likely that victims will be reluctant to disclose their situation. This may be due to risk of violent retribution, mistrust of institutions, lack of perceived alternatives, loss of agency secondary to psychological trauma, fear of forfeiting what autonomy they do retain, inability to access private confidential consultations with health providers, fear for dependent children and other family members, or fear for legal consequences such as deportation.

Potential harms from interventions

There are potential harms to victims of slavery if identification or intervention occurs without appropriate expertise or access to support services for victims, or those treating them. Potential harms include the re-traumatising of victims through: disclosure of current or prior trauma without offering appropriate and ongoing support and safety, lack of promised access to follow-up supports within the health sector or other sectors, and/or negative consequences if individuals perceive a practitioner or organisation as judgmental or 'victim-blaming' in approach. Potential harms may also include unintended consequences of identification, including exposure to risk of harm or loss of right to remain in New Zealand for those on temporary visas, wherein slavery is misunderstood as primarily an immigration issue. There is some evidence of these harms in New Zealand, particularly among young persons involved in sex work who have been shown to view contact with any health and other services as emotionally harmful.[23]

Contact with the health system represents an opportunity for intervention, acknowledging that there are significant barriers to identification of, and positive interventions for, victims of slavery. It is imperative that New Zealand has a responsive system in place, supported by an informed health workforce.

Doctors and other health practitioners as advocates for change: addressing slavery and its health consequences in New Zealand

The New Zealand Medical Association describes doctors as advocates for improved population health and equity, and having a role in sector leadership, including driving and facilitating change.[28] Doctors have used their positions of influence to lead for change on numerous health issues frequently at odds with the status quo, including nuclear war, climate change and the abuse of children in Australian prison camps on Nauru.[29]

A robust health response to slavery has been described as the ability to identify those at risk, or current victims, and to treat them in a compassionate, culturally competent and trauma-informed manner

in collaboration with other services and advocacy partners.[12] Doctors and other health practitioners in New Zealand have many opportunities to lead for change through advocating for a cross-government approach to address this issue with its health, legal, immigration, societal and cultural complexities.

The Domestic Violence Act 1995 and related family violence laws are currently being strengthened by Government around forced marriage through the criminalisation of coercion to marry.[30] Practitioners can advocate for Government to further strengthen other legislation such as the Crimes Act and PRA to ensure children and adults are not exploited in New Zealand. They can also advocate for Government to review emerging international law, such as that of the UK Modern Slavery Act 2015, to ascertain whether New Zealand should be implementing analogous legislation that prohibits companies with slavery in their supply chain to operate within New Zealand.[5]

At the health system level, practitioners can advocate for leadership by the Minister of Health to ensure that all levels of the health sector have procedures in place to identify and respond appropriately to slavery. This includes improving access to high-quality healthcare for those at risk of, or victims of, slavery. A starting point is for the Minister of Health to strengthen health legislation by broadening the eligibility criteria for access to services under the Health and Disability Services Eligibility Direction 2011,[26] from that of only being eligible to receive services if a 'victim of trafficking in people offence' to aligning with the current evidence on all practices of slavery in New Zealand. It requires the development of robust and useful policies and guidelines that strengthen existing referral pathways for children who are being exploited, for example, under the broad mandate of the Children, Young Persons, and Their Families Act 1989. It also includes pathways for referral to the Ministry for Vulnerable Children, Oranga Tamariki and when to contact the police; education and training for practitioners in victim identification and support; and resourcing for continued research into slavery and associated health consequences in New Zealand. [5]

In addition to improving their own cultural competency, knowledge and expertise, practitioners can lead their organisations to develop culturally competent protocols and guidelines (including referral processes) within their local context to respond appropriately to slavery. This includes building alliances with local organisations working with migrants and refugees, and women's refuges, both to facilitate victims accessing healthcare and to support practitioners in caring for them. This would include best practice use of trained interpreters. They can also lead their regulatory and professional bodies (such as the Medical Council of New Zealand, medical colleges and associations) to develop culturally competent policies and resources that address slavery and its health consequences in New Zealand. Health organisations must not be complicit in enabling structures that propagate slavery, for example, that the agencies health organisations contract with are not exploitative of migrant workers.[5] Practitioners can ensure that their health organisations have structures to prevent this from occurring, including robust monitoring.

