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This Issue in the Journal

Ethnic and socioeconomic disparities in the prevalence of cardiovascular disease in New Zealand

Wing Cheuk Chan, Craig Wright, Tania Riddell, Susan Wells, Andrew J Kerr, Geeta Gala, Rod Jackson

Cardiovascular disease refers to a group of diseases of the circulatory system, such as heart attacks and strokes. Prevalence refers to percentage of people with disease in a population. This study demonstrated there are marked differences in cardiovascular disease prevalence by ethnicity and socioeconomic status in New Zealand in 2007. Māori had the highest percentage of people with cardiovascular disease; approximately two-thirds higher than European and Asian New Zealanders. Ensuring everyone with cardiovascular disease receive appropriate preventative treatment is likely to be cost-effective in reducing the long-standing differences in ethnic morbidity and mortality rates seen in New Zealand.

The burden of modifiable cardiovascular risk factors in the coronary care unit by age, ethnicity, and socioeconomic status—PREDICT CVD-9

Andrew J Kerr, Andrew McLachlan, Sue Furness, Joanna Broad, Tania Riddell, Rod Jackson, Susan Wells

We studied patients admitted to the Middlemore Hospital Coronary Care Unit (CCU) with heart problems. An electronic decision-support program (Acute PREDICT) was used to record their potentially modifiable heart risk factors and to provide advice to staff and patients about appropriate ways to reduce the risk of future heart attacks and strokes. A third of patients were younger than 55 years old. Younger patients were much more likely to be smokers, obese, and have adverse cholesterol levels than older patients. Of the younger patients, the Māori and Pacific patients and those from poorer areas were most likely to smoke, be obese, and have diabetes. This information should be used in designing programs to improve these risk factors in these very high risk CCU patients, to reduce their chance of future heart attacks and strokes.

Cardiovascular risk management at a Māori-led Primary Health Organisation—findings from a cross-sectional audit

David Peiris, Jonathan Murray, Doreen Scully, Virantha Tilakawardene, Lorraine Hetaraka-Stevens, Tereki Stewart, Anushka Patel

In this study we looked at the results of a newly implemented electronic cardiovascular risk screening program at Tamaki Healthcare, a Māori-led Primary Health Organisation in Auckland. The study highlights the potential for electronic risk assessment programs to rapidly gather data and assess the effectiveness of cardiovascular risk management in primary healthcare settings. The study found Māori to be twice as likely as non-Māori to be at high risk of developing heart disease

or stroke. Encouragingly, there were no ethnicity differences in access to the evidence-based medicines that can reduce a person's risk of developing a heart attack or stroke. Although this was pleasing, there was still a great deal of improvement needed in meeting best practice recommendations overall. Tamaki Healthcare is committed to promoting high quality healthcare and will use this information to strive for better health outcomes for its enrolled population—especially those who are most vulnerable to healthcare disadvantage.

Acute stroke services in New Zealand: changes between 2001 and 2007

P Alan Barber, John Gommans, John Fink, H Carl Hanger, Patricia Bennett, Nina Ataman

Stroke affects approximately 8000 New Zealanders every year of whom just over half will die or be dependent on others for their day to day care. There is overwhelming evidence that care in a stroke unit results in fewer people dying or being dependent. This study has shown that there have been improvements in the provision of stroke care compared to an earlier survey in 2001. Half of the population are now admitted to hospitals with a stroke unit—up from 1 in 10 in 2001. However, there remain discrepancies in the provision of the type and quality of stroke care across the country, with an ad hoc approach in many centres.

Utilising practice management system data for quality improvement in use of blood pressure lowering medications in general practice

Jim Warren, Rekha Gaikwad, Thusitha Mabotuwana, John Kennelly, Timothy Kenealy

The information in GPs' computers can be used to identify patients whose blood pressure medications are being managed less than ideally. This study has found that we can use the doctor's computer record to make a 70%-accurate assessment of whether a patient has potential for more appropriate management of blood pressure through medication. Adherence—people getting and taking their medication as regularly as the doctor believes they should—is one of the top issues.

Establishment of a Difficult Hypertension Clinic in Whangarei, New Zealand: the first 18 months

Walter van der Merwe

This article describes the experience with a new outpatient service set up at Whangarei Hospital to treat patients with hypertension (high blood pressure) referred by general practitioners because their blood pressure remains poorly controlled despite the use of appropriate medication. These people are at high risk of heart attack, stroke, and premature death. The experience with the first 150 referrals is reviewed. A simple approach to management is followed at the clinic based on modern treatment guidelines and incorporating general cardiovascular risk management and lifestyle modifications. Excellent results were obtained with more than 60% of patients achieving normal blood pressure (less than 140/90 mmHg). High

blood pressure is the most common modifiable risk factor for cardiovascular disease and there is a strong need for specialist clinics where general practitioners can refer patients whose high blood pressure is proving resistant to treatment. Such clinics (along with medical specialists with expertise in high blood pressure) have largely disappeared from New Zealand hospitals—this makes no sense at all as they are low tech, low cost, and have the potential to deliver substantial cost-savings to the health service.

Cardiovascular disease risk factor assessment and management in gout: an analysis using guideline-based electronic clinical decision support

Keith Colvine, Andrew J Kerr, Andrew McLachlan, Peter Gow, Sunil Kumar, Jason Ly, Chris Wiltshire, Elizabeth Robinson, Nicola Dalbeth

People who have gout are frequently at high risk for heart attack and stroke. This is underappreciated even in people who admitted to hospital with gout. Our study has shown that helpful medication is often missed in patients with gout. We feel that looking closely at the heart attack and stroke risk in all patients who have gout (and managing this risk appropriately) will have high benefit.

A survey of thyroid function test abnormalities in patients presenting with atrial fibrillation and flutter to a New Zealand district hospital

David D W Kim, Simon Young, Rick Cutfield

This article is a summary of analysis of survey data looking at thyroid hormone blood testing in patients admitted to hospital with problems with atrial fibrillation/flutter, one of the most common heart rhythm disturbance that can sometimes be triggered by over-production of thyroid hormone. Our survey data showed that a significant proportion of the patients who ideally should have been screened with this blood test were not screened. Of the patients who were screened, only a small proportion of patients had elevated thyroid hormone activity, but the frequency of this condition was high enough for us to continue to recommend this thyroid blood test screening in the hospitalised patients with atrial fibrillation/flutter.

Bleeding events in patients receiving enoxaparin for the management of non-ST-elevation acute coronary syndrome (NSTEMI) at Dunedin Public Hospital, New Zealand

Hesham Al-Sallami, Ruth Ferguson, Gerard Wilkins, Andrew Gray, Natalie J Medlicott

This was a retrospective review of bleeding complications caused by the anti-clotting drug enoxaparin at Dunedin Hospital. Enoxaparin is a very useful drug but up to 20% of patients can experience bleeding or bruising. This drug is usually given to patients admitted with chest pain and heart attacks. The investigators reviewed all chest pain and heart attack admissions in 2005 where a treatment with enoxaparin was instigated. The rate of bruising and bleeding was similar to that reported in the literature. Risk factors for bleeding were the duration of treatment and impaired

kidney function. The investigators advocate individualising treatment particularly in patients at a higher risk of bleeding.

Acute rheumatic fever in the Waikato District Health Board region of New Zealand: 1998–2004

Polly Atatoa-Carr, Anita Bell, Diana Lennon

Acute rheumatic fever (ARF) is a disease caused by a bacterial throat infection and can result in rheumatic heart disease (RHD). This paper summarises an audit of the hospital notes of cases of ARF in the Waikato District Health Board region from 1998 until 2004. A total of 77 cases of ARF were found in this period, particularly in Māori and Pacific community members (90% of cases were Māori or Pacific). This audit looked at the details of each case (age, ethnicity, deprivation), and how each case was diagnosed and notified. Recommendations are made in order to improve the management and prevention of this disease in the Waikato region, and nationally. ARF is a preventable chronic disease with potential life-long consequences. If the rate of ARF in Māori in New Zealand was reduced to that of European New Zealanders, then the impact of this disease on New Zealand communities (which includes early death, illness, and inability to work or learn) and the significant costs of this disease to the New Zealand health sector would be virtually eliminated. In addition, disparities between the health and social outcomes for Māori compared to non-Māori would be improved.



Reducing health inequalities: a foremost priority

Norman Sharpe

There are large differences in health risk, outcomes, and access to care in New Zealand. These derive from a complex mix of socioeconomic, ethnic, geographic, and access-related factors which are particularly evident for heart health but relevant to health in general. They are unnecessary, avoidable, unjust, and should be regarded as embarrassing and unacceptable. Health inequalities should be viewed as a foremost priority for a caring community and deserving of concerted attention until reduced and removed.

As a new government is elected, it is timely to question the actual substance of our national commitment to the reduction and eventual removal of health inequalities in New Zealand. At a time of unusual global and national economic stress, it is crucial to confirm that quality and equity in healthcare are prerequisites for true economic wellbeing in the long-term. Environmental change and increased investment in health promotion and preventive care are vital, acknowledging the need for the careful balance needed between this investment and the ever increasing demand for clinical care.

Ultimately, the extent to which we commit to and succeed with reduction of health inequalities will be a measure of our community values and how much we actually care.

The considerable challenge we face in this respect is highlighted in the report from Middlemore Hospital in this issue of the *Journal* which describes the inequitable distribution of the burden of modifiable cardiovascular risk factors in patients presenting with an acute cardiovascular event.¹ One-third of patients were under 55 years of age. Smoking and obesity rates were very high, particularly in younger and Māori and Pacific patients. Adverse lipid profiles and diabetes were a common accompaniment. The “upstream” origin of much of this burden was evident from the finding of association of smoking, obesity, diabetes, and elevated triglyceride levels with increasing levels of social deprivation.

The study findings are a very close reflection of the data recently reported from the *New Zealand Health Survey 2006/07*.² In the Survey, smoking prevalence for the adult population was less than 20% for the first time, but 42% and 27% for Māori and Pacific people respectively.

Obesity prevalence in adults was 26.5% but 41.7% for Maori and 63.7% for Pacific people. Smoking prevalence increased in a graded fashion from 11.8% in NZ Dep I (quintile) to 33.1% in NZ Dep V. Obesity prevalence was 20.9% in NZ Dep I and 37.6% in NZ Dep V. Morbid obesity (BMI>40) was about 2% for NZ Dep I-IV but 7.9% in NZ Dep V.

The Middlemore study findings are also highly consistent with the reported emergence of an adverse cohort effect for ischaemic heart disease mortality in New Zealand identified from the 1951 cohort onward.³

Combining projected mortality rates with projected demographic trends to 2015, the heart disease mortality burden is projected to actually increase for Māori. Thus present inequalities will worsen in the next decade without effective focused interventions to change this trajectory. Effective preventive measures and clinical care may still be working differentially to reinforce the inverse care law—those most in need may be least likely to receive such benefits.

Further consistency is found with the retrospective hospital admission data for acute coronary syndromes between 1989 and 2002/03.⁴ During this period hospital admissions for acute myocardial infarction in New Zealand doubled. Part of this increase could be attributed to changes in diagnostic criteria and coding. However, hospital admissions for acute coronary syndromes (acute myocardial infarction and unstable angina) increased by two-thirds, and doubled for Māori and Pacific men and women.

Finally, also in this issue of the *Journal*, are current (2007) cardiovascular disease prevalence data which again highlight ethnic and socioeconomic disparities.⁵ In 2007 Māori had the highest age-standardised prevalence of cardiovascular disease compared with “other” New Zealanders (non-Māori, non-Pacific, and non-Indian)—7.41% compared with 4.45%. There was a clear gradient of increased cardiovascular disease prevalence with increasing level of social deprivation. In the 55–59 years age group, the prevalence amongst the most deprived quintile was more than twice that of the least deprived.

Age-specific prevalence amongst the least deprived quintile of Māori was almost identical to that of the most deprived “other” New Zealanders.

Enough of data. The requirement now more than ever is to reconfirm our commitment to achieve quality and equity standards of healthcare for all New Zealanders and to reduce and eventually remove these large unacceptable inequalities.

The New Zealand Health Strategy 2000,⁶ other ancillary strategies, and the recent complementary *Quality Improvement Plan for Cardiovascular Disease and Diabetes*⁷ provide clear priority objectives. A life-course approach appreciative of the various levels of causation and referenced to the health continuum is required, balancing investment in public and population health approaches with improvements in clinical care.

The importance of concerted “upstream” actions on the social determinants of health is emphasised in the recent final report from the World Health Organization’s Commission on the Social Determinants of Disease.⁸ Their report *Closing the Gap in a Generation* focuses the need for a concerted society, governmental, and institutional response with emphases on early childhood development and education, improved housing and working conditions, and social protection policy supportive of all people.

The Commission recommends tackling the inequitable distribution of power, money, and resources, which is pertinent globally and within individual countries including

New Zealand. The need for strengthened governance dedicated to equity should apply equally from the community level to global institutions.

In New Zealand we are witnessing the onslaught of a new wave of inequality-related ill health which threatens to inundate the health system. The need to address it is urgent and requires greater leadership and cohesion. At this most difficult economic time we need to realise the value of collective commitment and refocus our efforts to ensure that reduction of inequalities remains a foremost priority.

Competing interests: None known.

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Ethnic and socioeconomic disparities in the prevalence of cardiovascular disease in New Zealand

Wing Cheuk Chan, Craig Wright, Tania Riddell, Susan Wells, Andrew J Kerr, Geeta Gala, Rod Jackson

Abstract

Aim To describe the prevalence of cardiovascular disease (CVD) in New Zealand by ethnicity and socioeconomic status using NHI-linked electronic national databases.

Method CVD prevalence by ethnicity and socioeconomic status in New Zealand in 2006/07 were estimated from national datasets of public hospital discharges, mortality registrations, and pharmaceutical dispensing over the period 1988–2007.

Results In 2007, Māori had the highest age-standardised prevalence (7.41%) compared to non-Māori, non-Pacific, and non-Indians (4.45%). Māori males and females had the highest age-specific prevalence of CVD across virtually all age groups. There was a clear gradient of increasing CVD prevalence with increasing level of social deprivation. The corresponding age-specific CVD prevalence among the least deprived quintile of Māori were similar to the most deprived quintile of 'Other' New Zealanders.

Conclusion Consistent with mortality trends, this study confirms marked ethnic and socioeconomic disparities in CVD prevalence that are (at least in part) independent of each other. Aggressive targeting of CVD risk management among these relatively easily identifiable high-risk patient groups with known CVD could be a highly cost-effective way of reducing health disparities in the short term.

Cardiovascular disease (CVD) remains the leading cause of death in New Zealand despite the age standardised mortality rate having fallen by more than 40% between 1997 and 2003.¹ Coronary heart disease and cerebrovascular disease combined accounted for 8889 deaths in New Zealand in 2003 compared to 7932 deaths related to cancer.¹ In New Zealand, longstanding ethnic and socioeconomic disparities have been well documented for CVD mortality.^{2,3}

Patients with prevalent CVD are at the highest risk of developing future CVD events,^{4,5} and would benefit the most from aggressive cardiovascular risk factors management. This study aims to identify specific subgroups with the highest prevalence of a broad range of cardiovascular disease in New Zealand.

As far as we are aware, this is the first published New Zealand study to estimate national CVD prevalence by ethnicity and socioeconomic status using multiple datasets linked by the National Health Index (NHI) number, a unique national personal identifier for all New Zealanders which is attached to major routinely collected health datasets.

Methods

This study is based on data extracted from the National Minimum Dataset (NMDs) (for hospital events), the New Zealand Health Information Service national mortality collection (1988–2007), and the National Pharmaceutical collection (July 2001 to June 2007).

The following hospital discharge codes and procedural codes were used to identify patients with known CVD (including codes for coronary heart disease, ischaemic stroke, peripheral vascular disease, congestive heart failure, hypertensive heart disease, atrial fibrillation, and ventricular fibrillation):

- ICD 9 diagnosis codes: 250.7, 250.71, 250.72, 250.73, 290.4, 401, 402, 404, 410-414, 427.3, 427.4, 427.5, 428, 428.1, 428.9, 429.2, 433, 434, 435, 436, 437, 437.1, 437.3, 437.8, 437.9, 438, 440.1, 440.2, 440.21, 440.22, 440.23, 440.24, 440.29, 440.3, 440.31, 440.32, 441, 442, 443.9
- ICD 9 procedure codes: 360, 361, 362, 380, 381, 3922, 3924, 3925, 3926, 3928.
- ICD 10 diagnosis codes: E1050, E1051, E1052, E1053, E1059, E1150, E1151, E1152, E1153, E1159, E1450, E1451, E1452, E1453, E1459, F011, G45 (except G453), G46, I10, I110, I119, I130, I132, I139, I20 to I25, I46, I461, I48, I490, I50, I500, I501, I516, I63, I64, I65, I66, I670, I671, I672, I679, I679, I693, I694, I698, I700, I701, I7020, I7021, I708, I709, I71, I72, I739, I74, R96, R98.
- ICD 10 procedure codes: 3270000-3276318, 3300000-3318100, 3350000-3355400, 3380000-3380612, 3530400-3530501, 3531000-3531005, 3531200-3531501, 3845619, 3849700-3850304, 3850500, 3855000-3857101, 3857200, 3863700, 3865308, 3870600, 3870601, 3871200, 9020100-9020103, 9022900, 9023000.

In addition, the National Pharmaceutical data collection from July 2001 to June 2007 was used to identify people with two or more prescriptions for glyceryl trinitrate, isosorbide dinitrate, isosorbide mononitrate, nicorandil, and perhexiline, which are used almost exclusively to manage angina. To exclude those patients for whom nitrate prescribing formed part of a diagnostic test, only patients with two or more prescriptions were selected.

The CVD prevalence estimates exclude all the deaths identified by the mortality collection via encrypted NHI linkage. The NHI number is a unique identifier that is assigned to each health services user in New Zealand and it allows linkage between different data collections.

In keeping with the New Zealand CVD risk management guidelines,⁴ CVD prevalence estimates were stratified by ethnicity according to the following groups: Māori (ethnic code 21), Pacific people (30–37), Indian (43), and ‘Other’ New Zealanders. However, since NHI only records Statistics New Zealand level 2 ethnic codes, the Indian group of this study includes Indian and Fijian Indian but not some of the other Indian subcontinent groups such as Sri Lankan and Pakistani. The standard New Zealand prioritised definition of ethnicity (Māori, then Pacific peoples, then Indian peoples) was used. The most recently available ethnicity codes from all national collections were used for each NHI.

Socioeconomic status was measured using the NZDep2001 index of deprivation by quintile at the census area unit (CAU) level. NZDep2001 is an index of deprivation for small areas, accounting for nine variables covering income, employment, access to transport, education, and home ownership.⁶

Age-specific prevalence was calculated using a 2006/07 population derived from the national collections and NHI. The study population required a person to:

- Have an NHI;
- Be listed as a New Zealand resident on the NHI;
- Have had a health service contact (e.g. GP consult, public or private hospital admission, or mental health services use) or currently enrolled with a primary health organisation (PHO) in the 12-month period (July 2006 to June 2007); and
- Not be registered as deceased prior to 1 July 2007.

The prevalence proportions were separated into 5-year age groups from 0 to >85 for direct age standardisation using the World Health Organization (WHO) World population as the standard.⁷

Standard errors (SE) and 95% confidence intervals for age standardisation are calculated from the following formula:

$$\sigma_{\bar{x}} = \sqrt{\frac{\sum w^2(p^*(1-p)/n)}{w^2}}$$

w = weights of the WHO population within the age bracket.

p = prevalence proportions within the age bracket.

n = number of people in the denominator within the age bracket.

Results

The study population included 4,191,388 people in New Zealand, which is a 0.87% undercount compared to Statistics New Zealand estimates of the resident population at June 2007 of 4,228,000.⁸

In 2007, a total of 281,333 people in New Zealand were estimated to have CVD as defined by this study (Table 1). About 9.7%, 4.1%, and 1.4% of people with CVD in New Zealand were of Māori, Pacific, and Indian ethnicities respectively. The remainder (84.8%) of people with CVD were mainly of European descent and are referred to here as ‘Other’ New Zealanders.

Māori had the highest age-standardised prevalence of CVD, which was 67% higher than among ‘Other’ New Zealanders.

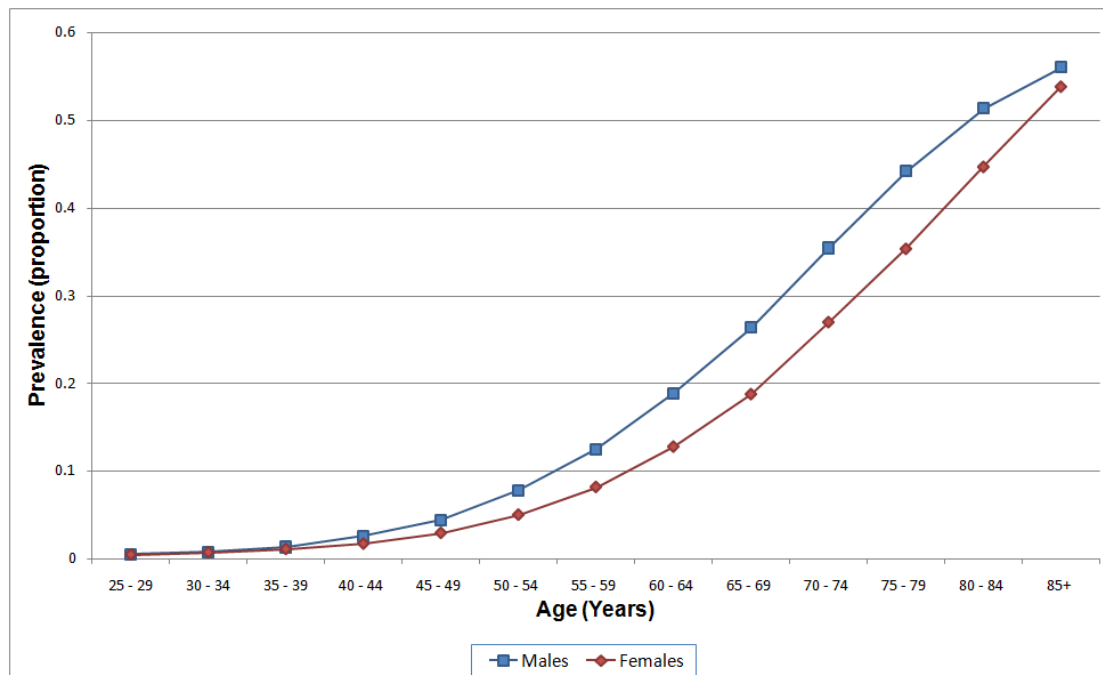
Table 1. Estimated number of people in New Zealand with prevalent cardiovascular disease (CVD) by ethnicity in 2007

Variables	Māori	Pacific*	Indian	‘Other’ New Zealanders	New Zealand (total)
Number of people diagnosed with CVD	27,217	11,488	4,018	238,610	281,333
Population number	570,356	286,282	102,267	3,232,483	4,191,388
Crude prevalence (%)	4.77	4.01	3.93	7.38	6.71
Age-standardised prevalence (%) with 95% confidence interval	7.41 (7.33–7.49)	5.68 (5.58–5.77)	4.96 (4.81–5.10)	4.45 (4.44–4.47)	4.77 (4.75–4.78)

*Mostly of Samoan, Tongan, Niuean, or Cook Islands origin.