There are resources in the international literature that could be adapted for New Zealand, which cover identification of individuals in situations of slavery, culturally competent and trauma-informed treatment, service referral, legal issues, security (of the victim and practitioner) and prevention.[12] One example is a tool developed for practitioners to support a person who is at risk of, or living within a forced marriage. Components of the tool include seeing the person in private, taking a detailed family history, assessing any immediate risk and developing a safety plan, shared decision-making, liaising with local organisations with expertise in the area and arranging a follow-up visit as a safety check.[25]

Victims of slavery can perceive providers as being unable or unwilling to hear disclosures about sensitive topics and respond without judgment. There is evidence, however, that supportive and empathetic responses, and a collaborative process may encourage and allow disclosure in future interactions.[23] There is the opportunity for skilled practice by a culturally competent health workforce to support disclosure and identification of victims, or those at risk,

through practitioners continuing to further develop and maintain their own cultural and professional competencies, and support their colleagues and peers to do so.

Conclusion

Slavery is a serious, complex and often hidden problem in New Zealand. We have endeavored to raise awareness about this neglected issue and highlight the numerous opportunities for doctors and other health practitioners to address slavery and its adverse health effects. Practitioners can, and should be leading advocates for change at government, health system and organisational levels. Key recommendations for a safe approach towards identifying and managing people in situations of slavery include building rapport, and culturally competent practice with an empathetic non-judgmental approach. Responses should be based on the respect, promotion and protection of human rights, and occur within a robust person-centric coordinated government response to addressing slavery and its health consequences in New Zealand.

Competing interests:
Nil.

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Holiday headache

Nicole McGrath

Obtaining a travel history is an often forgotten component of the clinical assessment that proved essential in the diagnosis and treatment of this patient.

Case report

A 21-year-old previously well female living in Northland presented with severe headache, vomiting and diplopia that developed over one day. She reported an impacted left wisdom tooth and one previous migraine only. At presentation she was afebrile with no meningism or rash. She had partial left abducens palsy. Corrected visual acuity, ophthalmoscopy, visual fields and the rest of the neurological and general examinations were normal.

Full blood count and C-reactive protein, CT/CTA and subsequent MRI/MRV head scans were normal. The next day she complained of tingling of the left side of her face. The examination revealed complete left abducens palsy, normal facial sensation. On lumbar puncture there was a raised cerebrospinal fluid (CSF) white cell count of 19, 47% lymphocytes, 39% polymorphs, red cell count 940, increased CSF protein of 0.76 grams/litre. Gram stain and culture, CSF viral polymerase chain reaction panel, mycobacterium studies and cytology were negative.

Over the next few days her left hemi-facial symptoms worsened with no improvement in her headache or diplopia. She developed reduced light touch and pain sensation over the left forehead and maxillary region and a reduced corneal reflex.

On further questioning, the patient revealed that she had been having regular milder headaches for three months that she had attributed to the fact she had left her glasses behind with her boyfriend. It transpired that her boyfriend lived in the US. She revealed that she had attended open air concerts in Louisiana and Texas three months before this presentation, where she had sustained numerous "insect" bites. She remembered having a fever and feeling unwell. We therefore arranged Lyme serology testing that revealed a positive serum IgG of 1024 and positive CSF titre of 1:4 (IgG) by the Trinity Biotech IFA test, in which washed cultured organisms are used as the substrate and exposed to serial dilutions of the patient's serum or CSF. She commenced oral doxycycline 100mg bd for one month. At the end of treatment her headaches had resolved and the left abducens palsy was incomplete. On last review six months later, her only remaining symptom was dry left eye. Eye movements were full; there was persistent anaesthesia over the left forehead with reduced corneal reflex.

Discussion

Lyme Disease does not occur de novo in New Zealand as the spirochete *Borrelia burgdorferi* has not yet crossed our borders. Until a travel history was obtained, neuroborreliosis was not considered. Our patient did not associate her distant trip to the US with her current illness so direct questioning was required. Louisiana and Texas are not endemic for Lyme disease but it has been reported in every state in America. The patient did not recall having a skin rash consistent with erythema migrans and did not feel her headaches occurring over three months were severe enough to mention. The most common manifestations of neuroborreliosis are cranial neuropathy, lymphocytic meningitis and radiculoneuritis.[1] Cranial neuropathies other than facial are less common and typically occur within two months of the tick bite. Lyme meningitis may begin acutely or subacutely and may continue for months if not treated. Intermittent headache is the most common symptom, with the pain severity ranging from mild to disabling. CSF examination shows lymphocytic pleocytosis, usually around 100 cells/microlitre, but can range

from 8 to more than 1,000, moderately increased CSF protein and normal glucose.

The majority of laboratory tests performed for Lyme disease are based on detection of the antibody responses. We based our diagnosis on positive immunoglobulin (Ig) G titres. The addition of IgM or immunoblot does not necessarily increase diagnostic accuracy and they are not easily available in New Zealand.

Treatment can be oral doxycycline, amoxicillin, cefuroxime or parenteral ceftriaxone, cefotaxime, penicillin G. Prognosis is generally good, even with delayed diagnosis, as in our case.

Competing interests:
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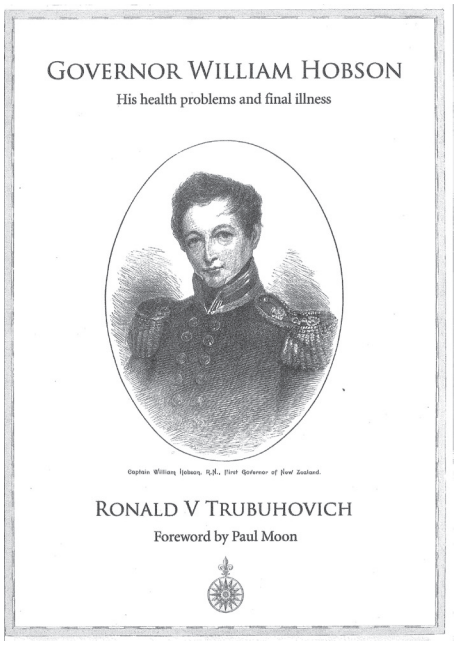
Governor William Hobson: his health problems and final illness

Yee Chen Lau



Ron Trubuhovich. Published by Ron Trubuhovich and the Auckland Medical History Society, 2015. ISBN 9780473344597. Contains 63 pages. Price NZ$25

Captain William Hobson, our first governor, had a tumultuous year before his untimely death in 1842. Marred by opposition, limited funding, understaffing and personal bad health, he battled through duties with vigour and dedication. What ultimately took his life days before his 50th birthday is still shrouded by speculations and conspiracy. Was it stroke, yellow fever or even accidental overdose? This book not only looks at the potential cause of Captain Hobson's death but also looks into the illnesses and disabilities that he suffered from throughout his career, from the early years when he was serving in the navy fighting pirates in the Caribbean to the last few days of his life serving as New Zealand's first governor.

Trubuhovich attempts to decipher and investigate the cause of his death by sieving through available evidence, documentation and publications. By summarising evidence from the Royal Navy record, newspaper articles, first person account, personal diary and correspondence, we get an insight into the signs and symptoms Captain Hobson was suffering from; differentiate between myth and truth.