Age specific prevalence—As expected and illustrated in Figure 1, the prevalence of CVD in New Zealand increases rapidly from 35 years of age and is higher in all age groups in males compared to females.

Figure 1. Age-specific prevalence of cardiovascular disease in New Zealand by gender in 2007



As shown in Figures 2 and 3, Māori males and females had the highest age-specific prevalence of CVD compared to all other ethnic groups after age 35 years. Although not readily apparent in Figures 2 and 3, CVD prevalence among Māori females was 184% higher than females in the 'Other' New Zealanders group in the 45-49 year age group. Similarly, CVD prevalence in Māori males was 98% higher than 'Other' New Zealand males in the 35-39 year age group.

Prevalence among Indian and Pacific males was intermediate between Māori and 'Other' New Zealanders up to the age of 64 years. However, CVD prevalence among Pacific females is higher than Indian females from age 45 years onwards. The CVD prevalence among both Pacific and Indian peoples is lower than 'Other' New Zealanders after age 70 years for males and after age 75 years for females.

NZDep2001 was available for 91% (n=256,277) of people with CVD and for the remaining 9% NZDep has not been estimated due to the small size of the population living in those CAU.

There was a clear socioeconomic gradient in prevalence of CVD. People living in most deprived areas had consistently higher age-specific prevalence than people living in less deprived areas (Figure 4). For example, in the 55-59 years age group, the prevalence among the most deprived group was 123% higher than their least deprived counterparts.

Figure 2. Age-specific prevalence of cardiovascular disease in New Zealand by ethnicity (*males*) in 2007

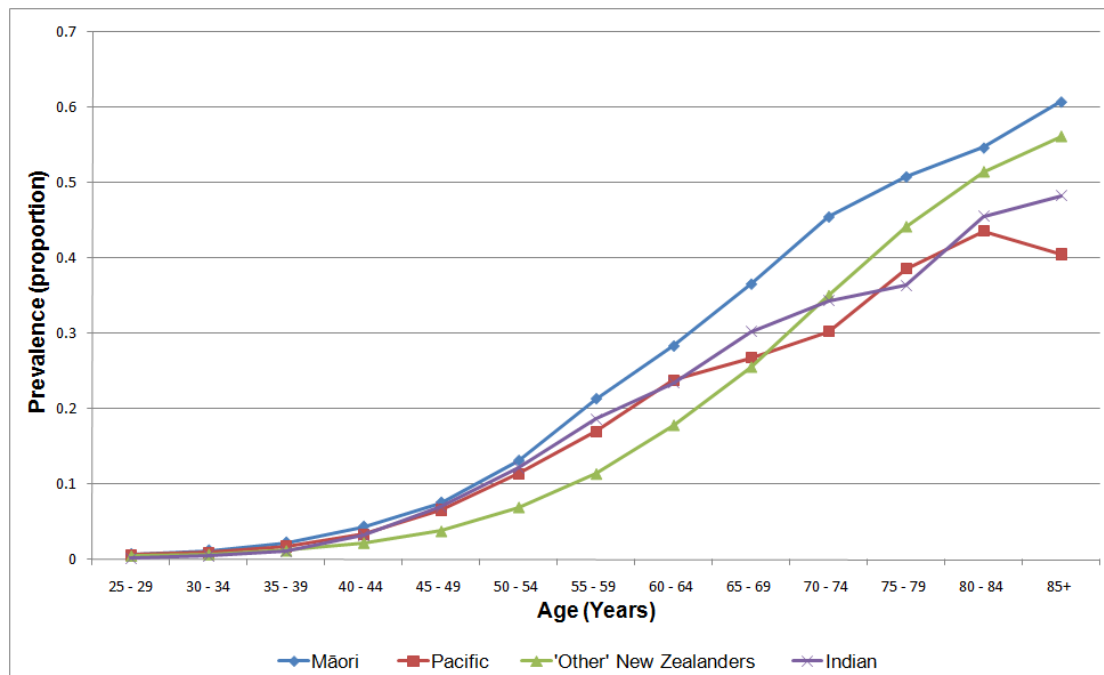


Figure 3. Age specific prevalence of cardiovascular disease in New Zealand by ethnicity (*females*) in 2007

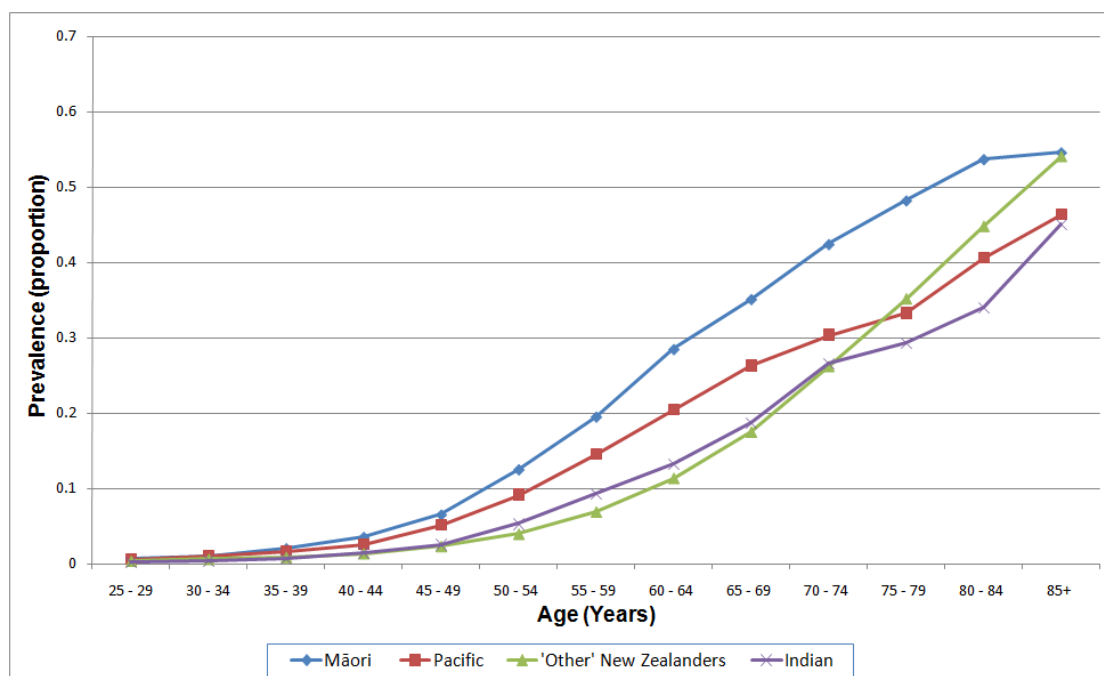
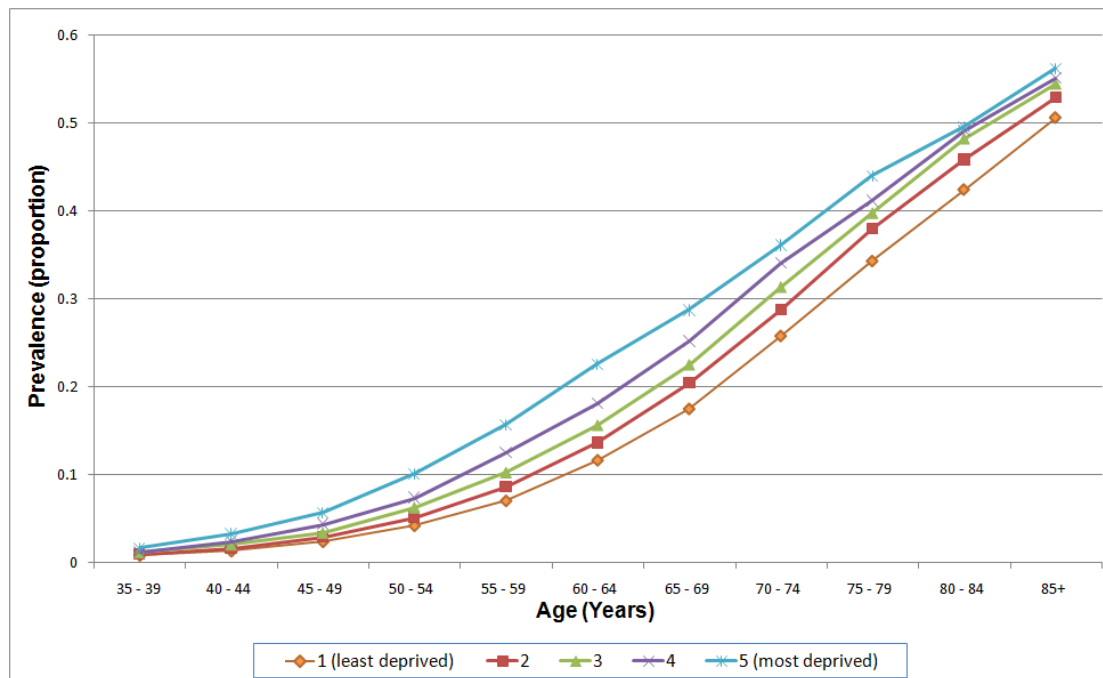


Figure 4. Age-specific prevalence of cardiovascular disease in New Zealand in 2007 by quintiles of socioeconomic deprivation



As illustrated in Figure 5, the corresponding age-specific prevalence among the least deprived quintile of Māori and the most deprived quintile of ‘Other New Zealanders’ were almost identical up to 79 years of age.

Between ages 40–59 years, the most deprived quintile of Māori had consistently at least a 240% higher CVD prevalence than the least deprived quintile of ‘Other New Zealanders.’

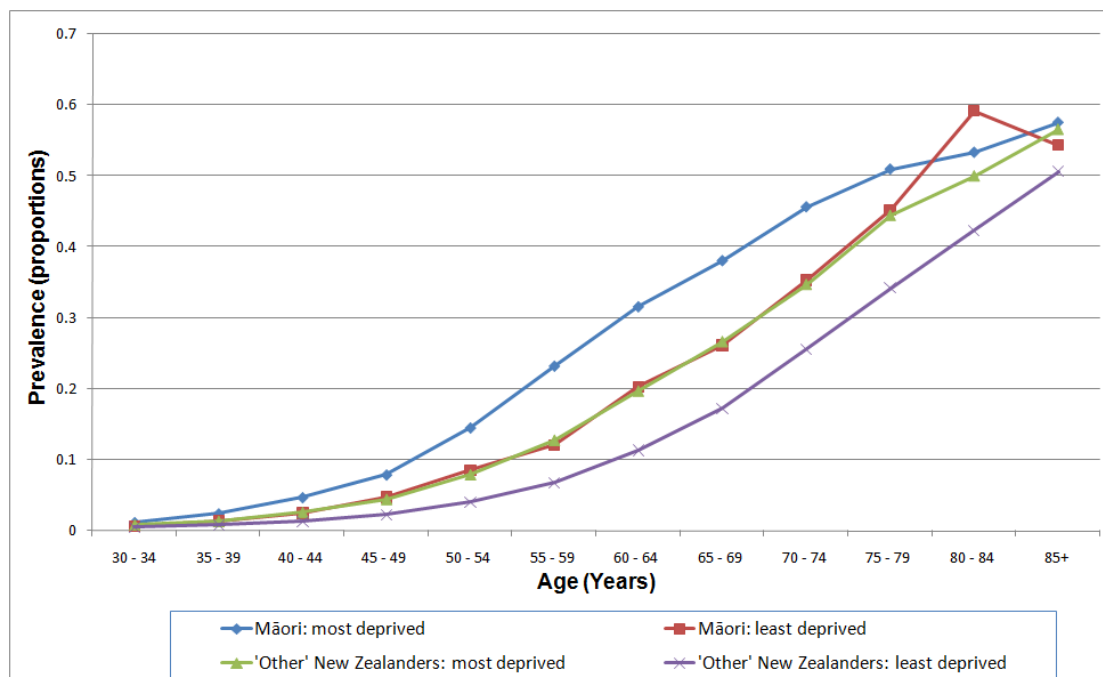
Discussion

Inequalities in health status between different groups within a given population are found internationally. These include inequalities by age, sex, ethnicity, and socioeconomic group.

This study has demonstrated major disparities in the prevalence of CVD in New Zealand by ethnicity and socioeconomic deprivation, based on national hospitalisations and mortality datasets between 1998 and 2007 and the National Pharmaceutical data collection from 2001–2007.

The relative burden of CVD falls most heavily on Māori, middle-aged Pacific, and Indian peoples and those who live in the most deprived areas of New Zealand. It has also demonstrated that the most consistent and compelling disparity in CVD prevalence is that for the indigenous Māori population.

Figure 5. Comparison of age-specific cardiovascular disease prevalence between the most and least socioeconomically deprived quintiles of Māori and 'Other' New Zealanders



Ethnic and socioeconomic disparities in CVD mortality have been previously described in the New Zealand census mortality study.⁹⁻¹² The study also demonstrated that disparities in cardiovascular mortality between Māori and non-Māori persisted after adjusting for socioeconomic status.¹¹ Consistent with the mortality findings,² our study demonstrated that age-specific prevalence of the least deprived Māori were similar to the prevalence of CVD among the most deprived 'Other' New Zealanders group up to 79 years of age.

It is important to note the marked differences in population demography when comparing health outcomes between ethnic groups. Māori have a much younger age structure than the total New Zealand population. According to the 2006 New Zealand census, the median age of Māori was 22.7 years compared to 36 years for the total population.^{13,14} Proportionally, the crude CVD prevalence among Māori is in fact lower than for 'Other' New Zealanders (Table 1). However, after adjusting for the effect of age, prevalence among Māori was 66% higher than among 'Other' New Zealanders.

Consistent with national CVD risk management guidelines,⁴ this study also demonstrated Pacific and Indian populations had higher age-standardised prevalence of CVD than 'Other' New Zealanders. It is interesting to note, however, that CVD prevalence among both Pacific and Indian populations were lower than 'Other' New Zealanders in the older age groups. The "healthy migrant effect" may in part account for this observation¹⁵ or perhaps these older people are more likely to have persisted with the traditional healthier diets they had in their countries of birth.

This study did not examine temporal trends in prevalence. Since prevalence of CVD depends on the dynamic interactions between incidence and mortality, it is uncertain if the disparities demonstrated in this study have narrowed or widened over time. Nevertheless, we have identified a significant opportunity to reduce future CVD morbidity and mortality disparities in New Zealand.

Targeting patients with prevalent CVD is likely to be a cost-effective strategy to reduce the morbidity and mortality burden of CVD since patients with known disease are at the highest risk and would benefit most from interventions. NHI-linked National Pharmaceutical usage data routinely collected in New Zealand could become a convenient source of information to identify the potential gaps in management of CVD. Further research with linkage to pharmaceutical data is likely to be very relevant in shaping and evaluating ongoing policy and interventions in addressing disparities of CVD outcomes in New Zealand.

A major strength of the study is that the findings are derived from national data collections and are therefore not subjected to the response rate biases common in many prevalence surveys. Moreover, as this study is based on data for the entire New Zealand population, the large numbers have made it possible to estimate prevalence for multiple population subgroups with a high degree of precision.

A weakness is that the findings are dependent on the electronic recording of CVD events of the publicly funded health system. Moreover, these analyses used census area units rather than meshblocks for classifying people by socioeconomic status as these were the data most readily available. We have since done some preliminary analyses using meshblocks, which not surprisingly show a wider disparity in prevalence than using census area units, since it is a better measure of socioeconomic status. In future studies we plan to use meshblock-based measures of socio-economic status where possible. Furthermore, an extended range of CVD was selected for the study to demonstrate disparities in prevalence, which made comparison to results of similar studies more difficult. A new 2007/08 extract for diabetes prevalence and a more specifically defined CVD prevalence are now underway.

Private hospital admissions and diagnoses from general practice were not included. Therefore, these estimates are conservative since some patients with CVD such as peripheral vascular disease, transient ischaemic attack (stroke), or heart failure may not present to public hospital services. However, few acute CVD events result in admission to private hospitals in New Zealand and given the relatively long timeframe of the study, the completeness of routinely collected health statistics, and the availability of a unique national health identifier, the study is likely to provide reasonably accurate prevalence estimates of significant CVD.

It is known that the national collections suffer from an undercount in non-European ethnic groups (normally causing a numerator/denominator bias)^{9,16} but in this analysis both numerators and denominators came from the same NHI-derived population frame and hence do not suffer from this bias.

The potential benefits of a comprehensive national secondary prevention strategy is highlighted by the recent observation that more than 60% of coronary heart disease hospitalisations in New Zealand in 2005 were accounted for by patients who had coronary heart disease admissions in the previous 5 years.¹⁷ Therefore, even a small

improvement in adherence to secondary prevention is likely to have a significant impact on future total hospitalisations.

The high-risk patient groups highlighted by this study are easily identifiable as they have all had previous contacts with health services. These groups should be prioritised for secondary prevention, to help reduce the major disparities in cardiovascular health in New Zealand. Therefore, in order to effectively and efficiently remove CVD inequities in New Zealand, future health policies and interventions should aim to realign the inequitable distribution of resources, including healthcare, and prioritise Māori health gain within the health sector.

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The burden of modifiable cardiovascular risk factors in the coronary care unit by age, ethnicity, and socioeconomic status—PREDICT CVD-9

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Abstract

Aims To investigate the burden of modifiable cardiovascular disease (CVD) risk factors in patients admitted to coronary care by age, ethnicity, and socioeconomic status.

Design and setting Cross-sectional study of patients presenting to the Middlemore Hospital Coronary Care Unit with an acute CVD event from July 2004 to June 2006.

Methods CVD risk factor data was electronically collected using Acute PREDICT. Socioeconomic status was estimated using the NZ Deprivation 2001 index (NZDep01).

Results Of 973 patients 34% were <55 years and 10% were <45 years, 24.8% were women, and 44.6% lived in areas classified as most deprived. 61.5% were European/other, 13.0% NZ Māori, 15.2% Pacific, and 10.3% South Asian. Younger patients, regardless of ethnicity, were much more likely to be smokers, be obese, have elevated LDL and triglyceride, and low HDL levels. Māori and Pacific patients were more likely than European/other patients to smoke, have diabetes, obesity, elevated triglycerides, and low HDL. These ethnic differences persisted across the age range. Increasing deprivation was associated with more smoking, obesity, hypertriglyceridaemia and diabetes, with the excess of smoking and obesity being most pronounced in younger patients.

Conclusions In patients presenting to coronary care, there is a high burden of adverse modifiable CVD risk factors, particularly in younger patients and among Māori and Pacific people from areas of high deprivation. These risk factors are a major and reversible contributor to future CVD risk in these groups, and an important target for secondary prevention programs.

Cardiovascular disease (CVD) is the leading cause of death and hospitalisations for New Zealanders. Those who suffer a CVD event such as a myocardial infarction are at very high risk for further events. However this risk could be reduced by as much as 80% by targeting modifiable risk factors which include poor diet, obesity, physical inactivity, high blood pressure, hyperlipidaemia, and smoking using appropriate combinations of lifestyle modification and effective preventive medications.¹

CVD increases with age and occurs earlier in men than in women but there are also disparities in cardiovascular health outcomes by ethnicity and by socioeconomic deprivation. Age-specific coronary disease mortality rates for Māori and Pacific people are 2–3 times those of non-Māori non-Pacific.²

A similar magnitude of increased mortality occurs for those from the most deprived compared to the least deprived areas.³ The prevalence of poorly controlled modifiable CVD risk factors is known to be high in these groups from population studies.^{4,5}

The aim of this study was to describe the burden of modifiable cardiovascular risk factors in patients presenting to a Coronary Care Unit (CCU) in South Auckland by age, ethnicity, and socioeconomic status.

Methods

Acute PREDICT—From 2004 the PREDICT-CVD electronic decision support program for CVD risk assessment and management⁶ was implemented in the CCU of Middlemore Hospital as part of the ‘Acute PREDICT’ program.

Nursing and junior medical staff were encouraged to use PREDICT to assess and manage cardiovascular risk in individual patients admitted with an acute cardiovascular event when the patient was in a stable condition (usually at Day 2 of admission). Patients who died early, were too clinically unstable, or were discharged before an assessment could be completed, were not entered into PREDICT.

The program was accessed on all the CCU computers via the hospital intranet and communicated with a decision support server within CMDHB Information Technology services. All data items (demographic, CVD risk factors, and management variables) were manually entered. The ward clerk entered the demographic details from the hospital patient information system on admission to CCU whilst the clinical details were subsequently entered by nursing staff and verified by medical staff.

Once all the required data was entered, it was sent to the central server and within seconds the clinician received evidence-based risk management recommendations derived from New Zealand CVD guidelines.⁷ Each time PREDICT was used, an electronic CVD profile was stored. For the purposes of this study, the first completed assessment for each patient from 1 July 2004 to 30 June 2006 was extracted and made available to the research team with only the National Health Index (NHI) number retained as a unique identifier.