This is not an easy read. Unlike other free-flowing stories telling bibliographies or non-fictional books, this book is punctuated by evidence, notes and indexes, making reading more like reading one's private notes. One needs some degree of understanding of New Zealand's history and its leading historic characters to follow the series of events without getting lost.

However, if history and medical knowledge is your forte, this book makes for an interesting read, particularly about one of the more important characters who shaped and influenced New Zealand's history.

Competing interests:
Nil.

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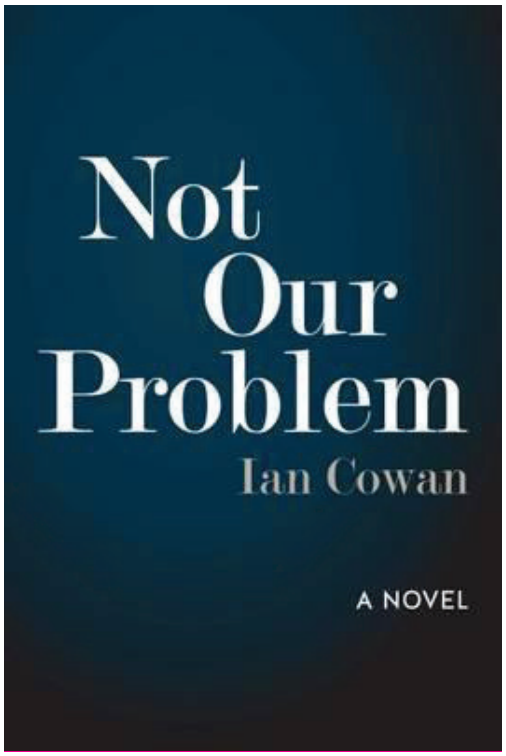
Not Our Problem

Frank Frizelle



Ian Cowan. Published by Mary Egan Publishing, Feb 2015. ISBN 9780473326968. Contains 275 pages. Price NZ$35

This soft-covered 250-page book (with 246 references) is the work of Ian Cowan, a radiologist in Christchurch. Though a work of fiction, it covers the very real events around the changes in health provision that occurred from 1987 to 1998, leading up to the Stent report. This was a time when health systems were undergoing a dramatic swing away from patient-centred approach, and with doctors and nurses having a significant role in the management of hospitals, to the financial and managerial model seen in the ideologically different market-driven model. Management and non-clinical duties were removed from the clinician's role, and management was brought in from business outside of health section to change the process. These were introduced with the usual misleading lies of increasing transparency and accountability and the better use of limited financial resources. This understandably led to major conflict of culture with some clinicians, as the New Zealand health system became an experiment.

It is with this backdrop that the story develops of a surgical registrar (Steve Cassidy), who thinks that by having time away from his clinical role and getting involved in management he can do more good than working as a clinician. As he takes on a management role he sees the clash of cultures. He moves from the issues around patient care, such as lack equipment, sick and complex patients on non-specialised wards, "safari" ward rounds, the ongoing public grandstanding and abuse of the self-righteous media about standards of patients, the burnout of clinical staff, to the issues of hospital management, driving change with a focus on the financial bottom line, which make most of the clinical issues worse.

Cowan worked in the health system as a clinician over this time and well under-

stands the background of the change in philosophy that occurred from the Gibbs report to the creation of the Crown health enterprises (CHEs), and what happened in regard to clinical care. The story is an easy read of the issues involved and today makes an interesting look back in recent time as how we work in a healthcare model somewhere between where things were and where things were being driven to.

Many readers may have forgotten about how the Stent report was a HDC report followed on from a clinician-generated report "Patients are dying". The Stent report stated in its conclusion, "It is my (Robin Stent) opinion that in 1995 and 1996 the Canterbury Health Board and management did not offer the leadership that builds trust and commitment, or the common vision and purpose to inspire employees and support them. They also did not implement the structure, together with systems for control and accountability, to ensure that responsibility was understood and exercised at all levels. This led to lack of cooperation and low morale. Canterbury Health was warned by many parties that the breakdown in relationships between management and clinicians could lead to a reduction in standards and this occurred".