Data and definitions – Detailed data definitions have been published previously.⁶ In brief, demographic data collected included age, gender, ethnicity, and the National Health Index (NHI) number. For these analyses ethnicity was categorised in four groups: New Zealand Māori, Pacific, South Asian, and European/other. Pacific peoples were defined according to New Zealand Health Information Service ethnicity data protocol⁸ as having Level 2 codes 31 to 37 and South Asian defined as Level 2 codes 43 and 44 excluding Japanese and Korean—i.e. being Indian, Fijian Indian, Pakistani, Sri Lankan, Bangladeshi, Nepali, Afghani, or Tibetan.

As a measure of socioeconomic status (SES) the domicile code (where available and valid) for each patient was obtained from the hospital information system. This was linked to New Zealand Deprivation 2001 (NZDep01) index and reported as decile of deprivation from 1 (least deprived) to 10 (most deprived). The NZDep2001 is a small area index of deprivation that provides a score for each meshblock in New Zealand based on nine variables (material and social domains of deprivation) from the 2001 Census.^{9,10}

CVD risk factor data included family history of premature ischaemic cardiovascular disease, diagnosis of Type 2 diabetes, smoking status (smoker, non-smoker, or past smoker who quit more than 12 months ago), systolic and diastolic blood pressure (mmHg) and lipids (total cholesterol/HDL ratio, LDL, HDL and triglycerides), and body mass index (BMI).

The blood pressure was the mean of two consecutive readings when the patient was clinically stable on day two or three in hospital. Lipid data entered was the lipid profile drawn at hospital admission in the emergency department.

Details regarding prior CVD admissions, including ischaemic heart disease (IHD), stroke or transient ischaemic attack (TIA), peripheral vascular disease (PVD), percutaneous coronary intervention (PCI), and/or coronary artery bypass graft (CABG), for patients in the cohort were obtained from Counties Manukau District Health Board case-mix data. Clinical targets for individual CVD risk factors are drawn from the New Zealand CVD guidelines.⁷

To compare the clustering of risk factors in individual patients each patient was scored out of 7 according to the number of guideline risk factor targets not achieved. Patients received one point for each of the following—BMI ≥ 30 kg/m², smoker, Type 2 diabetes, systolic BP >130 mmHg, LDL cholesterol >2.5 mmol/L, HDL cholesterol <1.0 mmol/L, and serum triglyceride level ≥ 1.7 mmol/L.

The study was approved as an audit by Northern X Regional Ethics Committee (AKY/03/12/314).

Analyses—All analyses were conducted using SAS version 9.1 software, and plots drawn using MS Excel software. Difference in mean age between ethnic groups was tested using a generalised linear model adjusted for ethnicity. Differences in demographics and treatment targets by age group and ethnicity were assessed using the Chi-squared statistic of general association. Differences in demographics and treatment targets by deprivation quintile were assessed using Cochran-Mantel-Haenszel test for non-zero correlation, stratified by age group.

To investigate the association of ethnicity on modifiable risk factors, generalised linear models with adjustment for age, gender, and NZDep01 decile were used.

Results

Between 1 July 2004 to 30 June 2006, 1813 patients were admitted to the Middlemore Hospital Coronary Care Unit with an acute cardiovascular event and 973 (54%) had a PREDICT assessment completed. Patients not assessed with PREDICT were similar in their distribution of ethnicity and socioeconomic status to those assessed. However they were slightly older (61.7 ± 13 , 59.9 ± 12 y, respectively) and more likely to have had 3 or more previous CVD admissions.¹¹

Age and gender (Table 1, and Figures 1–2)—Thirty-four percent of acute CVD presentations to the Middlemore CCU occurred in patients younger than 55 years of age; 10% were in those under 45 years. Younger patients were much more likely to be smokers, be obese, and have elevated LDL and triglyceride levels, and low HDL. However, the number failing to meet New Zealand CVD Guideline target risk factor levels was high in all age groups. The cohort included 75.2% men. Women were on an average of 3 years older than men (62 years and 59 years, respectively). Compared with men they had higher HDL levels (1.5 mmol/L vs 1.2 mmol/L, $p < 0.0001$), lower triglyceride levels (1.9 vs 2.1 mmol/L, $p = 0.003$) but identical mean LDL levels (2.9 mmol/L). Women were more likely to be obese defined as BMI ≥ 30 kg/m² (47% vs 40%, $p = 0.047$), and had higher mean blood pressures (129.5 vs 126.4 mmHg, $p = 0.03$). Rates of smoking and Type 2 diabetes were not significantly different.

Ethnicity (Table 2, Figures 1–2)—There were 61.5% classified as European or other ethnicity, 13.0% NZ Māori, 15.2% Pacific, and 10.3% South Asian. The Māori, Pacific, and South Asian patients were younger than the European/other group by 10.7, 9.3, and 7.3 years respectively, and more likely to live in areas of greater deprivation (65%, 83% and 49% in NZDep01 9 or 10, respectively, compared with 30% of European/other patients).

Compared with the European/other patients, the Māori and Pacific patients were more likely to smoke and have higher levels of risk factors associated with the metabolic syndrome,⁷ including Type 2 diabetes, obesity, elevated triglycerides, and low HDL. The burden of these risk factors was higher in younger Māori and Pacific compared with the European/other groups, but persisted across the age range. The South Asian patients also had higher rates of Type 2 diabetes, smoking, and elevated triglycerides relative to the European/other group, but rates of obesity were similar. Mean systolic BP and LDL cholesterol did not vary significantly across the ethnic groups.

Table 1. Demographics and failure to meet clinical targets, by age group

		Age group						
	All	<45	45–54	55–64	65–74	75+	P value	
	N=973 100%	n=102 (10.5%)	n=230 (23.6%)	n=274 (28.1%)	n=249 (25.6%)	n=118 (12.1%)		
Demographic	N	%	%	%	%	%	- 0.0006 <0.0001	
Mean (± SD) age, years	[59.9 ± 11.9]	[39.3]	[50.1]	[59.2]	[69.4]	[78.1]		
Women	241	24.8	22.5	18.3	21.5	31.7		32.2
European & other*	598	61.5	36.3	44.3	57.3	75.9		95.8
NZ Māori	127	13.1	27.5	19.1	15.0	4.4		2.5
Pacific†	148	15.2	22.5	22.6	16.8	10.4		0.8
South Asian	100	10.3	13.7	13.9	10.9	9.2	0.8	
Deprivation**							0.0003	
NZ Dep 1/2	129	13.3	6.9	12.6	12.8	14.5		18.6
NZ Dep 3/4	122	12.5	7.8	9.1	13.1	14.9		16.9
NZ Dep 5/6	102	10.5	8.8	6.5	11.7	12.4		12.7
NZ Dep 7/8	175	18.0	15.7	18.7	14.2	20.5		22.0
NZ Dep 9/10	434	44.6	59.8	52.6	47.4	34.9		29.7
History and clinical targets								
First admission	644	66.2	69.6	65.2	71.5	62.2	61.0	0.12
Type 2 diabetes	239	24.6	19.6	21.7	29.2	29.3	13.6	0.0027
Current smoker	262	26.9	60.8	37.4	27.7	11.6	7.6	<0.0001
Systolic BP >130 mmHg	332	34.1	18.6	33.0	30.7	40.2	44.9	0.0002
HDL <1.0 mmol/L	178	18.3	23.5	19.1	18.6	16.1	16.1	0.52
LDL >2.5 mmol/L	531	54.6	64.7	61.7	60.6	43.4	41.5	<0.0001
Triglycerides ≥1.7 mmol/L	507	52.1	69.6	59.1	53.3	42.2	41.5	<0.0001
BMI ≥30	407	41.8	58.8	51.7	43.4	34.9	18.6	<0.0001
Waist >100 cm(M) or >90 cm(F)	683	70.2	71.6	72.2	72.6	70.3	59.3	0.09

* Includes European and all other specific ethnicity groups other than Māori , Pacific and South Asian, and also those with missing information

**not available for 11 patients

† Mostly of Samoan, Tongan, Niuean, or Cook Islands origin

Figure 1. Percentage of current smokers (top panel), mean BMI (kg/m²) (middle) and percentage of patients with Type 2 diabetes (lowest panel), shown as a function of age for both ethnicity (left) and SES estimated by decile of deprivation (right)

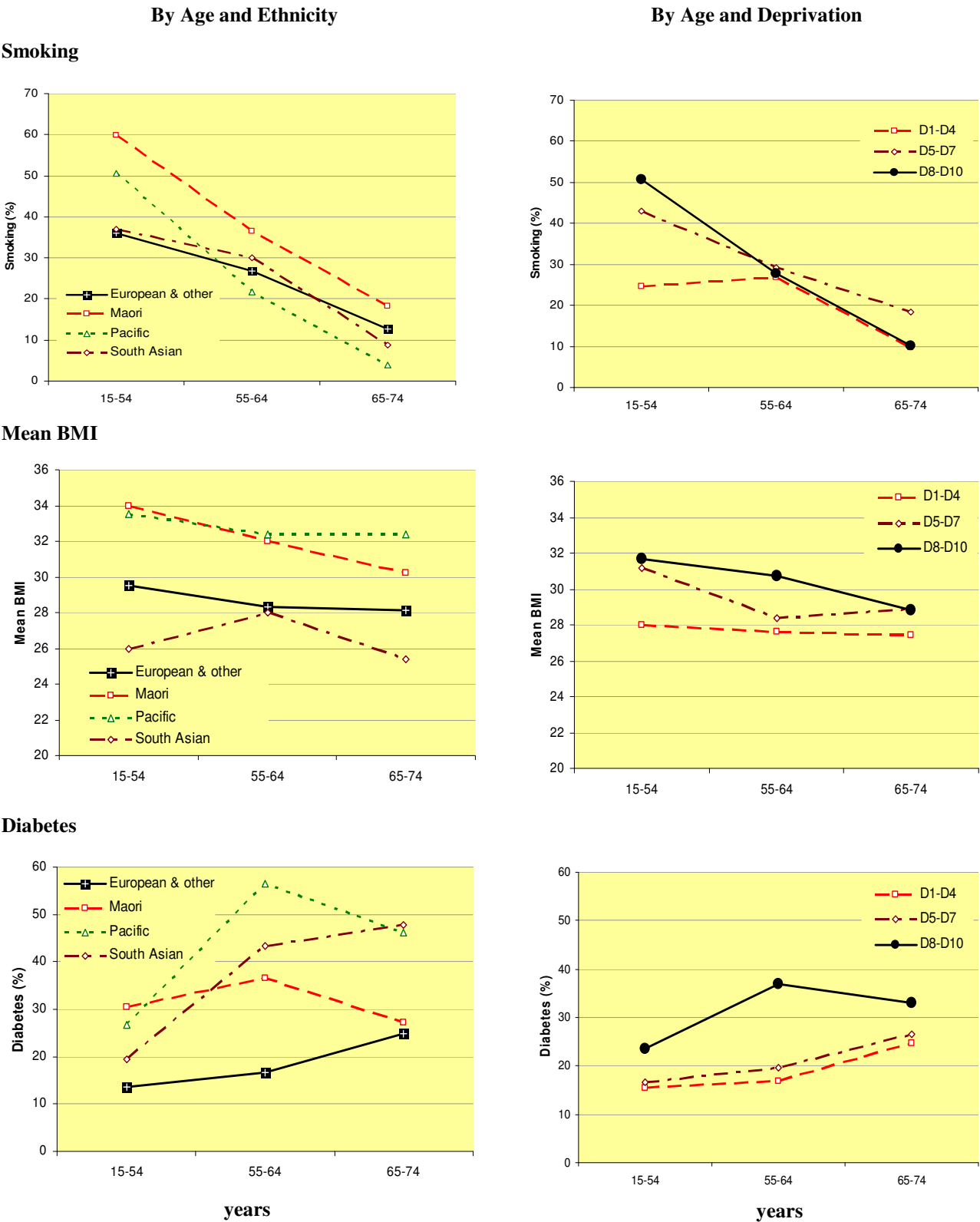


Figure 2. Mean LDL (top panel), HDL (middle) and triglyceride levels (below) in mmol/L are shown as a function of age group for both ethnicity (left) and SES estimated by decile of deprivation (right)

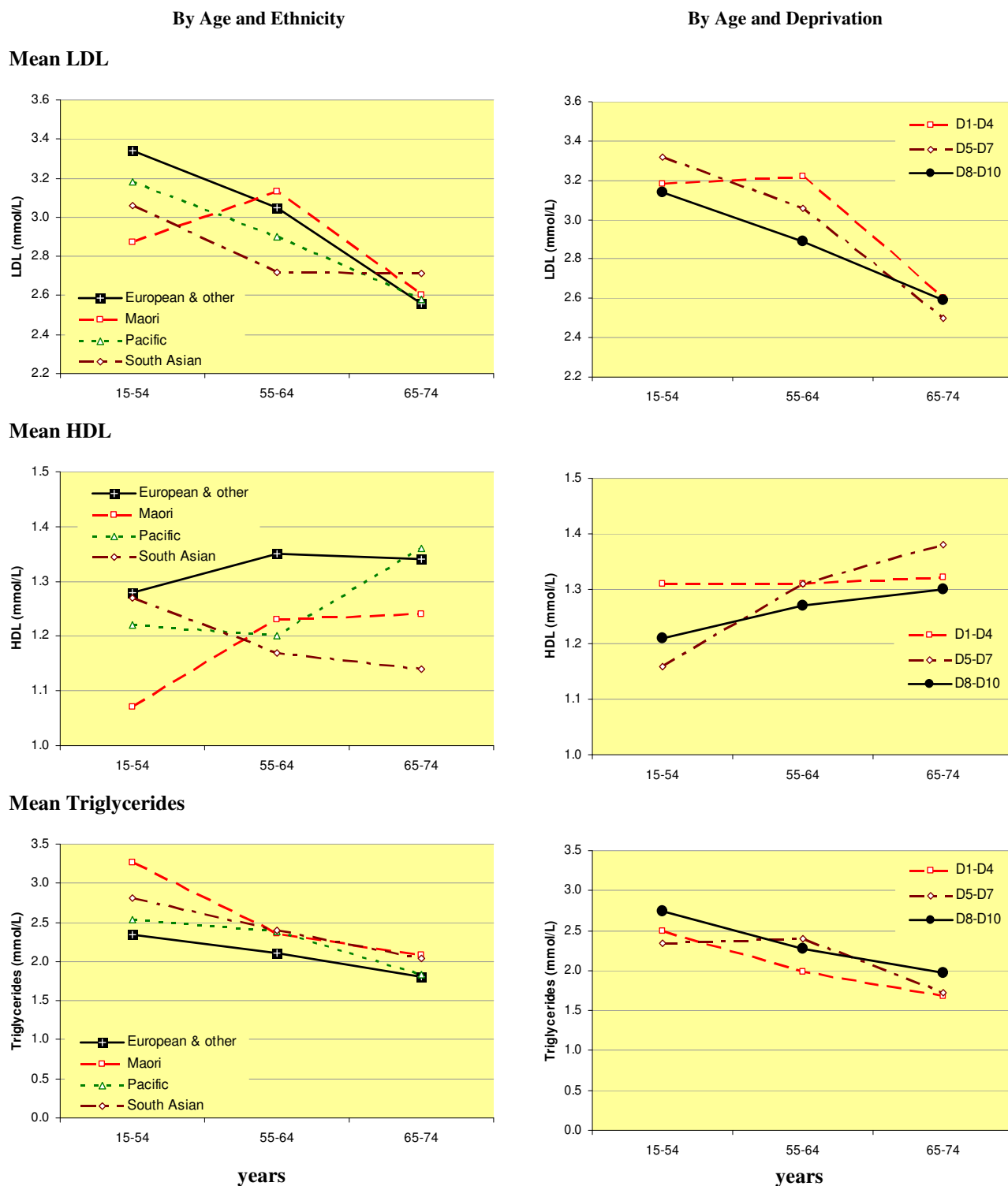


Table 2. Demographics and failure to meet clinical targets, by ethnicity

			Ethnicity group				P value
			European*	NZ Māori	Pacific	South Asian	
	N=973		n=598	n=127	n=148	n=100	
	100%		(61.5%)	(13.1%)	(15.2%)	(10.3%)	
Demographic	N	%	%	%	%	%	
Mean (± SD) age, years	[59.9 ± 11.9]		[63.4]	[52.7]	[54.1]	[56.1]	< 0.0001
Women	241	24.8	25.8	32.3	23.0	12.0	0.0043
European & other*	598	61.5	100.0				-
NZ Māori	127	13.1		100.0			-
Pacific	148	15.2			100.0		-
Indian	100	10.3				100.0	-
Deprivation**							
NZ Dep 1/2	129	13.3	18.9	3.1	0.7	11.0	} <0.0001
NZ Dep 3/4	122	12.5	16.9	3.9	2.7	12.0	
NZ Dep 5/6	102	10.5	14.9	7.1	.	4.0	
NZ Dep 7/8	175	18.0	18.7	19.7	12.2	20.0	
NZ Dep 9/10	434	44.6	29.9	65.4	83.1	49.0	
History and clinical targets							
First admission	644	66.2	66.7	62.2	66.2	68.0	0.77
Type 2 diabetes	239	24.6	18.1	31.5	39.2	33.0	<0.0001
Current smoker	262	26.9	20.9	47.2	33.1	28.0	<0.0001
Systolic BP >130mmHg	332	34.1	34.3	36.2	35.1	29.0	0.68
HDL <1.0mmol/L	178	18.3	15.7	24.4	19.6	24.0	0.0425
LDL >2.5 mmol/L	531	54.6	53.2	54.3	59.5	56.0	0.58
Triglycerides ≥1.7mmol/L	507	52.1	46.2	68.5	55.4	62.0	<0.0001
BMI ≥30	407	41.8	32.9	66.9	68.9	23.0	<0.0001
Waist >100cm(M) or >90cm(F)	683	70.2	65.4	84.3	85.8	58.0	<0.0001

* Includes European and all other specific ethnicity groups other than Māori , Pacific, and South Asian, and also those with missing information

**Not available for 11 patients

Table 3. Demographics and failure to meet clinical targets by NZ Deprivation Index

	All	NZ Deprivation Index decile					P value
		D 1/2	D 3/4	D 5/6	D 7/8	D 9/10	
	N=962*	n=129	n=122	n=102	n=175	n=434	
Demographic	%	%	%	%	%	%	
Mean (SD) age, years	[59.9 ± 11.9]	[62.5]	[62.7]	[61.9]	[61.0]	[57.2]	< 0.0001
Women	24.8	14.7	27.9	25.5	26.9	26.0	0.0122
European & other	61.5	87.6	82.8	87.3	64.0	41.2	} 0.14
NZ Māori	13.1	3.1	4.1	8.8	14.3	19.1	
Pacific	15.2	0.8	3.3	-	10.3	28.3	
South Asian	10.3	8.5	9.8	3.9	11.4	11.3	
History and clinical targets							
First admission	66.2	70.5	69.7	65.7	58.9	66.4	0.14
Diabetes mellitus	24.6	13.2	24.6	18.6	22.9	29.7	<0.0001
Current smoker	26.9	17.1	20.5	23.5	26.3	33.2	0.0117
Systolic BP >130mmHg	34.1	39.5	28.7	35.3	33.7	33.6	0.85
HDL <1.0mmol/L	25.8	14.7	25.4	22.6	27.4	29.5	0.23
LDL >2.5 mmol/L	54.6	61.2	51.6	54.9	51.4	54.6	0.08
Triglycerides ≥1.7mmol/L	52.1	36.4	47.5	50.0	51.4	58.5	0.0003
BMI ≥30	41.8	22.5	27.0	45.1	40.6	51.8	<0.0001
Waist >100cm(M) or >90cm(F)	70.2	58.9	56.6	70.6	69.1	77.9	<0.0001

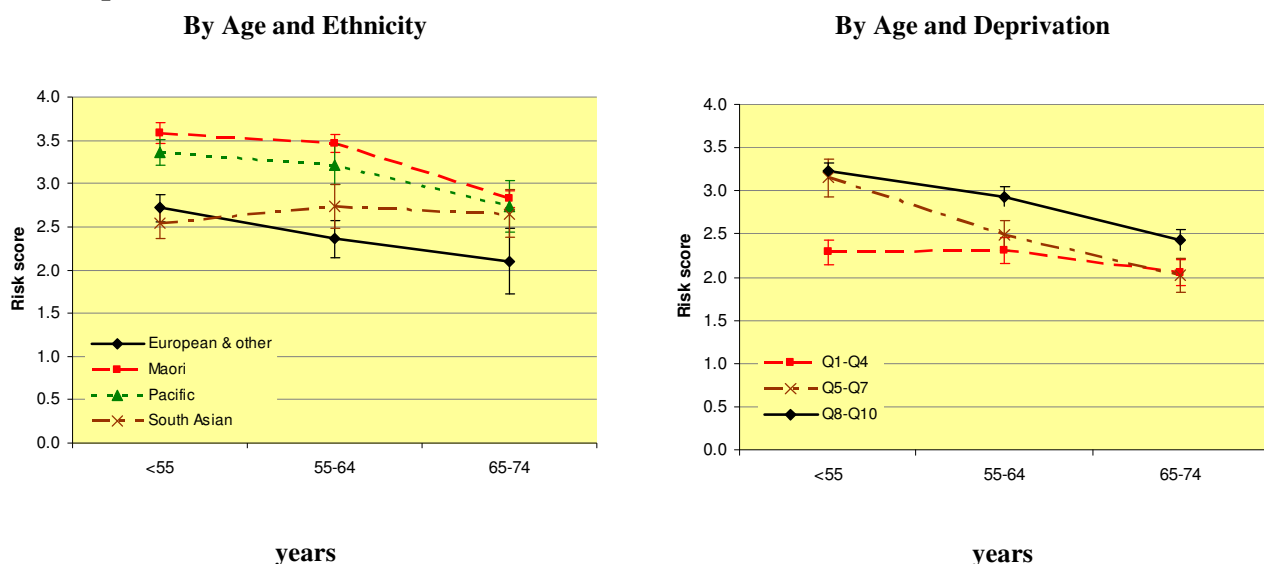
* 11 patients with missing NZ Dep not included

Socioeconomic status according to NZ Deprivation Index (Table 3, Figure 1–2)—

A large proportion (44.6%) of the patients lived in areas classified as most deprived (NZDep01 deciles 9 and 10). Patients from the most deprived areas were on average 4 to 5 years younger than those from less deprived deciles. Increasing level of deprivation was associated with smoking, obesity, higher triglyceride levels, and diabetes. Rates of smoking and obesity with deprivation are most pronounced in younger patients. Blood pressure, LDL, and HDL levels did not vary with NZDep01 deciles. Patients from NZDep 1 to 3 were predominantly European/other whereas those from the more deprived areas were more ethnically diverse.