This book exposes the complex issues of that time in a way that is easy to read and understand. I would recommend it to those practising (or wanting to understand it) in the health system today, as these issues still keep recurring, and lessons learned by one generation are at times forgotten by the next.

Competing interests:
Nil.

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Heart Foundation grants awarded July 2017

A total of 38 grants were awarded at the Heart Foundation's Scientific Advisory Group meeting in July. The awards include six Project Grants, 10 Fellowships and Scholarships, six Small Project Grants, one Grant-in-Aid Grant and 10 Travel Grants. Five Summer Studentships were also awarded to the Medical Schools at the University of Otago and the University of Auckland. The Heart Foundation has awarded $1.8 million of funding for heart research and specialist training for cardiologists in 2017, bringing the total awarded by the charity since 1970 to almost $60 million.

Project grants

Professor Bart Ellenbroek
School of Psychology, Victoria University
Why does mental illness affect the heart?
$151,438 over two years.

Dr Nigel Lever
ADHB Cardiology, the University of Auckland.
Pacemaker and Defibrillator Lead Extraction Project.
$88,370 over two years.

Dr Barry Palmer
Department of Medicine, the University of Otago—Christchurch.
Evaluation of placental growth factor as a diagnostic and prognostic biomarker in heart failure.
$118,846 over two years.

Associate Professor Miriam Rademaker
Department of Medicine, the University of Otago—Christchurch.
Phosphodiesterase 9 inhibition in heart failure.
$152,100 over two years.

Associate Professor Nigel Wilson
Department of Paediatric and Congenital Cardiology, Auckland DHB.
The Establishment of the New Zealand Rheumatic Heart Disease Registry.
$131,040 over two years.

Dr Joanna Young
Department of Cardiology, Canterbury DHB
Testing Strategies to Minimise Stress Testing in Patients with Acute Chest Pain and Negative Cardiac Blood Tests.
$148,563 over three years.

Fellowships and scholarships

Dr Mohammed Alawami
Overseas Training & Research Fellowship (one year).
Interventional cardiology training at Manchester Royal Infirmary in the United Kingdom.

Dr Sarah Appleby
Research Fellowship (two years).
Department of Medicine, the University of Otago—Christchurch.

Dr Susann Beier
Research Fellowship (three years).
Department of Anatomy with Medical Imaging, the University of Auckland.

Dr Manali Jain
Overseas Training & Research Fellowship (one year).
British Society of Echocardiography/SCMR/ESC MRI certification/SCCT certification.

Mr Timothy Jones
(PhD) Postgraduate Scholarship (three years).
Department of Physiology at the University of Auckland.

Dr Meredith Peddie
Research Fellowship (three years).
University of Otago—Dunedin.

Dr Katrina Poppe
Senior Fellowship (three years).
Department of Epidemiology & Biostatistics, the University of Auckland.

Dr Timothy Prickett
Senior Fellowship (three years).
Department of Medicine, the University of Otago—Christchurch.

Ms Zoe Ward
(PhD) Postgraduate Scholarship (three years).
Department of Medicine at the University of Otago—Christchurch.

Dr Mariusz Wolbinski
Overseas Training & Research Fellowship (one year).
Structural Heart Interventional Cardiology Fellowship Columbia University Medical Center / New York Presbyterian Hospital New York, USA.

Small project grants

Professor Christopher Bullen
Faculty of Medical and Health Sciences, the University of Auckland.
The completeness of capture of ACS and coronary intervention in ANZACS-QI and agreement between the ANZACS-QI and National datasets.
$14,867 over six months.

Associate Professor Gerry Devlin
Department of Cardiology, Waikato DHB.
Does Peer Support improve Secondary Prevention of Ischaemic Heart Disease?
$15,000 over 12 months.

Professor Rob Doughty
Department of Medicine, the University of Auckland.
Secondary Prevention of CVD: Proposal for a Randomised Study.
$15,000 over 10 months.

Professor Debbie Hay
School of Biological Sciences, the University of Auckland.
Tailored cardiovascular signalling: a therapeutic

prospect for adrenomedullin and related peptides? $15,000 over 18 months.

Dr Anna Rolleston
The Centre for Health Ltd.
The sustainability of outcomes and lifestyle changes of a kaupapa Māori enhanced 12-week exercise and lifestyle management programme for cardiovascular disease risk reduction.
$14,760 over 18 months.

Dr Jichao Zhao
Auckland Bioengineering Institute, the University of Auckland.
Investigating the possible mechanisms behind new-onset atrial fibrillation under diabetic conditions. $15,000 over 18 months.

Grant-in-aid

Dr Kenneth Tran
Auckland Bioengineering Institute, the University of Auckland.
Mitochondrial dysfunction in diabetic heart failure.
$15,000.

Travel grants

Mr Akash Deep Chakraborty
Department of Physiology, the University of Otago—Dunedin.
To attend the Australian Physiological Society (AUPS) Melbourne 2017.

Mr Mickey (Jui-Lin) Fan
Department of Physiology, the University of Otago—Wellington.
To attend the Recent Advances and Controversies in Measuring Energy Metabolism (RACMEM) Conference, Switzerland.

Dr June-Chiew Han
Auckland Bioengineering Institute, the University of Auckland.
To attend the Cardiac Physiome Society's 20th Workshop in Toronto, Canada.

Dr Joanne Harrison
Department of Pharmacology and Toxicology, the University of Otago—Dunedin.
To attend the MedSci Congress and Mitochondria Satellite Queenstown 2017, New Zealand.

Dr Rajesh Katare
Department of Physiology, the University of Otago—Dunedin.
To attend the 63rd Annual Conference of Association of Physiologists and Pharmacologists of India (APPICON 2017).

Associate Professor Denis Loiselle
Department of Physiology, the University of Auckland.
To attend the 20th Session of the Cardiac Physiome Workshop Toronto, Canada.

Dr Anna Pilbrow
Department of Medicine, the University of Otago—Christchurch.
To attend the American Heart Association (AHA) Scientific Sessions, Anaheim, CA, USA.

Dr Katrina Poppe
Department of Epidemiology and Biostatistics, the University of Auckland.
To attend the European Society of Cardiology annual congress, Barcelona 2017, Spain.

Dr Kenneth Tran
Auckland Bioengineering Institute, the University of Auckland.
To attend the Cardiac Physiome Society's 20th Workshop in Toronto, Canada.

Dr Stefanie Vandevijvere
Department of Epidemiology and Biostatistics, the University of Auckland.
To attend the International Congress of Nutrition Buenos Aires, Argentina.

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Risk of serious infections associated with use of immunosuppressive agents in pregnant women with autoimmune inflammatory conditions

An observational cohort study was conducted among 4,961 pregnant women with rheumatoid arthritis, systemic lupus erythematosus, ankylosing spondylitis, psoriatic arthritis or inflammatory bowel disease.

The researchers reviewed the subjects' exposure to steroids, non-biological drugs or tumour necrosis factor (TNF) inhibitors. Serious infections (hospital admissions) were recorded in 71 (0.2%) of the subjects. The risk for serious infections was found to be similar for each of the three treatment groups. However, the dose-response analysis showed that high dose steroid use was found to be an independent risk factor.

Consequently, the authors recommend that pregnant women using high dose steroids should be monitored closely for development of serious infections.

***BMJ* 2017; 356:j895**

Knowledge of proprietary and generic drug names among hospital prescribers

Although medical students are taught clinical pharmacology using generic drug names, prescribing in hospitals often uses brand names. As a result, junior doctors may be prescribing drugs without knowing their nature or mode of action.