Clustering of risk according to age, ethnicity and NZ Deprivation index (Figure 3)—The mean number of poorly controlled CVD risk factors is highest in young Māori and Pacific patients and the young from areas of greater deprivation. Māori and Pacific patients have on average approximately one more poorly controlled risk factor compared with European/other patients across the age range.

Figure 3. The mean risk score for patients by age ethnicity and NZ Deprivation 01. The risk score counts up to 7 poorly controlled CVD risk factors* for each patient



*BMI ≥ 30 kg/m², smoker, Type 2 diabetes, systolic BP >130 mmHg, LDL cholesterol >2.5 mmol/L, HDL cholesterol <1.0 mmol/L and serum triglyceride level ≥ 1.7 mmol/L

Association of ethnicity with modifiable risk factors in patients under 65 years living in more deprived areas—To investigate the association between ethnicity and risk factors adjusting for deprivation a subgroup analysis was performed. There were insufficient Māori and Pacific patients to compare risk factors across ethnic groups in patients over 65 years or who lived in less deprived areas. This subgroup analysis therefore included only those patients aged less than 65 years and from NZDep01 deciles 9 or 10.

For this analysis patients were grouped into one of three ethnicity groups - Māori, Pacific, and non- Māori /non-Pacific. After adjusting for age, gender, and NZDep Māori were more likely than non- Māori /non-Pacific patients to be current smokers (OR 2.27, 95%CI 1.22–4.20), and there was a trend towards higher mean BMI (mean difference 2.72 kg/m², 95%CI 0.90–4.53), more frequent Type 2 diabetes (OR 1.66, 95%CI 0.84–3.25) and higher mean triglyceride levels (mean difference 0.49 mmol/L, 95%CI -0.09–1.07 mmol/L).

Compared with non-Māori/non-Pacific patients the Pacific patients had higher BMI (mean difference 3.60 kg/m², 95%CI 1.93–5.27) and more frequent Type 2 diabetes (OR 2.28, 95%CI 1.23–4.21) but similar smoking rates (OR 1.15, 95%CI 0.64–2.04). They were less likely to report a family history of premature CVD (OR=0.44, 95%CI 0.25–0.75).

Prior CVD admissions—For 644 (66.2%) patients the index admission was their first CVD-related admission. Patients with prior admissions had lower mean LDL cholesterol (2.5 vs 3.1 mmol/L, $p<0.0001$) probably reflecting initiation of lipid lowering therapy in those patients. They were also less likely to be smokers (19.8% vs 30.6%, $p=0.001$). However, they were just as likely to be obese, and have elevated triglycerides and were more likely to have Type 2 diabetes mellitus (30% vs 21.3%, $p=0.0005$).

In these patients with previous CVD events, failure to achieve recommended treatment targets was common: 40.4% had LDL levels above 2.5 mmol/L, 19.5% HDL below 1.0 mmol/L (men) or 1.3 mmol/L (women), 47% had triglycerides above 1.7 mmol/L, 43.2% were classified as obese (defined as BMI $\geq$ 30 kg/m², and 20% smokers.

Discussion

In a cohort of patients presenting to the Coronary Care Unit there are important and systematic differences in the levels of modifiable CVD risk factors according to age, ethnicity, socioeconomic status, and history of prior CVD events. The most important observation was the greater burden of adverse modifiable risk factors in younger patients and particularly among Māori and Pacific people from areas of greater deprivation. These risk factors are a major and reversible contributor to future events in these groups and an important target for secondary prevention programmes.

Age effects—Age shows a strong association with modifiable risk factor incidence, with better levels at increasing age except for blood pressure and diabetes. This inverse association of risk factors with age is to be expected as people with lower exposure to risk factors will take longer to accumulate sufficient exposure to precipitate a coronary event, but some studies suggest a possible cohort effect, with poorer risk factor levels in younger patients than previously.¹²

Some studies suggest that patients presenting prematurely with CVD have a greater genetic predisposition than older patients.^{13,14} However, unlike genetic factors, many of CVD risk factors identified particularly in younger people in this cohort can be modified using existing lifestyle and pharmacological approaches.

Despite the improved data in older patients the burden of modifiable risk is still high. Compared with younger patients, older patients were more likely to have hypertension and Type 2 diabetes than other modifiable risks.

Ethnicity and CVD risk factors—The finding that Māori and Pacific people have worse CVD risk profiles than other ethnic groups is concerning given their known excess age adjusted coronary and all-cause mortality rates.¹⁵ Key differences in smoking rates, obesity, and diabetes remained when age, gender, and level of deprivation were controlled. In particular the combination of high smoking rates, obesity and Type 2 diabetes in Māori patients, and of obesity and diabetes in Pacific patients are of concern.

In this study we do not have comparative data regarding the incidence of CVD risk factors in the overall population and the risk distributions observed reflect in part the underlying risk distributions in the population. Nevertheless, these findings are consistent with prior New Zealand primary care data¹⁶ which reported higher rates of smoking, elevated blood pressure levels, lipid levels and prevalence of diabetes in Māori compared with non-Māori patients. Taken together with the known benefits of CVD risk factor modification, these data suggest that aggressive secondary CVD risk factor management within Māori and Pacific groups may have major benefits for those populations.

SES and CVD risk—Socioeconomic status has long been recognised as an important risk factor for cardiovascular disease.¹⁷ This is partly due to documented associations between SES and adverse levels of modifiable cardiovascular risk factors in our study and others.⁴ However, two recent studies have found that area based measures of SES had predictive value independent of the traditional Framingham equation risk variables.^{18,19} These SES measures may be a proxy for variables such as psychosocial stress, access to health care, and adherence with therapy which are only partly captured by traditional risk factors.

SES, ethnicity, and modifiable risk—Prior New Zealand data has reported that at least half of the ethnic disparity in mortality between Māori and non-Māori is accounted by SES.¹⁵ However, in this cohort using NZDep01 as a measure of SES, there remained very significant differences between Māori and Pacific compared with non-Māori /non-Pacific in modifiable risk factor levels in the the patients resident in more deprived areas.

While this will in part be due to lack of specificity of the deprivation measure (which is based on where an individual lives and not any specific personal measures of SES), other factors not captured by SES measures may vary by ethnicity and may therefore influence modifiable risk factor levels. These could include cultural beliefs and lifestyle behaviors, psychosocial stress, health system access and performance, and medication compliance.

CVD risk factors in patients with known CVD—Of particular concern is the observed gap between observed and recommended risk factor levels in those presenting with a known history of CVD. In these patients CVD risk factors should already be aggressively managed.⁷ Whilst it is encouraging that these patients have lower LDL level and smoking rates compared with first presenters, 40% still failed to meet the conservative NZGG LDL target of 2.5 mmol/L. This and the high levels of

obesity and elevated triglyceride levels indicate important gaps in lifestyle and pharmacological management in secondary prevention in our community.

Limitations—As discussed, the measure of socioeconomic status used in this study is an area based measure and does not take into account determinants of socioeconomic status at an individual level. As a result it is possible that the effects of socioeconomic status may have been underestimated in this study.²⁰

Misclassification of ethnicity within this study must be considered. A recent report that compared self-identified ethnicity data with hospital record data found concordance for about 90% of New Zealand Europeans, but only 70% of Māori, Pacific, and South Asian people.²¹

The New Zealand Guideline Group (NZGG) definition⁷ of metabolic syndrome requires at least three out of five risk factors. In our data, fasting glucose was not available and triglyceride levels were not consistently fasting so we are unable to report prevalence of metabolic syndrome according to NZGG criteria.

Acute PREDICT blood pressure data was collected when patients were lying quietly in hospital, typically on medication started at admission. The relatively good target blood pressure data we report under these conditions probably underestimates the problem of blood pressure control in the community. LDL and triglyceride data were from admission samples and not necessarily fasting. As a result the failure to meet targets for these fractions may have been overestimated. However, this is a random effect and unlikely to bias the ethnic and socioeconomic differences observed.

Just over half of the CCU patients in the study period were entered into Acute PREDICT. The most common reasons for non-inclusion were random factors, particularly time and staff constraints. Although approximately 1 to 2% of CCU admissions die after admission to CCU and are not entered into PREDICT, most other very sick patients although not assessed when acutely unwell were eligible when they had recovered. There were only minor differences between those included and not included for key determinants of risk which included age, gender, ethnicity, socioeconomic status and history of CVD. It is therefore unlikely that the risk factor distribution in the PREDICT group is unrepresentative of the overall CCU group.

Population perspective—Two-thirds of patients in our cohort presented with their first CVD event. Many of these patients had a cluster of potentially modifiable risk factors, emphasising that improved population health initiatives and individualised CVD risk screening and management programmes are needed. But, whilst programs specifically targeted to improve lifestyle risk factors in high risk groups will help to improve cardiovascular risk, ongoing efforts to reduce inequalities and poverty in New Zealand society are also critical.²²

Several general issues for the primary prevention and management of CVD among Māori and Pacific people also need addressing. These include: systematic differences in the distribution of income, education, employment, and housing that shape Māori/Pacific peoples' exposure to health risks and their access to (and utilisation of) health services,⁵ the negative and cumulative effect of cardiovascular risk factors over a lifetime, differential treatment and referral patterns), and the impact of racial discrimination.²³

Conclusion

In patients presenting to the Coronary Care Unit there is a high burden of modifiable CVD risk factors, smoking, obesity, diabetes mellitus, raised triglycerides, and low HDL particularly in younger patients, and particularly among Māori and Pacific people from areas of greater deprivation. This data can be used to inform the targeting of CVD secondary prevention programmes.

Competing interests: None known.

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Cardiovascular risk management at a Māori-led Primary Health Organisation—findings from a cross-sectional audit

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Abstract

Aim To examine the cardiovascular disease (CVD) risk profile and management for the first 12 months of an electronic risk assessment program at Tāmaki Healthcare, Auckland.

Methods An audit of risk assessment and medication data supplemented by a manual case record review.

Results 1522 people were screened representing around 15.5% of the eligible population. Of the 1420 people with data available, 248 (17.5%) had a calculated 5-year CVD risk $\geq 15\%$ and another 177 (12.5%) had previous CVD. Māori were significantly more likely to be at high CVD risk than non-Māori (OR 2.07 (1.51–2.84); $p < 0.001$). For Pacific peoples (mostly of Samoan, Tongan, Niuean, Fijian, or Cook Islands origin) there was no increased likelihood of high CVD risk. Medication data were available for 399 (95.5%) people at high CVD risk. Prescribing rates for this group were 78.1% for blood pressure lowering, 71.9% for lipid-lowering, 65.3% for anti-platelet, and 50.3% for all three therapies. Whilst this group may represent the better end of the management spectrum, success in achieving treatment targets was modest. For 451 people with either diabetes or established CVD, 65.9% and 66.1% were not meeting blood pressure and lipid management recommendations respectively. There were very few disparities in prescribing rates and attainment of target levels by ethnic group.

Conclusion This study has shown that a primary care electronic risk assessment program can be rapidly implemented within 12 months. Although the sample may not be representative due to a small proportion screened so far, major disparities in risk factor prevalence rates were found—particularly for Māori. Furthermore, substantial guideline-practice gaps were encountered in the appropriate prescribing of cardiovascular medicines and attainment of recommended targets. Several Tāmaki Healthcare initiatives to address these findings are discussed.

Cardiovascular disease (CVD) is the leading cause of premature death and disability in Aotearoa/New Zealand (NZ)¹ and it remains the main reason for the widening gap in life-expectancy between Māori and non-Māori.² It is well established that absolute risk-based approaches to CVD event prediction have better discriminating ability^{3,4} and cost-effectiveness^{5–7} than the traditional, single risk factor-oriented paradigm.

Although Aotearoa/NZ has been a world leader in promoting an absolute risk based guideline,⁸ its uptake has been variable and significant gaps in evidence based care remain.^{9–11} The recent incorporation of electronic risk assessment tools has been promising in improving uptake of the absolute risk paradigm.^{12–15}

The PREDICT™ decision support system, implemented in ProCare Primary Health Organisations (PHOs) in Auckland, is producing valuable information on CVD risk factor epidemiology. Such data, along with a unique national health identifier, place the country in a good position to generate population specific risk assessment tools. Moreover, with PHO funded incentives and future national CVD performance indicators,¹⁶ identification of at risk populations is likely to increase over the next few years.

Despite these promising initiatives important and yet unanswered questions remain. It is not clear whether risk-based screening programs lead to improved management practices. In addition to the impact on population health outcomes this has significant implications for health planners.¹⁷ Furthermore, given that Māori are disproportionately affected by CVD, it is critical that research is undertaken to see whether Māori are equally benefiting from absolute risk based care. This study seeks to provide further information in these areas.

Methods

In December 2006, Tāmaki Healthcare Charitable Trust, a Māori-led PHO, implemented an electronic CVD-risk assessment program across 12 of its member general practices. In 2007 a further 3 practices joined and 1 practice left the PHO leaving a total enrolled population of around 42,000 people in the Auckland area.

Based on the screening recommendations by the NZ Guidelines Group (NZGG),⁸ practitioners were funded to perform an electronic risk assessment for the following groups:

- Māori/Pacific/Indian subcontinent groups: men ≥ 35 years, women ≥ 45 years.
- All other ethnic groups: men ≥ 45 years, women ≥ 55 years.
- People with known risk factors for CVD or diabetes: men ≥ 35 years, women ≥ 45 years.
- People with diabetes regardless of age.

Two electronic risk assessment options were available within existing practice management systems: PREDICT and the MedTech 'Edge-CVD management' module. Ethnicity was derived from the PHO register through a combination of self-identification and retrieval from the National Health Index.

Using the NZ coding system¹⁸ we grouped ethnicity into five categories: NZ European/Others, Māori, Pacific peoples, Indian subcontinent, and other Asian. Thirty-six people of mainly Middle Eastern or African origin accounted for the 'others' in the NZ European/Others category.

NZ Deprivation Index quintiles are geographically determined using variables from census data and are a measure of socioeconomic status (one=least deprived, five=most deprived).¹⁹ These data are supplied by the NZ Ministry of Health and, at the time of analysis, calculations were made using the 2001 census (NZDep01). (As of July 1, 2008 all PHO registers were updated using 2006 census data.)

Data were collected from:

- (1) A de-identified version of routinely submitted CVD risk assessment data;
- (2) A medication query run at each clinic to obtain the prescription history (from January 2006 to March 2008) for those who had undergone a CVD risk assessment; and
- (3) A manual clinic record review of patients with either a calculated or clinical 5-year CVD risk of $\geq 15\%$ was conducted by a PHO nurse to determine details of non-pharmacological management practices.

For part (3) we purposively sampled all available Māori and Pacific records and took a random sample of other ethnicities to obtain equal proportions.

Five-year risk of a fatal or non-fatal CVD event was calculated using the 1991 Anderson Framingham equation.²⁰ Event endpoints include myocardial infarction, coronary heart disease, stroke or transient ischaemic attack, peripheral vascular disease, and congestive heart failure. Included in this calculation was the NZGG 5% upward adjustments for high-risk groups.

These groups are based on ethnicity (Māori, Pacific, Indian subcontinent), family history of coronary heart disease, high risk diabetes (diabetes duration >10years, albuminuria, or HbA1C>8%) or metabolic syndrome (derived from the National Cholesterol Education Program ATPIII 2001 definition).⁸ The adjustment is made only once. Recent data suggests that the 5% upward adjustment for ethnicity is a more accurate estimate of risk.²¹

Frequency distributions were reported as proportions or means/medians. Differences in individual risk factors and treatment prescribed for ethnic groups and social deprivation quintiles were either adjusted or standardised for age and sex. Because the major CVD-risk factors are integrated in the Framingham risk equation, we did not adjust for any of these in assessing differences in overall CVD risk across ethnic and social groups. Statistical analyses were carried out using SAS v9.1 software (Cary, NC: SAS Institute Inc, 2002-2003).

All member practices provided written consent to participate in the study and were given the opportunity to review the final manuscript. The study was also reviewed by the chairperson of the Northern X Regional Ethics Committee and under its Observational Studies Guidelines it was determined that it did not require committee review and approval.

Results

CVD risk profile

In total, 1522 people had an electronic CVD risk assessment performed over the screening period December 2006–November 2007. Clinical data were available for 1420 people (55.7% male, 44.3% female). Only 40 people (2.8%) had more than one risk assessment performed reflecting the recent implementation of this programme. For these individuals we report data from the most recent assessment. Table 1 below gives an estimate of the proportion of patients screened at each clinic in the target risk groups.

Table 1. Estimate of the proportion of patients in target groups screened between December 2006 and November 2007, by clinic

Clinic	Number of months in the CVD programme	Number of patients screened	Number of patients in target groups seen at least once	Coverage %
A	6	6	1057	0.6
B	11	11	574	1.9
C	7	16	623	2.6
D	8	14	545	2.6
E	12	29	744	3.9
F	10	44	792	5.6
G	8	72	1239	5.8
H	9	15	191	7.9
I	7	54	413	13.1
J	12	169	1139	14.8
K	9	53	155	34.2
L	10	277	644	43.0
M	12	375	853	44.0
N	12	387	864	44.8
Total		1522	9833	15.5

Table 2. The demographic and risk factor characteristics of 1420 people with a CVD risk assessment performed

	n	Mean age (yrs)	Personal CVD history (%)	Current/recent smoker (%)	Mean systolic BP (mmHg) (95% CI)	Mean TC:HDL ratio (95% CI)	Diabetes (%)	High risk diabetes (%)	Family history CHD (%)	Metabolic syndrome (%)
Males										
NZ European/ Other	219	58.7	13.4	22.6	130.8 (128.6–133.0)	4.14 (3.97–4.30)	11.8	45.8	23.5	11.2
Māori	93	54.0	20.7	35.8*	131.2 (127.9–134.4)	3.95 (3.71–4.19)	31.7***	47.9	34.2	34.3***
Pacific	129	53.3	10.0	29.6	129.9 (127.1–132.6)	3.81 (3.61–4.02)*	36.7***	54.8	22.6	43.5***
Indian sub-continent	318	51.1	16.1	9.8***	125.7 (123.9–127.5)***	3.92 (3.79–4.06)	30.0***	40.4	29.5	26.8***
Other Asian	32	57.0	12.4	2.8*	125.7 (120.1–131.2)	4.00 (3.59–4.41)	37.1***	35.5	8.4	31.5**
Total	791	54.1	14.8	19.3	128.8 (127.7–129.9)	3.94 (3.86–4.01)	26.6	45.4	26.4	26.2
Females										
NZ European/ Other	150	59.6	9.2	13.8	131.9 (129.4–134.4)	3.60 (3.45–3.76)	13.3	28.7	23.6	5.4
Māori	92	57.9	12.2	50.9***	131.6 (128.4–134.8)	3.67 (3.48–3.97)	21.4	60.0**	38.4*	22.8***
Pacific	114	56.8	6.1	18.3	128.9 (126.0–131.7)	3.35 (3.17–3.52)*	38.0***	64.5***	28.2	36.4***
Indian sub-continent	249	54.6	10.9	1.2***	126.1 (124.1–128.1)***	3.34 (3.21–3.46)**	29.2***	31.7	32.5	23.7*
Other Asian	24	60.6	0.0	5.9	132.8 (126.4–139.0)	3.45 (3.06–3.83)	28.6	23.6	18.8	16.8
Total	629	56.9	9.4***	14.8*	128.6 (127.4–129.9)	3.50 (3.41–3.56)***	25.8	44.6	29.9	21.2*
Total assessed	1420	55.4	12.5	17.1	128.7 (127.9–129.5)	3.74 (3.68–3.80)	26.1	45.0	28.1	23.7

Notes:

Ethnic sub-group means are age adjusted and prevalences are age standardised to the total population.

Total prevalence rates are age/sex standardised

Significance testing between ethnic groups was performed for each sex using NZ European as the referent group and was age adjusted.

Significance testing for sex differences used males as the referent group and was also age adjusted.

***p <0.001, **0.01<p>0.001, *0.05<p<0.01

In calculating the number of patients in the target group we were only able to extract demographic information from the PHO service utilisation records. This means that some people with the clinical criteria for screening (outlined above) who were outside the age criteria range will be excluded from this denominator. Nevertheless a marked variation in screening rates was apparent.

Table 2 outlines the demographic and risk factor characteristics of the sample. When compared with the population eligible for screening, there was little difference in Māori representation (13.0% of those screened vs 14.3% of those eligible). When compared with the NZ European/other group, the major disparities by ethnicity in risk factor prevalence were due to smoking (high rates amongst Māori and Pacific, and low rates amongst Indian subcontinent people) and diabetes/ metabolic syndrome (high rates amongst Māori, Pacific, and Indian subcontinent groups).

Table 3 below shows the NZ adjusted Framingham risk profile stratified by sex. In total 425 people (30.0%) were identified to be at high CVD risk (either a clinical or calculated five-year CVD risk of $\geq 15\%$). Māori were significantly more likely to be at high CVD risk than non-Māori (OR 2.07 (1.51–2.84); $p \leq 0.001$). For Pacific peoples, despite high smoking rates and diabetes, there was not an overall increased likelihood of high CVD risk. This can be mainly attributed to younger age and lower past CVD event rates. For NZDep01 quintiles, the Quintile 5 group was significantly more likely to be at high CVD risk than Quintile groups 1–3 (OR 1.54 [1.19–1.99]; $p < 0.001$).