This report concerns a study carried out in a large Australian teaching hospital, which throws some light on this issue. Eighty-one medical students and doctors were involved. They were asked to identify the generic names of 20 commonly used drugs when presented with their brand names. No participant was able to provide the generic name, class or mode of action for all 20 drugs, with an average of 8.3 of 20 and 6.3 of the 10 most common drug names correctly identified.

The researchers note that the medical students were notably worse in the generic recognition and that this may have skewed the results towards lower scores. Nevertheless, they conclude that these data support calls to mandate prescribing using generic rather than brand names of drugs in hospitals.

Internal Medicine Journal 2017; 47:959–962

The effect of patient age at intervention on risk of implant revision after total replacement of the hip or knee

Total joint replacements for end-stage osteoarthritis of the hip and knee are cost-effective and demonstrate significant clinical improvement. However, robust population-based lifetime-risk data for implant revision are not available to aid patient decision making, which is a particular problem in young patient groups deciding on best timing for surgery.

This population-based cohort study reviews data concerning more than 60,000 patients who had undergone total hip replacement and more than 50,000 who had undergone total knee replacement. The lifetime risk of requiring revision surgery in patients who had total hip replacement or total knee replacement over the age of 70 years was about 5% with no difference between sexes. For those who had surgery younger than 70 years, however, the lifetime risk of revision increased for younger patients, up to 35% for men in their early 50s, with large differences seen between male and female patients (15% lower for women in same age group).

The authors of the study conclude that their evidence challenges the increasing trend for more total hip replacements and total knee replacements to be done in the younger patient group, and these data should be offered to patients as part of the shared decision making process.

***Lancet* 2017; 389:1424–30**

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A Case of Scurvy

By WM. YOUNG, M.D., F.R.C.S.E.

Scurvy in adults is so rare a disease in this country that it seems worth while publishing this case:—

Mrs. X., aged 77, has for several months shown signs and symptoms pointing to carcinoma of the stomach. Owing to pain, vomiting, and flatulence, she had greatly restricted her diet, avoiding meat and taking neither fruit nor vegetables. She took milk, but only when boiled. I was sent for because of repeated bleeding from the nose and general malaise. A fortnight later I saw her again and found she had swollen, painful, and bleeding gums and her breath was very foetid. She was cachectic, depressed, and complained of feeling weak and ill. There were purpuric spots on the arms and legs. The right knee was swollen and painful and showed an ecchymosis on the surface. There was now no doubt about the diagnosis. With fresh milk, raw meat juice, and orange juice there was marked improvement in a few days. Potatoes and other vegetables were added to her diet. Three weeks later the patient was up and there were no signs of scurvy.

In Green's Encyclopedia of Medicine and Surgery (1908) we find it stated, with reference to scurvy in adults, that "this disease is now chiefly of historical interest... It has become one of the rarest of diseases." However, statistics show that it is not so very rare a disease, for in the decennial period 1906–1915 there were 403 deaths from scurvy in England and Wales, 31 in Scotland, and 25 in Ireland. From the recent report of the Glasgow Health Committee ("British Medical Journal," 7th July, 1917) we see that whilst, normally, three or four cases are admitted annually into the Poor Law Hospitals of Glasgow, there were admitted between 15th February and 27th June of this year no less than fifty cases, with one death, and all the cases were in men who were dwellers in model lodging-houses. It has been suggested that the outbreak is due to the recent shortage of potatoes, the only form of fresh vegetable which this class of patient is accustomed to prepare.

This case opens up the interesting and difficult question of diet in stomach cases. The old lady had left off fruit and vegetables partly on medical and partly on her own advice; but since she has been taking these articles of diet, pain, vomiting, and flatulence, such marked symptoms before, have all disappeared.

Since writing the above, I have ascertained that four deaths (all of males) from scurvy were registered in New Zealand in 1906, but none during the ten years 1907 to 1916.

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