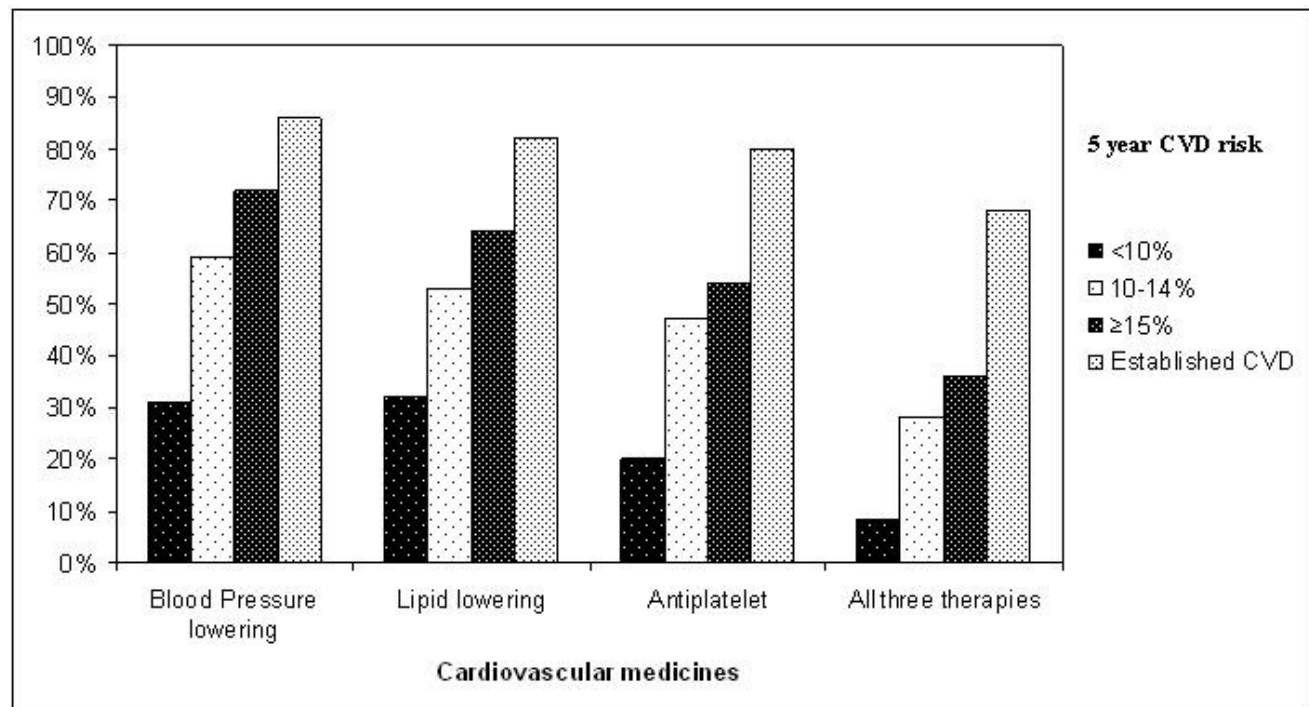
Table 3. Sex stratified NZ adjusted Framingham risk profile by ethnicity

Gender and ethnicity	n	Percentage receiving NZ 5% adjustment	% with NZ adjusted Framingham 5yr CVD risk			Percentage with established CVD
			<10%	10–14%	$\geq 15\%$	
Males						
NZ European/Other	219	33.8	45.2	14.2	21.5	19.2
Māori	93	100	28.0	18.3	32.3	21.5
Pacific	129	100	33.3	27.9	27.9	10.9
Indian subcontinent	318	100	54.4	17.6	15.4	12.6
Other Asian	32	43.8	56.3	9.4	18.8	15.6
Total	791	79.4	45.4	18.1	21.2	15.3
Females						
NZ European/Other	150	26.0	63.3	12.0	14.7	10.0
Māori	92	100	38.0	27.2	21.7	13.0
Pacific	114	100	53.5	22.8	18.4	5.3
Indian subcontinent	249	100	71.9	13.3	5.6	9.2
Other Asian	24	29.2	66.7	20.8	12.5	0.0
Total	629	79.7	61.4	17.0	12.7	8.9
Total assessed	1420	79.5	52.5	17.6	17.5	12.5

Medical management for high-risk individuals

Prescribing patterns—Medication data were available for 1334 people (93.9%) of the sample. Figure 1 below shows the prescribing patterns of the three major cardiovascular medication groups by CVD risk.

Figure 1. Cardiovascular medication prescribing patterns by CVD risk group (n=1334)



For the vast majority of people, the prescribing patterns for all three therapies remained consistent across the 27 months of medication history. There appeared to be little impact from the risk assessment itself in stimulating new prescriptions. For high-risk groups (either a clinical or calculated 5-year CVD risk $\geq 15\%$), across all ethnicities, prescribing rates were 78.1% for blood pressure lowering, 71.9% for lipid lowering, 65.3% for antiplatelet, and 50.3% for all three therapies.

For patients prescribed lipid lowering therapy, 91.3% were prescribed statins, 4.9% statins and fibrates, and 3.8% fibrates alone. Exclusion of patients prescribed fibrates alone did not appreciably change the results. For blood pressure lowering therapy, both Māori (OR 3.63 [1.64–8.08]; $p=0.002$) and Pacific peoples (OR 2.67 [1.25–5.70]; $p=0.01$) were significantly *more* likely to be prescribed medication when compared with NZ Europeans/ others after adjusting for age and sex. No significant differences were found between the two Asian ethnic groups and NZ Europeans/ others.

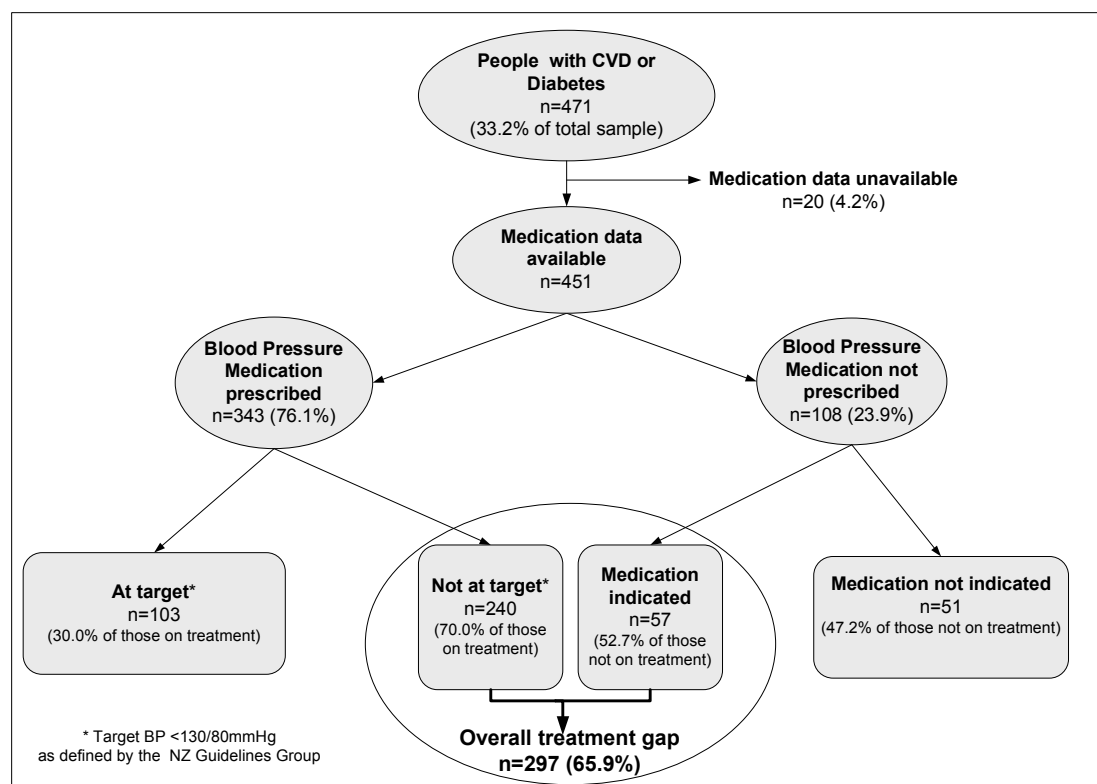
For antiplatelet therapy, lipid lowering therapy, and combination therapy, for all three drug groups there were no significant differences in prescribing patterns across ethnic groups. Similarly, there were no significant differences in prescribing patterns across all NZDep01 quintiles for all three therapy types and combination therapy.

Adequacy of treatment—Success in achieving target thresholds (as set by the NZGG) for people with established CVD or diabetes was examined. In these groups blood pressure targets of $<130/80$ mmHg and lipid levels of a total cholesterol <4

mmol/L, LDL cholesterol <2.5 mmol/L, total cholesterol:HDL cholesterol ratio <4.5 are recommended. Practitioner recording of LDL cholesterol results was not mandatory in this program and so attainment of lipid targets was largely derived from total cholesterol and total cholesterol:HDL ratio results.

Figures 2 and 3 below show the gaps in reaching target thresholds for 451 people with either diabetes or established CVD.

Figure 2. Proportions achieving blood pressure targets for people with CVD or diabetes according to NZGG guidelines



65.9% and 66.1% of people were either not attaining target blood pressure and lipid level recommendations respectively or were not prescribed guideline indicated therapies. There were no significant ethnicity variations in achieving target blood pressure or lipid levels with one exception- Indian subcontinent people were more likely to be achieving target lipid levels (OR 3.15 [1.80–5.52]; $p<0.001$) than NZ Europeans/others after adjusting for age and sex. Similarly, there were no significant differences in achieving target blood pressure or lipid level recommendations across all NZDep01 quintiles.

Figure 3. Proportions achieving lipid level targets for people with CVD or diabetes according to NZGG guidelines

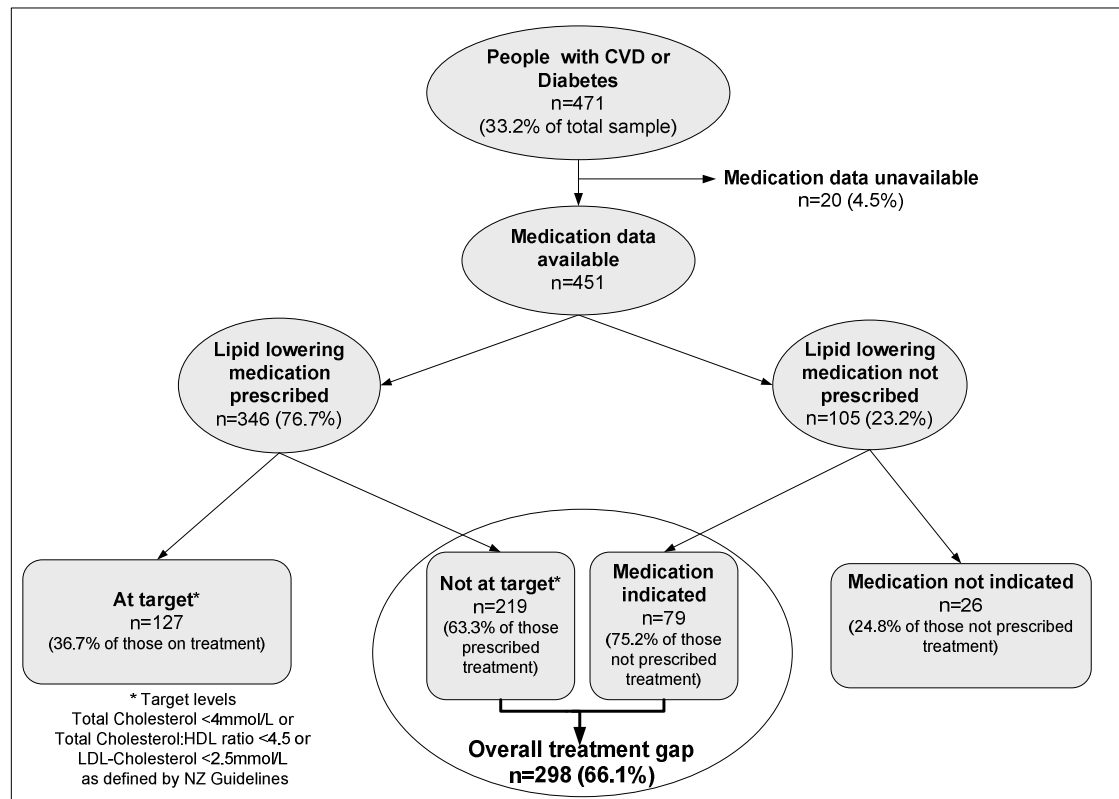


Table 4. Non-pharmacological care practices for high CVD risk people

All high risk people n=283 (Māori n=73, Pacific n=70, Indian/other Asian n=72, NZ European/Other n=68)	
Median number of consultations in the previous two years	12
Mean % of consults for each patient in which the blood pressure was checked	52.6%
% with at least two documented lipid checks in the previous two years	42.8%
% with documentation of lifestyle assessment or advice at least once in the previous two years for:	
(1) smoking	29.3%
(2) nutrition	34.3%
(3) alcohol	9.5%
(4) physical activity	36.4%
% with a green prescription recorded	7.8%
% currently enrolled in the Care Plus programme	54%
People with diabetes (n=135)	
% with a documented specialist review in the previous two years	43.7%
% with a documented eye review in the previous two years	56.3%
% with at least two HbA1c checks in the previous two years	77.8%
% with a Diabetes Get Checked review in the previous twelve months	92.6%

Other medical management for high risk individuals—Records from 283 (66.6%) of the 425 high risk patients were manually reviewed. Table 4 above lists the key findings from this final component of the audit.

Discussion

This study has shown that an electronic risk assessment program can be rapidly implemented in a primary care environment with 15% of an approximate 10,000 eligible population screened in less than 12 months. Aside from the usual drawbacks of clinic records based research, the variable uptake by practitioners and inconsistent screening amongst its enrolled population is clearly the major limitation to this study. We urge caution, therefore, in extrapolating these findings to the general population. As with other studies¹⁴ it is hoped that Tāmaki Healthcare’s electronic risk assessment program can increase overall screening rates across all clinics and reach those at highest risk of CVD.

The factors behind the variable uptake are worth exploring via a ‘systems’ approach examining issues such as workforce capacity, information systems, financial incentives, leadership, training, and support for the program. Attention to such issues was key to improvements in CVD screening rates in two recent NZ studies.^{13,22} Systems level audit and feedback cycles using the Wagner Chronic Care Model²³ have also been shown to be of benefit in Australian Aboriginal health services.²⁴

Consistent with the literature, we found Māori to be at the greatest risk of CVD. The findings suggest that some of the biggest gains for Māori in CVD risk reduction lie in smoking prevention/cessation and diabetes prevention/management. Lifestyle interventions at both the primary care and population level are key components to this. The recording rates of lifestyle management practices in this study were low.

This is not to say that lifestyle management is not being performed but the findings complement the Rafter et al²⁵ study highlighting that CVD lifestyle management is not well documented by most primary care practitioners. Current electronic CVD risk assessment packages have little emphasis on non-pharmacological management. Integration of lifestyle assessments into the electronic assessment along with prompts to perform brief interventions, especially smoking cessation,²⁶ could improve CVD outcomes.

For pharmacological management, the prescribing patterns of the three guideline indicated therapies (antiplatelet, blood pressure and lipid lowering medicines) for high risk individuals were higher than those found by Ridell et al¹¹ and markedly better than those by Rafter et al.¹⁰

As with the Ridell et al study, it was encouraging to find no evidence of ethnicity or NZDep01 quintile disadvantage in prescribing patterns. There was even some evidence that blood pressure medication prescribing was better for high risk Māori and Pacific peoples.

The stable prescribing history may mean that these high risk individuals have a better management profile than those who have not participated in the programme and so caution should again be exercised in extrapolating these findings. Even so, despite better than previously published prescribing rates, large gaps remain with only half of all high risk individuals prescribed all three indicated therapies. Furthermore, very

large gaps were found in attaining NZGG recommended targets for blood pressure and lipid levels. Two out of every three people with either diabetes or CVD were not meeting these targets.

Despite the considerable body of research that informs clinical practice, this study reflects a consistent finding that there are substantial gaps in the uptake of evidence into routine care.²⁷ Studies exploring the reasons for sub-optimal implementation of clinical guidelines in general practice indicate complex and multiple barriers at the health-system, doctor and patient level.²⁸

Electronic decision support is a promising initiative to address some, but clearly not all, of these barriers. Further research is needed in Aotearoa/NZ on the best implementation strategies for well described evidence. This would help broaden our knowledge of the critical contextual issues that make the uptake of evidence successful in some settings and not in others.

As a Māori-led PHO the disparities in CVD risk between Māori and non- Māori are of prime concern to Tāmaki Healthcare. These disparities are not restricted to CVD. In response, the PHO is in the process of re-orienting itself toward meeting the fundamental goal of improved and equitable health outcomes for its enrolled population.

A key strategy, therefore, is to effectively engage with the PHO's provider practices in the creation of integrated programs that focus on prevention and management of chronic conditions. Tāmaki Healthcare considers this to be one of the areas where the greatest health gains for Māori can be made in an environment where limited resources need to be channelled for the greatest effect. The PHO has commenced work on a Māori model for chronic conditions management and is developing strategies to promote the uptake of this model amongst its member practices. Such a model needs to complement and go beyond traditional doctor-patient oriented care.

Existing services that exemplify this include a diabetes self management and education program which is aligned with the Whare Tapa Wha model²⁹ and additional clinical services that have a specific Māori focus (dietician, health psychology, child health and smoking cessation services). Several new positions (including a cardiac rehabilitation nurse, community support worker, and two lifestyle planners) have been created to support these programmes.

The PHO will also examine whether additional financial incentives to undertake CVD reviews for Māori and other vulnerable groups will result in improved screening and management of CVD risk. Whilst increased access to services and population-based initiatives are essential, a sustained commitment on the part of government to addressing ethnic and socioeconomic inequities in health is equally crucial.

Coordinated and well resourced strategies could maximise the impact of CVD programs and ultimately enhance primary health care's contribution to better health outcomes.

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Acute stroke services in New Zealand: changes between 2001 and 2007

P Alan Barber, John Gommans, John Fink, H Carl Hanger, Patricia Bennett, Nina Ataman

Abstract

Aim To determine changes in the organisation of acute stroke management in New Zealand between 2001 and 2007.

Method A questionnaire was sent to 58 New Zealand hospitals; it included questions about access to organised stroke care, the presence of designated areas for stroke patient management, guidelines for stroke management, and audit.

Results Responses were received from all hospitals surveyed, with 46 admitting stroke patients either acutely or for stroke rehabilitation. Sixteen District Health Boards (DHBs) covering 88% of the population have a physician who provides overall leadership for stroke services. Seven of 46 hospitals, covering 48% of the population, had areas designated for acute management of stroke patients. Rehabilitation for patients older than 65 years was carried out in designated areas for patients with stroke in seven hospitals, covering 49% of the population. Only 13 hospitals (serving 60% of the population) had audited local inpatient stroke care at the patient level and 10 (45% of the population) at the service level.

Conclusion While there have been improvements in the development of an organised approach to acute inpatient acute stroke care in New Zealand there remain major variations between different centres. The training of general physicians, geriatricians, and neurologists in stroke medicine must be seen as a priority.

Since the early to mid 1990s, overwhelming evidence shows that stroke unit care significantly reduces death and disability after stroke compared with care in general wards.¹ However in New Zealand-wide surveys performed in 2001 and 2002, only one large urban and four medium-sized regional hospitals out of 41 had stroke units, and only one hospital had a dedicated stroke rehabilitation unit.^{2,3} Since this time, New Zealand and international stroke guidelines have clearly stated that all patients admitted to hospital with stroke should expect to be managed in a stroke unit and that the provision of organised stroke care should be seen as a priority.^{4,5}

We have repeated the surveys with the aim of obtaining an overall picture of the provision of stroke services throughout New Zealand and to determine whether or not this has improved in recent years. This report concentrates on the acute management of stroke with the results from the rehabilitation components of the survey published separately.⁶

Methods

We updated and combined the questionnaires used in the original surveys of acute stroke services (2001) and stroke rehabilitation services (2002).^{2,3} This questionnaire was sent to the medical director or a physician known to have an interest in stroke at each of 58 hospitals thought to admit patients with stroke. These hospitals were identified from a New Zealand hospital directory and covered the whole of the country. The hospitals were divided into three groups according to the population served; large (urban hospitals serving populations

>180,000), medium (urban or regional hospitals serving populations of 40,000–180,000), and small (regional hospitals serving populations <40,000).

The questionnaire was designed by the authors to identify different aspects of the organisation of stroke care and took approximately 10 minutes to complete. Questions were asked about access to specialist or organised stroke care, the presence of designated areas for stroke patient management, the availability of brain and vascular imaging, guidelines for stroke care, and audit. The questionnaire was sent out in June 2007 with a second one sent to those hospitals not responding at 4 weeks. Centres that had still not responded at 8 weeks were contacted by telephone.

Results

Questionnaires were returned by all 58 hospitals. Eight centres did not admit patients with stroke. A further 4 (predominantly rehabilitation) hospitals in major centres admit patients with stroke after the acute phase and the responses from these hospitals have been merged with those of the acute feeding hospitals. The remaining 46 hospitals are the subject of this report. There were 7 large, 16 medium, and 23 small hospitals.

Staffing—Sixteen District Health Boards (DHBs) representing 88% of the population have a physician who provides overall leadership for stroke services. Seven of these physicians are general physicians (in DHBs serving 31% of the population), six are geriatricians (26% of population) and three are neurologists (31% of population). There are five DHBs without a lead physician responsible for overall leadership in stroke; none of which have an organised stroke service. Twenty of the hospitals (91% of the population) had multidisciplinary teams (MDT) with expertise in the care and rehabilitation of people with stroke. In 11 of these 20 hospitals the MDT spent only 25% of their time with stroke patients and in only 3 hospitals did the MDT spend 75% or more of their time with stroke patients.

Stroke unit care—Seven of 46 hospitals, covering 48% of the population, had areas designated for acute management of stroke patients. These units were standalone acute stroke units (2 large hospitals), or designated areas of a general medical ward (3 medium), neurology ward (1 large) or general rehabilitation unit (1 medium). An additional large urban hospital has advanced plans for a stroke unit and a further 2 hospitals (1 large, 1 medium) have a mobile stroke team consisting of stroke physicians and a stroke nurse specialist.

Six of 7 stroke units usually admitted patients within 12 hours of presentation with the other unit admitting patients by 48 hours. Six of 7 units were able to admit at least 75% of the patients presenting to their hospital with stroke and patients spent 75% or more of their acute hospital stay within the unit in 6 units.

Rehabilitation for patients older than 65 years was carried out in designated areas in 7 hospitals, covering 49% of the population. This was in a designated area of a general rehabilitation ward in 6 hospitals with only 1 large hospital having a dedicated stroke rehabilitation unit. Post-acute care in the other hospitals (51% of the population) was carried out in general medical (16) or general rehabilitation (21) wards.

Rehabilitation was carried out at a separate facility for patients younger than 65 in seven of the DHBs (59% of the population). Only three medium sized urban or regional hospitals had designated areas for younger stroke rehabilitation, all of which were within a general rehabilitation ward. The remaining younger stroke patients had rehabilitation in general medical (16), general AT&R (12) or rehabilitation units (13).

Use of clinical pathways, guidelines and audit—Clinical pathways for stroke care had been developed in 16 hospitals (47% of the population). Guidelines and protocols for the management of various aspects of stroke care had been developed in 27 hospitals (serving 83% of the population). However, between 20–40% of the New Zealand population were

admitted to hospitals without guidelines covering the management of swallowing, blood pressure, prevention of venous thromboembolism, and secondary prevention of stroke. Only 13 hospitals (serving 60% of the population) had audited local inpatient stroke care at the patient level and 10 (45% of the population) at the service level.

Availability of brain and vascular imaging—Twenty-six hospitals had CT on site. The usual wait for CT, including those where patients are transferred to another larger hospital, was less than 24 hours in 33 hospitals serving 82% of the population, and more than 24 hours in 13 hospitals, including 2 large urban and one medium regional hospitals. Carotid duplex ultrasound scanning was available within 1 week in 19 hospitals (covering 67% of the population) and was usually available within 1 month. Transthoracic echocardiography was available in 25 hospitals (>95% of the population) with transoesophageal echocardiography available in 16 hospitals (90%).

Treatment with tissue plasminogen activator—Eleven large or medium-sized hospitals serving 67% of the population had protocols for the use of tissue plasminogen activator (tPA). All but one of these hospitals had treated a patient with tPA in the past 12 months. Seventy-nine patients were thrombolysed in the past 12 months with the numbers of patients treated in each hospital ranging from 1–20 with 5 hospitals treating 5 or more, and 3 hospitals treating 10 or more patients.

Comparison with 2001 survey—Comparisons between the results of the 2007 and 2001 surveys are given in Table 1. In the past 6 years there has been an increase in the number of stroke units and approximately half of the population are now admitted to hospitals with acute stroke units. There has also been an increase in patients having rehabilitation in areas for people with stroke, although there remains only one dedicated stroke rehabilitation unit.

Table1. Comparison of acute stroke services in 2001 and 2007

Variables	2001/2 N (% Pop)	2007 N (% Pop)	P value
Number of hospitals	41	46	
Large urban	7	7	
Medium urban/regional	17	16	
Small regional	17	23	0.724 [†]
Lead stroke physician	5 (26)	16 (88)	0.023
Designated areas for			
Acute care	4 (11)	7 (48)	0.332 [‡]
Rehabilitation <65 years	0	3	0.096 [‡]
Rehabilitation >65 years	1* (9)	7* (49)	0.039 [‡]
Pathways	10 (38)	16 (47)	0.290 [†]
Guidelines	34 (78)	27 (83)	0.988 [†]
Investigations	23 (78)	19 (71)	0.168 [†]
Thrombolysis	2 (9)	11 (67)	0.007 [†]
Blood pressure	17 (52)	19 (73)	0.988 [†]
Swallow	19 (61)	22 (73)	0.752 [†]
VTE prevention	16 (53)	21 (73)	0.829 [†]
Secondary prevention	19 (55)	21 (73)	0.949 [†]
Audit			
Patient level	8	13	0.242 [‡]
Service level	9	10	0.592 [‡]

*Only 1 hospital with a dedicated stroke rehabilitation unit; [†]Chi2 test; [‡]Fisher's exact test.

Most DHBs now have lead stroke physicians. There have been non-significant increases in the number of hospitals with guidelines or protocols for the management of common problems following stroke, apart from a marked increase in the numbers of hospitals with thrombolysis protocols.

Discussion

The major finding of this study is that there have been improvements in the provision of organised acute inpatient stroke care since 2001. There has been an increase in the number of acute stroke units from 4 to 7. Half of the population are now admitted to hospitals with a stroke unit compared to only 11% in 2001. Similarly the number of stroke rehabilitation units has increased from one to seven. Access to brain and vascular imaging has improved. There has been a slow increase in the numbers of patients treated with tPA. There is greater use of guidelines and protocols for the management of common problems following stroke.

What are the likely reasons for this improvement? There is no doubt that the evidence that stroke units are effective has been accepted. In a 2004 survey of New Zealand physicians, almost all respondents thought that stroke units and stroke rehabilitation units were beneficial.⁷ All but 5 of the 21 DHBs now have identified lead physicians, an increase from only 5 in 2001. A number of these physicians have formed the Stroke Unit Network of New Zealand (SUNNZ), an alliance that shares practical guidelines and protocols for the management of common problems after stroke (see <http://www.stroke.org.nz/pdfs/SUNNZguidelines.pdf>).

Further improvements are likely to be driven by lead clinicians adapting guidelines and protocols for local circumstances and driving the development of organised stroke services within their DHB. Conversely, it is unlikely that organised stroke care will develop in other hospitals until physicians with a special interest and expertise in stroke are identified.

However, there are still major discrepancies between the evidence base and practice. Just under half of New Zealanders do not have access to organised inpatient stroke care and there are still major teaching hospitals without organised stroke care. A meta-analysis of all randomised and quasi-randomised studies demonstrated a reduction in the odds of death or institutionalised care for patients receiving some form of specialised inpatient stroke care compared with conventional care.¹ Only 18 patients need to receive organised inpatient stroke care to prevent one from dying or being dependent at 1 year.⁸ Organised inpatient stroke care does not increase (and possibly decreases) length of hospital stay and is not more expensive than care in a general ward.^{1,8,9} The introduction of a stroke rehabilitation unit in Christchurch resulted in an 8-day reduction in length of stay.¹⁰

There are also concerns about the quality of the services provided. Only two of the stroke units are stand alone units with the remainder in designated areas of general medical, neurology or AT&R wards. There is still no comprehensive stroke unit in New Zealand where acute management and rehabilitation occur in the same ward, although some of the stroke units transfer patients to designated stroke rehabilitation areas.

The use of guidelines was more widespread, but 20–30% of the population is served by hospitals where there were no guidelines for the management of common complications following stroke or for the secondary prevention of a further stroke. This, in conjunction with the limited use of audit, suggests that there is an ad hoc approach to the care of many stroke patients, and that the opportunity to identify and address local deficiencies in stroke care is missed.

Only 79 patients were treated with intravenous rt-PA in the preceding year, representing about 1% of all acute stroke patients.⁴ This is despite the fact that 67% of the population are admitted to hospitals with protocols for the use of rt-PA. It is now 12 years after the National Institute of Neurological Disorders and Stroke (NINDS) trial found that patients treated with rt-PA within 3 hours of symptom onset were approximately one-third more likely to have complete or near complete recovery compared to those receiving placebo.^{11,12} Only 16 patients need to be treated with rt-PA to prevent one from dying or becoming dependent,⁸ and for every 7 patients treated, neurological improvement is seen in one. Treatment with rt-PA is cost effective.¹³ Without organised acute stroke care the numbers of patients receiving stroke thrombolysis is likely to remain small.

In the previous surveys, the care of stroke patients in medium sized urban and regional hospitals was similar to large urban hospitals. Indeed, care in some regional hospitals was “better” than most of the large hospitals. However, since this time most of the larger urban hospitals have developed stroke units, while there has been no corresponding increase in the number of stroke units in the medium and smaller-sized hospitals. This is likely to reflect the presence of lead clinicians being early adopters of organised stroke care. Without the training of general physicians, geriatricians and neurologists in stroke medicine these numbers are likely to remain small.

There remain variations in the nature of care received depending on place of residence. These discrepancies may be addressed with the development and implementation of Ministry of Health stroke service specifications which are based on population size.¹⁴ These specifications suggest that hospitals serving more than 180,000 people should aim to have a lead stroke physician, an acute or comprehensive stroke unit, and an expert, stroke-dedicated multidisciplinary team.

Smaller hospitals serving fewer than 80,000 people should still have a lead physician but are not necessarily expected to have a stroke unit. Rather, patients should be aggregated within a general ward with an MDT team expert in rehabilitation. Medium-sized hospitals should have a combination of these approaches. However, these are recommendations only with no requirement for these specifications to be met and without DHB and MOH commitment the further development of organised stroke services will remain patchy.

So what is the way forward? The ongoing work of individual lead clinicians and SUNNZ will have some effect but this study has shown that this approach has been slow and is dependent on the drive of clinicians and acceptance by hospital managers of the need for organised stroke services. A formalised and compulsory national audit programme of stroke services could be considered by the Ministry of Health, as in England. This would ensure regular audit and enable the comparison of service provision between DHBs.

This study has a number of limitations. Questionnaires offer a convenient means of surveying clinical practice in a large number of hospitals. However, the most appropriate individual within an institution may not be targeted and responses to a survey may not reflect actual practice. Attempts were made to contact physicians with a known interest in stroke at each institution. We did not systematically attempt to verify responses but made clear it that no hospital would be identified. It is reasonable to assume that the responses reflect the state of stroke management in New Zealand.

There has been a failure to implement best practice guidelines in New Zealand for the care of patients admitted with stroke. The evidence in favour of organised inpatient care is overwhelming, and achieving this goal should be the highest priority. The situation in New Zealand is unlikely to change without training more general physicians, geriatricians, and

neurologists as stroke physicians. In the interim, there is a need to identify physicians in each hospital who will be responsible for stroke services.

Competing interests: Four authors work in an honorary capacity for the Stroke Foundation of New Zealand; as national medical director (JF) or regional medical advisors (PAB Northern, JG Central, CH Southern). All four were also members of the Ministry of Health's Stroke Advisory Committee 2002–4.

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Utilising practice management system data for quality improvement in use of blood pressure lowering medications in general practice

Jim Warren, Rekha Gaikwad, Thusitha Mabotuwana, John Kennelly, Timothy Kenealy

Abstract

Aim To assess use of Electronic Medical Records (EMRs) to identify patient cases for potential quality improvement in use of blood pressure-lowering medications in general practice.

Setting One metropolitan general practice in Auckland with a high proportion of Pacific patients.

Participants Patients registered as regular patients with the practice; classified within the previous 5 years as having hypertension; with at least one prescription for antihypertensive medication in the year prior to the evaluation period of 9 May to 8 November 2007.

Intervention Iterative discussion of quality improvement opportunities and review of EMRs with a panel of practice clinicians to identify agreed quality indicators based on EMR data. This resulted in a set of eight evidence-based criteria for patients classified with hypertension, implemented as database queries, which identify cases for potential quality improvement. The panel conducted blind assessment of antihypertensive therapy on a sample of 20 cases matching at least one criterion and 20 cases that met no criterion; the case classifications based on the database queries were then revealed for direct comment and consideration by the panel.

Results Of 517 eligible patients, 209 (40.4%) met one or more of the eight criteria. Of these 209, 110 (21.3%) met only criteria related to persistence of medication possession and/or blood pressure recording. After assessment of the 40-patient sample by the practice GPs, the eight criteria taken as a whole had a Positive Predictive Value of 70% (95% CI 46-88%) and Negative Predictive Value of 70% for clinician assessment of suboptimal therapy and/or process.

Conclusion EMRs can provide moderately reliable identification of patients with suboptimal management of blood pressure in general practice. It should be noted, however, that the complexity of required query formulation is substantial with current tools. Identification of patients with poor persistence of antihypertensive therapy is the most promising outcome for follow-up investigation. The study needs to be replicated in a range of different practice settings.

Clinical audit is a process for quality improvement that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change.¹ In 2004, 99.0% of New Zealand general practices (920 out of 929 respondent practices) used specifically designed patient management system software to assist with recording of patient and clinical consultation details

and to help with the daily running of their business.² This routine use of patient management systems motivates further exploration of the potential of general practice EMRs to provide the data for quality audit reports that can support clinical audit both to provide objective measurement of a practice's attainment of evidence-based quality of practice, and to identify specific cases that merit follow-up.

Hypertension is a major risk factor both in cardiovascular disease (CVD; New Zealand's number one killer³) and in chronic kidney disease (CKD).⁴ Broadly accepted hypertension treatment guidelines exist; notably, JNC7.⁵ These guidelines identify compelling indications for individual drug classes, such as ACEi (angiotensin-converting enzyme inhibitor) or ARB (angiotensin receptor blocker) with diabetes and CKD.⁵

Although no specific guideline should be expected to apply to 100% of individuals in a general practice setting, by the nature of evidence based guidelines, we expect that high rates of adherence to these compelling indications will yield the best health outcomes. Thus, the use of blood pressure lowering medications is a particularly worthwhile area of investigation with respect to quality audit research.

It has been shown that EMRs can be used to produce high-specificity alerts with respect to antihypertensive prescribing quality.⁶ In this paper we assess use of EMR data to identify specific cases for quality improvement in use of blood pressure lowering medications in general practice.

Method

This research was conducted under University of Auckland Human Participants Research Ethics Committee approval Reference no 2007/078. The method, rationale and surrounding technical issues have been reported previously.^{7,8} Test statistics were calculated with the *diag* routine in Stata 9 software.

The setting was a West Auckland general practice with a predominance of Pacific patients. Quality improvement criteria were developed via an iterative process working with a panel consisting of the practice manager, two GPs of the practice, and two of the practice's nurses.

Three 1-hour meetings with the panel were conducted on the premises of the practice between May 2007 and July 2007 to develop a quality audit report based on EMR data from the practice. The information needs for audit were determined by the investigators external to the practice and the practice's panel. (Note—among the authors, JK is a GP of the practice, TK is a GP external to the practice, and RG has practiced medicine outside NZ.)

The quality audit report was designed to document:

- Descriptive data about the practice (e.g., prevalence of hypertension);
- Positive attributes (numbers that the panel would like to raise—e.g., percent of patients diagnosed with hypertension with blood pressure now controlled) and
- Quality improvement opportunities.

After each of the three meetings, queries were implemented to populate the quality audit report from practice data, including prescribing and relevant laboratory data and observations for the 18-month period preceding the first meeting, and also all problem classifications (Read Codes) for the preceding 5-year period. Use of unique practice identification codes (not NHI numbers) for each patient allowed the practice to identify patients while maintaining patient anonymity in data used by the external investigators.

Relevant laboratory tests were identified in advance of the first meeting by analysis of guidelines (notably, JNC7⁵), but extended based on meeting results (in particular, to include estimated Glomerular Filtration Rate, eGFR). Heuristics text processing to detect blood pressure (BP) readings in EMR notes was also extended between meetings based on feedback from the practice.

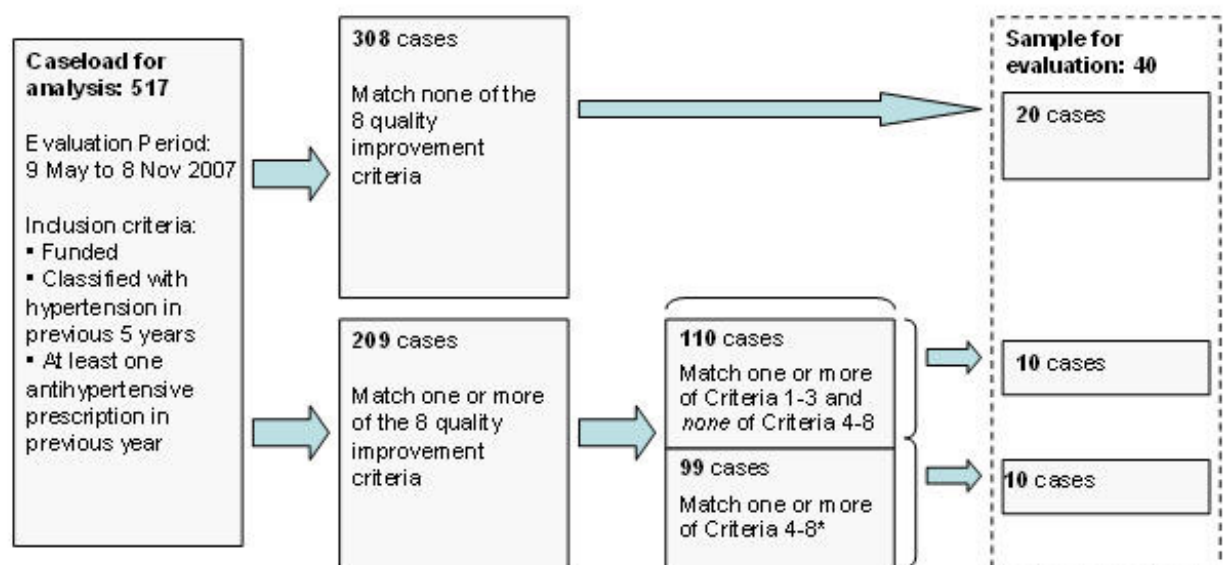
The queries required pre-processing to compute the duration of medication supply for each prescription as indicated by dose, frequency, pack size and repeats (generally 90 days). *Lapses* were identified where a medication, if first dispensed on the day of prescribing and subsequently taken as directed, would have run out. Periods of lapse were computed both for total antihypertensive therapy (AHT) and for several AHT drug groupings of interest to the panel, including ACEi and ARB (collectively), beta-blockers, and thiazide diuretics. Computational methods have been previously described by Warren et al.⁹

Table 1 shows the eight quality improvement criteria arrived at upon conclusion of the third meeting with the expert panel. A recent evaluation period not previously reviewed by the panel was used as the basis for a sample to validate the criteria. The criteria were assessed by database queries for the period of 9 May to 8 November 2007 for all funded patients enrolled with the practice who had been classified with hypertension in the previous five years and had at least one antihypertensive prescription in the previous year. A random sample of 40 cases total was drawn where:

- 20 cases were drawn from among those patients satisfying none of the eight criteria;
- 10 cases were drawn from those patients satisfying one or more of Criteria 1–3, but none of Criteria 4–8; and
- 10 cases were drawn from those satisfying one or more of Criteria 4–8 (irrespective of whether they also satisfied one or more of Criteria 1–3).

This process is illustrated in Figure 1.

Figure 1. Criteria and sampling for evaluation



* 27 cases that match one or more of Criteria 4–8 also match one or more of Criteria 1–3

The practice panel, independent of the external investigators and blind from the data query results, assessed each of the 40 sample cases by review of records at the practice. For each sample case, the panel's GPs completed a three-question assessment instrument (Appendix 1) which queried:

1. Freedom from significant contraindications or interactions;
2. Therapy optimized, or satisfactory process of seeking optimal treatment;
3. Adequacy of EMR data to support assessment of AHT.

After assessing all 40 cases, the criteria met by each case were revealed to the panel. The panel's GPs then gave feedback and had the option to revise their assessment. Subsequently, there was a joint

meeting of the panel GPs and external investigators to further consider the assessments and feedback on the sample.

Table 1. Eight quality improvement criteria agreed with practice panel

Lack of persistence of medication; and/or lapsed BP recording

1. A lapse in AHT of >30 days and the lapse extends into the Evaluation Period (EP)
2. A period of >180 days with no BP measurements extending into the EP
3. A BP measurement of $\geq 160/100$ mmHg followed by a gap of >120 days in BP measurements extending into the EP

Persistently high BP; lacking indicated therapy; and/or lab test contraindicating treatment

4. Three or more consistently high BP measurements ($\geq 160/100$ mmHg) over 120 days or more where either
 - i) the last of these high BPs was within the EP or
 - ii) with no subsequent "controlled" BP ($< 160/100$ mmHg) measurements after the consistently high BPs
5. Classified with diabetes mellitus and not on ACEi/ARB at any time during EP*
6. Classified with myocardial infarction and not on beta-blocker at any time during EP*
7. Classified with renal impairment and on ACEi/ARB and with eGFR < 60 mL/min at any time during EP
8. On thiazide(s) and with serum uric acid > 0.42 mmol/L at any time during EP and not on Allopurinol or Colchicine

EP—Evaluation period (9 May to 8 Nov 2007); * i.e., a lapse of the indicated drug at some time during the EP and after the indicating diagnosis.

Results

There were 517 patients in the caseload for analysis. Of these cases, 209 (40.4%) met one or more of the 8 criteria during the 6-month evaluation period; 110 of the 209 (21.3% of total) met only Criteria 1–3—i.e. medication lapse or blood pressure measurement lapse. Figure 1 shows frequencies with which the criteria groupings 1–3 and 4–8 were met.

Assessment of the 40 sampled cases by the practice panel yields six false-positives and six false-negatives (see Table 2) thus giving the observed validity for the sample as: sensitivity 70%; specificity 70%; positive predictive value (PPV) 70%; and negative predictive value (NPV) 70%; by chance, the 95% confidence intervals are the same for each statistic (46–88%).

Table 3 shows the frequencies of individual criteria in the caseload and for the sample, and whether the panel concurred with the automated assessment. Tables 4 and 5 report the specific panel feedback for false-positive and false-negative cases, respectively, with Table 4 including those true-positive cases where the blind assessment was positive for Question 2 ("The therapy is optimised, or the process of seeking optimised treatment is satisfactory").

Table 2. Accuracy of automated queries as assessed against final review by the practice panel

		Final classification by panel	
		Quality suboptimal (+)	Quality optimal (-)
Classification by automated queries	Met one or more criteria (+)	14*	6
	Met none of the criteria (-)	6	14

*Including three cases described as optimal on blind assessment but where practice GPs concurred to criteria on final review; all others initially negative on Question 2 (refer to Appendix)

Table 3. Criteria and practice panel assessments for six-month evaluation period

Criterion	Number (as % of cases) in caseload	Number in sample	Number in sample where panel agreed with automated classification during blind assessment (after final assessment)
1	69 (13.3%)	7	4 (5)
2	79 (15.3%)	6	5 (5) *
3	21 (4.1%)	0	--
4	16 (3.1%)	1	1 (1)
5	39 (7.5%)	6	2 (2)
6	5 (1.0%)	0	--
7	25 (4.8%)	3	1 (3)
8	20 (3.9%)	0	--

*Criteria 1 and 2 co-occurred in two sample cases, one a true-positive and one a false-positive; Criterion 2 also co-occurred with Criterion 5 in a true-positive.

Table 4. Cases where panel initially disagreed with classification by automated queries (false-positives); and final classification after review

Case	Criteria satisfied	Panel comments on Question 2	GP Comments upon viewing criteria satisfied	Final class
1	5: Classified with diabetes mellitus and not on ACEi/ARB at any time during EP	CVR 9%	On dietary management	False-positive
2	5: Classified with diabetes mellitus and not on ACEi/ARB at any time during EP	BP for diabetes CVR 10%; ACEi last prescribed Feb 2007, seems to have "slipped off", list of regular medications	ACEi prescribed in Feb but not on list of medications (ACEi first prescribed in 2005)	False-positive*
3	1: A lapse in AHT of >30 days during the EP or the lapse extends into the EP	CVR 3%	Patient has low CVR and may not need Rx	False-positive
4	1: A lapse in AHT of >30 days during the EP or the lapse extends into the EP 2: A period of >180 days with no BP measurements extending into	CVR 6%	? Needs BP treatments. CVR 6%	False-positive

Case	Criteria satisfied	Panel comments on Question 2	GP Comments upon viewing criteria satisfied	Final class
	the EP			
5	1: A lapse in AHT of >30 days during the EP or the lapse extends into the EP	CVR 13%	Not detected. CVR 13%	True-positive
6	5: Classified with diabetes mellitus and not on ACEi/ARB at any time during EP	CVR 15% microalbuminuria; No uric acid recorded; BP not satisfactory	Given ACEi in 2003; only has IGT – misclassified	False-positive
7	7: Classified with renal impairment and on ACEi/ARB and with eGFR < 60mL/min at any time during EP	CVR 8%; Chronic renal failure; No lipids or glucose measurements for four yrs	Agree	True-positive
8	5: Classified with diabetes mellitus and not on ACEi/ARB at any time during EP	CVR 19%; BP too high; Microalbuminuria	On accupril since Dec 2002	False-positive
9	7: Classified with renal impairment and on ACEi/ARB and with eGFR < 60mL/min at any time during EP	CVR 20%; eGFR low; Cr high; BP too high	Agree	True-positive

EP—Evaluation Period; CVR—estimated 5-year cardiovascular risk as assessed by PREDICT,¹⁰⁻¹¹ based on the Framingham risk equations with some adjustments specific to New Zealand; *Negative for Question 3 (refer Appendix); IGT – Impaired glucose tolerance.

Table 5. False-negatives

Case	Panel comments on Question 2	GP comments upon viewing criteria satisfied
1	Microalbuminuria reducing CVR 9%, but needs better BP control	BP too high; On thiazide + gout + uric acid 0.46
2	CVR 7%; Microalbuminuria improving. Poor diabetes control	Poor diabetes control*
3	CVR 15%; BP too high; Medication insufficient; Poor attendance	Poor attendance (late)
4	CVR 22%; BP Rx	Thiazide + history of gout + high uric acid; BP too high; CVR 22%
5	CVR 15%, poor attendance ACEi-cough; Statin – constipation	Poor attender; ACE-cough; statin not taken
6	BP could be lower; ACEi therapy not maximised	ACEi could increase

*On further consideration, practice ambivalent on False Negative / True Negative status of this case

Discussion

This study assessed the use of EMRs to identify cases of relevance for quality improvement efforts in the context of antihypertensive prescribing in general practice. A three-session process of liaison between a clinical panel of a general practice and a group of analysts was able to derive a set of eight explicit criteria and associated database queries to the practice EMRs that were agreed to be indicative of cases that would warrant follow-up for quality improvement. When tested by clinical review on a sample of 40 cases, the criteria were observed to be moderately accurate indicators of cases relevant for follow-up.

Two main uses for this form of reporting for improvement of chronic disease management are evident. The first application is for near-term follow-up on specific

patients. This could take a form similar to our study protocol, wherein a practice panel reviews a sample of cases satisfying one or more of the automated criteria based on queries processed on their practice EMRs and there takes a decision to recall the patient, enter a note for next visit, or to accept the status quo.

The second application is to use the audit report (e.g. on a quarterly basis) as a baseline measure against which the effectiveness of any other quality improvement efforts may be tracked. The observed accuracy of the criteria as an indicator of clinical concurrence to suboptimal therapy or process (PPV, NPV, sensitivity and specificity) is only moderate; however, for the review application as per above the accuracy could be acceptable in terms of bringing a rich pool of cases to the attention of the panel for a low cost. That said, false-positives waste time for a review panel, providing impetus to improve reporting methods and/or the quality of the underlying EMRs.

Review of the cases from Tables 4 and 5 reveals that the use of CVR within quality audit criteria may improve accuracy. The practice with which we were working was in the process of running PREDICT CVD/Diabetes over all indicated patients, and thus had CVRs available to provide a convenient input to the criteria assessment process. Several observed False Positives (for cases 1, 3 and 4 in Table 4) had <10% CVR and several False Negatives had $\geq 15\%$ CVR (for cases 3-5 in Table 5).

In an ideal world we could also query the PREDICT CVD/Diabetes management recommendations as part of queries, and also would have access to more coded information on non-prescribing actions (e.g. the 'on dietary management' of Table 4, case 1). One could even envision running the PREDICT CVD/Diabetes algorithms in 'batch' mode to dynamically generate recommendations as part of the quality audit process, however this would only be effective if all required data were already in the EMR.

Other areas for improvement of the criteria performance related to more accurate interpretation of the prescribing record (noting cases 2 and 8 in Table 4, where re-prescription was done, but was missed by the database queries), less porous clinical criteria in specific areas (e.g. cases 1 and 4 in Table 5 around gout, uric acid and thiazides), and consideration of dose maximisation (case 6 in Table 5).

The diabetes/ACEi criterion (Criterion 5) seemed to be particularly vulnerable to the above problems and appears to be the most fruitful for refinement. It should be noted that the entire effort is underpinned by the high quality use of the Practice Management System being exercised by the general practice, where the 40 cases reviewed indicated the records to be almost perfectly fit to purpose (with the Diabetes/IGT confusion in case 6 in Table 4 as the sole exception beyond the prescribing issues noted above).

This study has a number of limitations. First is the use of a single practice, where the coding practices, interests, and biases of a few staff will have influenced the quality of the EMRs and the quality improvement criteria of interest. While the scale is of course small, EMR data in New Zealand general practice is held, in the first instance, at the practice level. Thus, we believe it is useful to investigate how the Practice Management System can extend the power of those specific clinicians to measure quality and pursue change in the areas that they consider to be of the highest priority.

In this regard, we do not see the localised development of the criteria as a limitation, but there is the obvious need to examine the transferability of the process across practices.

A further and significant limitation is the size of the sample drawn. The confidence intervals are large for the aggregate of the criteria and the sample far too small to test individual criteria (indeed, not all criteria were observed in the sample).

The practice population studied has a high average level of cardiovascular risk and renal disease. Renal impairment is a component of CVR but there are separate drivers (i.e. prevention or delay of renal failure) for a practice to look for improvements in blood pressure control and manage co-morbidities such as gout. At the simplest level, however, the problem in persistence of antihypertensives (assessed by Criterion 1) shows a promising pathway for intervention. Quality improvement strategies that improve medication persistence are recognised as a priority area for research by Cochrane Collaboration Reviews on this topic.¹²

The immediate future work programme is to investigate the issues and motivations associated with those patients whose prescribing patterns indicate a low medication possession ratio (MPR)¹³ and from the results of this to design a targeted intervention based on telephone and/or home visit. A serious concern is that, with 40% of caseload observed to be implicated in one or more quality improvement criteria, it is unclear how practices can raise sufficient resources to implement the indicated scale of evidence-based quality improvement programmes.

A further outstanding challenge lies with the technology of querying EMR data. At this stage there are some significant intermediate data structures that need to be built to answer questions as posed by our quality improvement criteria. These include:

- Identification of observations, both local observations such as BP and lab test results, which appear embedded in textual data fields, and which in the former case are sometimes, but not reliably, picked up by the practice management software for coded representation in the EMR.
- Grouping of medications into meaningful therapeutic groups (with consideration of issues such as combination drugs).
- Grouping of problem classification codes into meaningful groups.
- The complexity of temporal queries considering the boundaries of an evaluation period and the order of events (e.g. continuity of ACEi *after* a diabetes diagnosis *during* a specific 6-month period).
- Identification of the duration of a prescription (which is not always aligned to the period as stored in the practice EMR, depending on instructions given by the prescriber).

As such, at present the development of queries by practice managers is impractical and one would need to compromise to ask the questions that are easily formulated rather than exploiting the true potential of the practice EMRs. Improvement of Practice Management System query tools is required to suit the needs of quality improvement efforts.

Conclusion

EMR data has been shown to provide a basis for moderately reliable automated identification of cases with suboptimal management of blood pressure in the general practice setting as per criteria developed by a clinical panel of the practice. The criteria are suitable either for direct use in quality improvement efforts or for tracking of quality improvement outcomes over time. Further work is needed both to identify the transferability of this finding and to improve tools and methods for EMR querying. The practice involved in the study reported herein is, in the first instance, pursuing a follow-up of the cases where the EMRs indicate gaps in persistence of antihypertensive therapy.

Competing interests: None known.

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Appendix 1

Questionnaire for Practice Panel Case Assessment

Answer the following questions with respect to antihypertensive therapy for this patient for the period from 9 May 2007 to 8 Nov 2007. Tick either Yes or No for the questions.

1. The therapy is free of clinically significant contraindications and interactions. ☐ Yes ☐ No

If not, describe problem:

2. The therapy is optimized, or the process of seeking optimized treatment is satisfactory. ☐ Yes ☐ No

If not, describe your concern:

3. The data from the PMS satisfactorily explains the therapy. ☐ Yes ☐ No

If not, suggest facts missing:



Establishment of a Difficult Hypertension Clinic in Whangarei, New Zealand: the first 18 months

Walter van der Merwe

Abstract

A Difficult Hypertension Clinic was established at Whangarei Hospital (Whangarei, Northland, New Zealand) in March 2006 in response to a perceived need amongst general practitioners. The experience with the first 150 patients is reviewed. Mean BP at referral was 162/89 mmHg, and mean number of antihypertensive drugs was 2.49. Mean BP at discharge from the Difficult Hypertension Clinic was 138/78 mmHg and mean number of antihypertensive drugs 3.16.

The commonest cause of hypertension resistance was underprescription of diuretics. Secondary or contributory causes of hypertension were identified in 28 (19%) of patients, and white coat hypertension in three (2%). The Difficult Hypertension Clinic established in our hospital is an effective model for achieving clinical targets and care recommended in evidence-based guidelines.

Hypertension is quantitatively the largest risk factor for cardiovascular disease and the commonest cause of premature death in Western societies.¹ About 26% of the adult population is hypertensive, the prevalence increasing with age.¹ Most hypertension in New Zealand is managed by general practitioners. Difficult or resistant hypertension is common, and since the disestablishment of the hospital hypertension clinics from the 1980s to early 1990s and the retirement of a generation of hypertension specialists,²⁻⁵ general practitioners have often been left to struggle with difficult cases on their own.

The New Zealand Cardiovascular Risk Management Guideline offers only brief general principles of hypertension management and no information relevant to the management of difficult or resistant hypertension.⁶ Hypertension referrals to internal medicine and cardiology clinics are customarily given low priority.

In response to a steady flow of difficult hypertension (but not directly nephrological) referrals to the Whangarei Nephrology Clinic we set up a new Difficult Hypertension Clinic. General practitioners are invited to refer individuals with difficult to control hypertension and those in whom a secondary (curable) cause of hypertension is suspected.

The Clinic is based around a specialist nephrologist (WvdM) and a registered nurse (LB or WS). The nephrologist grades the referrals and the nurse arranges all preliminary investigations, including ambulatory blood-pressure monitoring (ABPM) where indicated, before the first clinic appointment. Where possible, one or more baseline blood pressure measurements are obtained by the nurse on a day prior to the clinic appointment, following the technique of JNC 7 guidelines.⁷

On the day of the clinic the patient is asked to arrive at least 15 minutes early in order for the nurse to obtain further resting blood pressure in a quiet setting. ABPM is done using a Welch-Allyn *Cardioperfect* machine (Skaneateles Falls, NY, USA), set to measure blood pressure every 30 minutes for 24 hours. Following physician clinic review further investigations may be initiated, and treatment changes initiated.

Follow-up appointments for titration of antihypertensive drugs, according to parameters set by the nephrologist are undertaken at nurse-led clinics in the outpatient department. These nurse-clinic visits are typically fortnightly until target blood pressure is achieved, with the nephrologist available for advice where required. Formal specialist follow-up visits are kept to a minimum although one is scheduled prior to discharging the patient back to the GP with a finalised clinical summary and recommendations.

The general approach to the management of hypertension and the investigation of secondary causes is based on the guidelines from The Seventh Report of the National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report (JNC 7 Guidelines).⁷

The Web address is www.nhlbi.nih.gov/guidelines/hypertension/ and the Physician's Reference Card can be downloaded for easy reference. The general approach to resistant hypertension follows Moser and Setaro's 2006 New England Journal of Medicine review⁸ with additional assistance in the appropriate use of diuretics from others.⁹⁻¹⁵

The nephrologist provides advice regarding overall cardiovascular risk management and where not already prescribed, lipid-lowering therapy and aspirin are commonly recommended. Lifestyle advice with regard to healthy diet and salt intake, weight management, alcohol, and smoking cessation is given by the hypertension nurse and simple information pamphlets on these topics are supplied to the patient. Specialist dietitian referral is also commonly utilised as well as referral to hospital and community-based Smoking Cessation services.

The first hypertension clinic was held on 16 March 2006. General practitioners have referred 95% of patients from the community and hospital practitioners the remainder. By the end of September 2007, 150 new referrals had been treated in the clinic, and it seemed an appropriate time to conduct a review of patient outcomes. We were most interested in initial and final blood pressures, patterns of medication use, and the common causes of hypertension resistance.

Method

The following data were extracted from clinic records on to an Access database relational database (Microsoft Corporation, Seattle WA, USA) for analysis: age, gender, self-declared ethnicity, body mass index, abdominal obesity (waist girth > 90cm women, 105 cm men), Metabolic syndrome as defined by the International Diabetes Federation, IDF,¹⁶ diabetes mellitus (as defined by the World Health Organisation/ International Diabetes Federation¹⁷), impaired glucose tolerance without overt diabetes (as defined by the World Health Organisation/ International Diabetes Federation¹⁷), microalbuminuria (30-300mg urine albumin excretion in 24 hours) or macroalbuminuria (>300mg urine albumin excretion in 24 hours), estimated glomerular filtration rate (e-GFR) according to the abbreviated Levey formula,¹⁸ dyslipidaemia (IDF metabolic syndrome criteria¹⁶ $\pm$ fasting cholesterol > 5mmol/l $\pm$ on lipid-lowering therapy), current smoking, alcohol use, abnormal electrocardiogram (ECG) or echocardiogram, ischaemic heart disease, cerebrovascular disease, peripheral vascular disease, baseline

and final blood pressure, baseline and final antihypertensive drugs, baseline and final aspirin and HMG-CoA reductase inhibitor use, number of clinic visits, details of ABPM utilisation, and investigations undertaken to exclude secondary causes of hypertension. Baseline and final 10 year cumulative risk of heart attack and stroke were also calculated as per the Joint British Societies calculator.¹⁹ This computation of risk is closely based on the New Zealand Risk Factor tables.⁶

Antihypertensive drugs were recorded in the database according—firstly to their class and secondly by their dose. Therapeutic class was encoded according to the following categories: angiotensin converting enzyme inhibitors (ACE-inhibitors), beta-blockers (conventional), thiazide diuretics, dihydropyridine calcium channel blockers (DHP CCBs), angiotensin-receptor blockers (ARBs), non-dihydropyridine calcium channel blockers (non-DHP CCBs), spironolactone, labetalol, carvedilol, frusemide, potassium-sparing diuretics (amiloride/triamterene), alpha-blockers, clonidine, methyldopa, and minoxidil. Labetolol and carvedilol were classed separately from conventional beta-blockers, although this had little impact on final analyses because of the small numbers of patients on these drugs.

Dose was encoded as a fraction of the maximum recommended daily dose by respective manufacturers (e.g. metoprolol 95 mg daily would be recorded as “beta-blocker ½”).

With regard to secondary causes of hypertension, renal disease was only classed as such when the hypertension was attributable to an identifiable primary renal disease (e.g. diabetic nephropathy, glomerulonephritis) but not when reduced GFR was secondary to essential hypertension (hypertensive nephrosclerosis).

Statistical analyses were performed of rates and proportions using Chi-squared and Student’s t-tests where appropriate using Intercooled Stata (version 9.2) software (StataCorp, College Station, TX, USA).

Results

150 new patients were seen from 16 March 2006 to 30 September 2007. Baseline patient characteristics were as listed in Table 1.

Mean baseline blood pressure was 162/89 mmHg and mean final blood pressure 138/78 mmHg ($p<0.001$ for both systolic and diastolic blood pressure). This change in blood pressure is represented graphically in Figures 1 and 2.

Blood pressure $<140/90$ mmHg was achieved in 92 (61%) patients.

Formal clinic visits to the nephrologist averaged 2.7 per patient (range 1–10) with an average 2 separate nurse-clinic visits for titration of medication. By the final visit 146/150 patients were on antihypertensive medication with three being identified as having true white coat hypertension (2%) and not requiring pharmacological treatment and one with pituitary-dependent Cushing’s syndrome no longer requiring antihypertensive therapy after a curative partial hypophysectomy.

ABPM was employed on one or more occasion in 56 (37%) patients, both in those not on medication and taking medication. In addition to the 3 with true white coat hypertension, an additional 9 (6%) were identified as having a white coat effect on top of established hypertension—that is elevated clinic blood pressures in medicated patients who demonstrated a satisfactory profile on ABPM.

Table 1. Baseline patient characteristics presented as n (% of total) or mean (range) unless otherwise stated

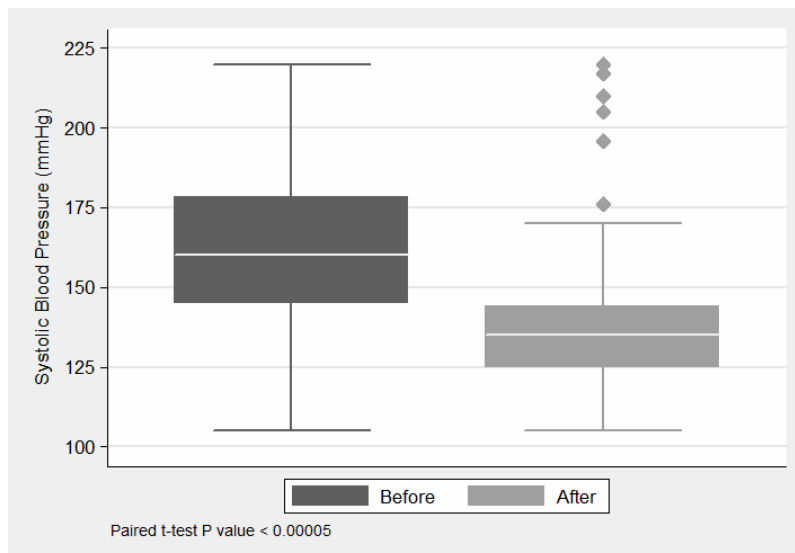
Variables	N or units
Age (mean, range)	58 (13–94)
Gender	Female 78 (52%) Male 72 (48%)
Ethnicity:	
New Zealand European	111 (74%)
New Zealand Māori	37 (24.6%)
Pacific People	1 (0.007%)
African	1 (0.007%)
Blood Pressure	162/89 mmHg (105–220/56–120)
Number of antihypertensive drugs*	2.49 (0–6)
Body Mass Index (weight in kg/height in m ²)	Mean 31 Range (20–60)
≤25	19 (12.7%)
25–29	56 (37.3%)
30–34	41 (27.3%)
≥35	34 (22.7%)
Abdominal obesity	103 (69%)
Metabolic syndrome (IDF)	80 (53%)
Diabetes mellitus	27 (18%)
Impaired glucose tolerance	19 (13%)
Micro/macroalbuminuria	49 (33%)
Dyslipidaemia	113 (75%)
Current smokers	25 (17%)
>2 standard drinks daily	15 (10%)
Abnormal electrocardiogram or echocardiogram**	87 (58%)
Ischaemic heart disease	20 (13%)
Cerebrovascular disease	7 (5%)
Peripheral vascular disease	11 (7%)
Chronic kidney disease stage:	e-GFR 71ml/min/1.73m ² (23–150)
0/1 (GFR ≥90 ml/min)	32 (21.3%)
2 (GFR 60–89 ml/min)	64 (42.7%)
3 (GFR 30–59 ml/min)	49 (32.7%)
4 (GFR 15–29 ml/min)	5 (0.33%)
5 (GFR <15 ml/min)	n=0
Statin and aspirin treatment	Statin 57 (38%); Aspirin 55 (37%)
JBS 10-year cardiovascular risk	Mean 32% (Range 0.5–100%)

*Only 138 (92%) on antihypertensive drugs at baseline; **Left ventricular hypertrophy reported in 57 of the 60 echocardiograms performed.

Secondary causes as a primary or contributory cause of hypertension were identified in 28 (18.6%) patients. These were: renovascular disease (n=10), primary renal disease (n=9), obstructive sleep apnoea (n=5), medication (n=3), pituitary-dependent Cushing's syndrome (n=1). The commonest secondary cause was atherosclerotic renal artery stenosis—of the 10 patients with this diagnosis, 4 were referred to the clinic with the diagnosis already made requiring further advice on hypertension management. Three of these had had renal percutaneous intervention and stenting and the 4th a nephrectomy. Of the 6 new diagnoses made 5 were amenable to angioplasty and stenting and all had good short-term outcomes.

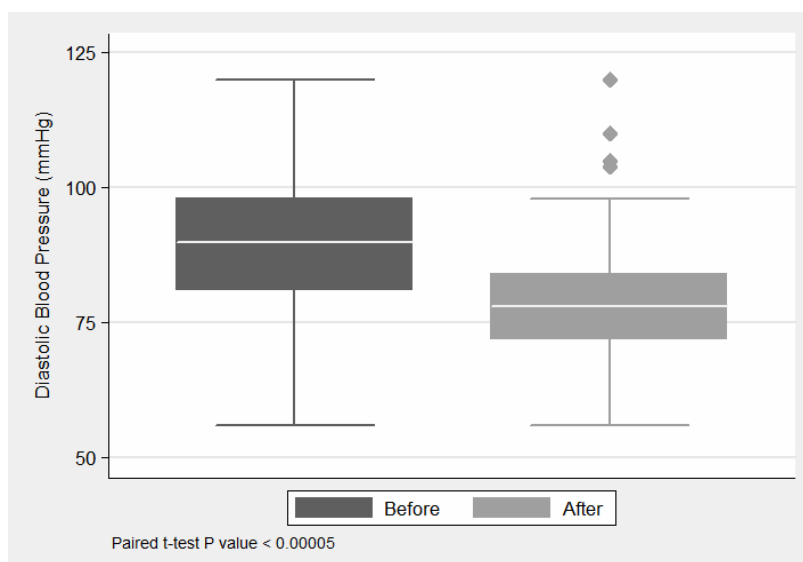
The three patients with medication-related hypertension were all chronic users of NSAIDs whose blood-pressure improved following NSAID withdrawal but all three still required antihypertensive medication.

Figure 1. Baseline and final *systolic* blood pressure represented by box plots



Note: The box indicates the interquartile range (IQR), and the line dividing the box the median value. The whiskers indicate values 1.5 IQR lower than the first quartile and 1.5 IQR higher than the third quartile, and dots any outlying values²²

Figure 2. Baseline and final *diastolic* blood pressure represented by box plots



Note: The box indicates the interquartile range (IQR), and the line dividing the box the median value. The whiskers indicate values 1.5 IQR lower than the first quartile and 1.5 IQR higher than the third quartile, and dots any outlying values²²

Mean number of antihypertensive drugs at baseline was 2.49 and at the final visit 3.16 (an increase of 0.67) (see table 2). The majority of patients had their medications adjusted which did not always mean an increase in the total number of drugs, but rather a change to more effective complementary combinations (20).

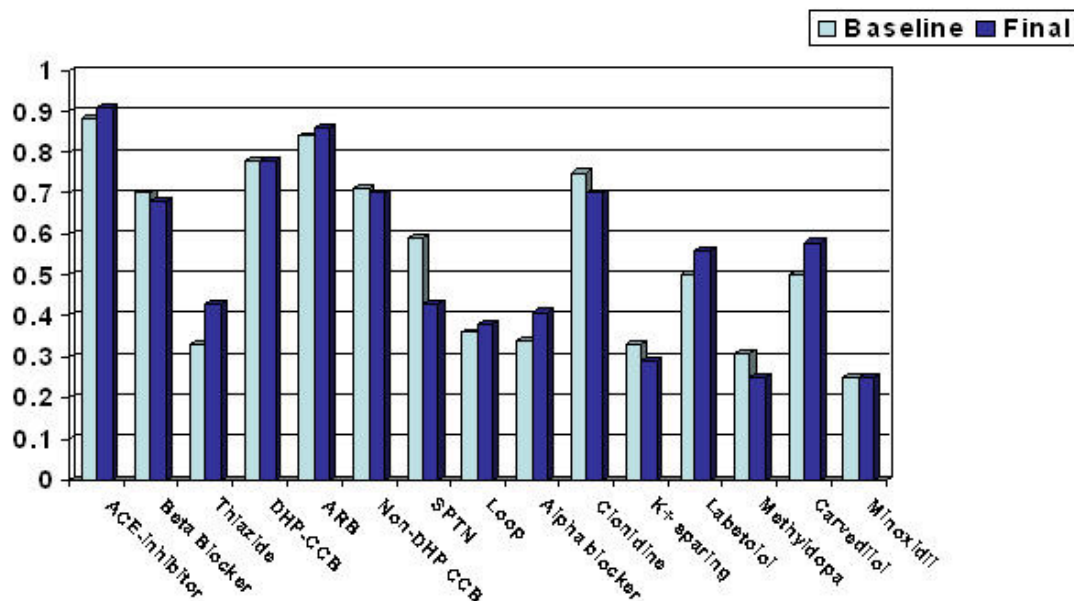
Mean dose of all drugs used averaged 0.68 at baseline and 0.676 at the final visit (see figure 3). The 6 most commonly prescribed medications at baseline were (in order of magnitude) ACE-inhibitors, beta blockers, thiazides, DHP CCBs, ARBs, and non-DHP CCBs (see Table 2). The 6 most commonly prescribed final drugs (in order of magnitude) were ACE-inhibitors, thiazides, beta blockers, DHP-CCBs, spironolactone, and ARBs (see Table 2). Among the 6 most commonly prescribed final drug classes, average dose only increased significantly (by 10%) in the case of thiazide diuretics (see figure 3), and reduced significantly in the case of spironolactone (by 33%);- the latter reflecting a small number of patients who were taking spironolactone at baseline in higher doses to treat heart failure, whereas all the new prescriptions for the drug were in the lower doses 12.5-25mg daily.

There was significantly increased prescribing of spironolactone (32 more patients), thiazides (16 more patients), ACE-inhibitors (13 more patients), and DHP CCBs (9 more patients). Average thiazide dosing per patient on that class of drug increased by 10% and most new thiazide prescribing was with chlorthalidone which is thought to be a more effective antihypertensive than hydrochlorothiazide or bendrofluazide (11–13). 16 patients were on a combination of thiazide and spironolactone.

Table 2. Antihypertensive drug use at baseline and discharge

Antihypertensive Drug Prescriptions	At Referral	At Discharge
ACE-Inhibitor	88 (58.6%)	101 (67.3%)
Standard beta blocker	73 (48.6%)	72 (48%)
Thiazide diuretic	69 (46%)	85 (56.6%)
DHP calcium channel blocker	46 (30.6%)	55 (36.6%)
Angiotensin receptor blocker	29 (19.3%)	28 (18.6%)
Non-DHP calcium channel blocker	23 (15.3%)	27 (18%)
Spironolactone	8 (5.3%)	40 (26.6%)
Loop diuretic	19 (12.6%)	19 (12.6%)
Alpha blocker	8 (5.3%)	11 (7.3%)
Clonidine	3 (2%)	5 (3.3%)
K ⁺ sparing	3 (2%)	7 (4.6%)
Labetolol	3 (2%)	4 (2.6%)
Methyldopa	4 (2.6%)	4 (2.6%)
Carvedilol	1 (0.66%)	3 (2%)
Minoxidil	1 (0.66%)	1 (0.66%)

Figure 3. Mean antihypertensive medication dosing by class as a percentage of maximum recommended daily dose



Total diuretic prescriptions (thiazide, spironolactone, frusemide, and K⁺sparing) increased from 99 to 151—and total renin-angiotensin system blocker (RAS-blocker) prescriptions (ACE-inhibitors + ARBs) from 117 to 129.

Aspirin and statin use increased from 55 (37%) and 57 (38%) respectively at baseline to 87 (58%) and 93 (62%) respectively with additional patients awaiting attention to this by their general practitioners. JBS 10 year risk of heart attack and stroke, taking into account drop in blood pressure only (but not modifications to lipids and smoking which weren't accurately quantified but which would have dropped the risk by a further significant amount) fell by a mean of 8% from 32% to 24%.

Discussion

The purpose of this new Difficult Hypertension Clinic was to fill a perceived gap in the specialist services currently available to Northland general practitioners—that is, a specialist clinic inviting referral of those patients with difficult or resistant hypertension, or those in whom a secondary cause is suspected.

This review of the first 150 referrals has established that a need does exist with average referral blood pressure being 162/89 in patients already taking an average of 2.49 antihypertensive drugs. Apart from their blood pressure, the referred patients were generally at high cardiovascular risk with >50% fulfilling the IDF criteria for metabolic syndrome and the majority having one or more markers of target organ damage.

In an average of 2.7 nephrologist-clinic visits and 2 nurse-clinic visits, the patients achieved a mean 24/11 fall in blood pressure with a mean increase of 0.67 medications to 3.16.

As in other reports, the chief cause of hypertension resistance was antihypertensive medication-related, and the chief medication issue was underprescription of diuretics.^{8,12,13} This relates both to underprescription of thiazides and in particular to underprescription of spironolactone, which is not currently in common use by Northland general practitioners.

Spironolactone is currently enjoying a revival of popularity with emerging evidence that it is a highly effective add-on (4th or 5th) drug in resistant hypertension with relatively few side effects if used at the currently recommended lower doses of 12.5–25 mg daily.^{14,15} It is a useful alternative when thiazides are not tolerated but can also be effectively combined with thiazides (at discharge 16 patients were on a thiazide/spironolactone combination).

RAS-blockers were probably also underprescribed in the referred patients—one of the core principles of hypertension management is that RAS blockade is required to make the majority of hypertensives salt-sensitive and their blood pressure will then respond in stepwise fashion to the addition of diuretics (20).

Apart from expertise with antihypertensive drug combinations, the Difficult Hypertension Clinic fulfills an important function in identifying secondary (treatable) causes of hypertension and also an ABPM service. ABPM is particularly valuable in identifying patients with white coat hypertension who do not require pharmacological therapy, and also in those with established hypertension on effective medication who also have a “white coat” effect and require ABPM to determine adequate antihypertensive control.

Given that hypertension is the most common modifiable risk factor for cardiovascular disease and death, it is the opinion of the author that, in New Zealand, management of hypertension is poorly taught both to medical students and to physician trainees. As a consequence there is no longer a critical mass of practitioners with both interest and expertise in this area. There is a case for incorporating it more formally in the training of both general practitioners and medical specialists, with the aim of producing a new generation of “hypertension specialists.”

According to the successful American Society of Hypertension model, this role can be undertaken by appropriately upskilled medical practitioners working in a variety of areas, including general practice.²¹

Summary

A review of the initial experience with a new Difficult Hypertension Clinic in a provincial hospital suggests that it is filling a previously unmet need. Some referrals might be avoidable in the future with appropriate GP upskilling on pharmacological management of hypertension, but it is felt that there will be an ongoing need for a specialist clinic of this sort.

The author would be delighted to hear from other New Zealand physicians or general practitioners interested in hypertension management or who might already be providing a similar service.

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Cardiovascular disease risk factor assessment and management in gout: an analysis using guideline-based electronic clinical decision support

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Abstract

Aim To assess the need for cardiovascular disease (CVD) risk management in patients with gout.

Methods We studied 100 consecutive patients referred to the rheumatology service for management of gout. CVD risk factor and management data were collected. PREDICT™ CVD decision support software was used to calculate Framingham 5-year CVD risk, and to analyse therapeutic targets.

Results Fifty-nine (59%) patients had a high (>15%) or very high ($\geq 20\%$) 5-year CVD risk. For those at high risk of CVD, target systolic blood pressure was achieved in 34%; target LDL-cholesterol in 49%, target HDL-cholesterol in 56%; and 81% did not smoke. For patients with diabetes, target HbA1c was reached in 40%. For high-risk individuals only 50% of eligible patients were on aspirin, 64% on beta-blockers, 53% statins, and 65% ACE inhibitors. There were no significant differences in duration of gout, presence of tophaceous disease, use of urate-lowering therapy or C-reactive protein between patients at high risk of CVD, and those with lower risk.

Conclusions Patients with gout referred to secondary care are at high risk for CVD, and have a large burden of modifiable risk factors. Implementation of CVD screening and management programs in these patients should have high therapeutic yield.

The diagnosis of gout has been identified as a risk factor for ischaemic cardiovascular disease (CVD) in primary care and population-based studies. In a study of the UK General Practice Research Database, patients with gout had a higher prevalence of coronary artery disease, and also diabetes, renal impairment, and hypertension, compared with control patients with osteoarthritis.¹ Similar findings were reported in a study of 12,000 patients attending Dutch general practices.² Community-based observational studies have confirmed that gout is associated with excess ischaemic CVD events.^{3,4}

In current clinical practice, treatment of CVD risk is based on the absolute likelihood of a CVD event, calculated using the Framingham risk tables.^{5,6} The aim of management in high-risk patients is then to treat all modifiable risk factors optimally.

The purpose of this study was to assess the need for CVD risk management in patients treated in secondary care for gout, through analysis of absolute CVD risk and the burden of modifiable CVD risk factors.

Methods

We studied 100 consecutive patients with gout from outpatient clinics and inpatient assessments at Middlemore Hospital and Auckland City Hospital, Auckland, New Zealand. All patients with gout met the Wallace criteria for diagnosis of gout.⁷ This study was approved by the Northern Region Ethics committee.

Baseline data including age, sex, ethnicity, disease duration, and tophus counts were obtained. Current medication and adverse events to prior therapy were noted. Established vascular risk factors such as previous ischaemic CVD events, hypertension, diabetes mellitus, dyslipidaemia, smoking status, and family history of CVD were recorded.

Ischaemic CVD was defined by the presence of either the following physician diagnosed conditions: angina, myocardial infarction, angiographically proven coronary artery disease, revascularisation procedures (percutaneous transluminal coronary angioplasty or coronary artery bypass graft surgery), transient ischaemic attack, ischaemic stroke or peripheral vascular disease.

Height (in cm), weight (in kilograms), waist circumference (in cm) and blood pressure were taken. Blood tests including fasting lipid studies (with calculated LDL-cholesterol), fasting glucose, serum creatinine, C-reactive protein, and serum urate were recorded. For patients with diabetes mellitus, the most recent HbA1c and urine albumin to creatinine ratio was noted.

The presence of the metabolic syndrome was also recorded, using the National Cholesterol Education Program's Adult Treatment Panel (NCEP/ATPIII).⁸ This defines the metabolic syndrome when at least three of the five following features are present: waist circumference ≥ 102 cm (men) or ≥ 88 cm (women), blood pressure ≥ 130 mmHg (systolic), or ≥ 85 mmHg (diastolic), HDL-cholesterol < 1.0 mmol/L (men) or < 1.3 mmol/L (women), serum fasting triglyceride > 1.7 mmol/L and serum fasting glucose ≥ 5.6 mmol/L.

The data for each patient were entered into the PREDICT™ CVD/DM decision support software, an electronic translation of the New Zealand Guidelines Group (NZGG) (2003) *Assessment and Management of Cardiovascular Risk* and the *Guidelines for the Management of Type 2 Diabetes*.^{9,10}

The guidelines incorporate recommendations for cardio protective diet, physical activity, weight management, smoking cessation, lipid modification, blood-pressure lowering, anti-platelet therapy and interventions for Type 2 diabetes and metabolic syndrome. The prediction model is based on the Framingham risk tables and reports the estimated 5-year risk of a CVD event for each patient. A representative screen for PREDICT™ is shown in Figure 1.

The PREDICT™ decision support software was also used to determine whether patients with gout were achieving CVD risk targets based on NZGG treatment recommendations. The following targets were recorded using the following recommendations: optimal body mass index (< 26 kg/m² in Polynesian patients and < 25 kg/m² in others), waist circumference (< 100 cm for men and < 90 cm for women), blood pressure (systolic < 130 mmHg and diastolic < 80 mmHg), and HDL-cholesterol (> 1.0 mmol/L). The LDL-cholesterol target was < 2.0 mmol/L for patients with previous coronary artery bypass graft surgery, and < 2.5 mmol/L for all other patients. Target HbA1c in patients with diabetes mellitus was < 7.0 %.

For each individual, current therapies were entered into the PREDICT™ decision support software. Recommendations regarding the use of aspirin, beta-blockers, ACE inhibitors or statins based on the treatment guidelines were generated, and compared with current therapies. Treatments were not considered to be recommended if contraindications or side-effects from the specified medications were present. Data comparison was by chi squared tests for dichotomous variables and Student t-tests for continuous variables on GraphPad Prism 4 software.

Figure 1. PREDICT screen

Results

Baseline characteristics—The baseline characteristics and laboratory values for the patients are shown in Table 1. The median disease duration was 10 years, and the majority of patients (63%) had established tophaceous disease.

Prevalence of CVD and 5-year CVD risk assessment—Fifty-one patients (51%) were at very high risk of a subsequent CVD event ($\geq 20\%$ risk of CVD events in 5 years). Thirty of the 51 patients had pre-existing ischaemic CVD, with 17 having a prior myocardial infarction or angina, 8 previous coronary revascularisation, 8 cerebrovascular disease, and 4 peripheral vascular disease (noting that some patients had more than one type of event). The remaining 21 patients at very high risk included 10 with diabetic nephropathy and 11 with a combination of factors to raise the CVD risk to $\geq 20\%$.

A further 8 (8%) patients were at high risk (16–19% risk), 20 (20%) at moderate risk (11–15% risk), and 21 (21%) at mild or low risk ($\leq 10\%$ risk). There was no difference in the prevalence of high CVD risk between ethnic groups; 39/71 (55%) of Polynesian

(NZ Māori or Pacific) patients were at high or very high risk, compared with 20/29 (69%) non-Polynesian patients (p=0.28).

Table 1. Baseline characteristics of patients with gout

Variables	N=100
Male sex, n (%)	78%
Age (years), median (range)	55 (24–84)
Ethnicity:	
European, n (%)	19%
*Pacific, n (%)	51%
NZ Māori, n (%)	20%
Other, n (%)	10%
Disease duration (years), median (range)	10 (0.5–35)
Diuretic use, n (%)	23%
Urate-lowering therapy, n (%)	80%
Tophaceous disease, n (%)	63%
Serum urate (mmol/L), median (range)	0.54 (0.17–0.91)
C-reactive protein (mg/L), median (range)	5 (<1–302)

*Mostly of Samoan, Tongan, Niuean, or Cook Islands origin.

Individual risk factors and the metabolic syndrome—CVD risk factors were frequently present in patients with gout (Table 2). Current hypertension was present in 60% of patients, and diabetes mellitus in 33%. The majority of patients (87%) met the NCEP/ATPIII criteria for the metabolic syndrome.

Table 2. Traditional CVD risk factors in all patients with gout

Variables	N=100
Male sex	78%
Family history of IHD	25%
Current smoker	19%
Diabetes mellitus	33%
Hypertension*	60%
Total cholesterol/HDL-cholesterol ratio ≥ 4.0	54%
Metabolic syndrome**	87%

*Defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg at the time of assessment;

**Defined by the NCEP/ATPIII criteria.

CVD risk and gout disease characteristics—The characteristics and pattern of gout were compared in patients at high or very high CVD risk and those at lower risk. As illustrated in Table 3, there were no significant differences in duration of gout, presence of tophaceous disease, use of urate-lowering therapy, or C-reactive protein between the two groups. Serum urate levels were lower in those at high risk, compared with lower risk groups.

Table 3. Gout disease variables in those with high CVD risk compared to lower risk groups

Variables	High risk N=59	Lower risk N=41	P value
Gout disease duration (years), mean (SD)	12.8 (9.9)	12.1 (7)	0.68
Diuretic use, n (%)	16 (27%)	7 (17%)	0.35
Urate-lowering therapy, n (%)	47 (80%)	33 (80%)	0.90
Tophaceous disease, n (%)	40 (68%)	23 (56%)	0.33
Serum urate (mmol/L), mean (SD)	0.51 (0.15)	0.58 (0.14)	0.04
C-reactive protein (mg/L), mean (SD)	36.3 (68)	22.2 (38)	0.19

CVD risk and therapeutic targets in high risk patients with gout—For the 59 patients with gout at high or very high risk of CVD (>15% in 5 years), we compared modifiable CVD risk factors with treatment guideline risk factor targets (Table 4).

Table 4. Modifiable risk factor targets in patients with gout at high or very high risk of CVD

(Each risk factor was compared with the guideline target)

Risk factor target*	Number (%) of patients achieving target, n=59 (unless stated)
BMI	5 (8%)
Smoking cessation	48 (81%)
LDL-cholesterol	29 (49%)
HDL-cholesterol	33 (56%)
Blood pressure	20 (34%)
HbA1c (in diabetics)**	12/30 (40%)

*See text for target values; **30/33 patients with diabetes were at high or very high risk of CVD based on risk table analysis.

Table 5. Recommended treatments in patients with gout at high or very high risk of CVD

(The number of patients receiving recommended treatment was compared with the total number of patients in whom treatment was indicated, based on treatment guidelines)

Treatment	Number (%) of patients receiving recommended treatment*
Aspirin	27/54 (50%)
Beta-blocker	16/25 (64%)
Statin	24/45 (53%)
ACE inhibitor	28/43 (65%)

*Treatments were not considered to be recommended if contra-indications or side-effects from the specified medications were present.

Recommended targets for BMI, blood pressure, lipids, and HbA1c were frequently not attained in the patients with gout. Similarly, many patients were not receiving recommended treatments to reduce CVD risk (Table 5). Of note, one-half of patients at high or very high risk were not receiving recommended aspirin therapy. There were similar, although less striking, omissions in the use of statins, beta-blockers, and ACE inhibitors.

Discussion

This study has shown that the majority of patients with gout treated in secondary care are at high risk for cardiovascular events, due to pre-existing CVD and a high burden of modifiable risk factors. The importance of individual risk factor assessment in patients with gout has recently been recognised in the EULAR management guidelines for gout.¹¹ However, our data suggest that cardiovascular risk is frequently under-appreciated or not addressed as part of clinical management of the patient with gout.

The high prevalence of CVD in patients with gout in this secondary care study is consistent with studies of gout in primary care and in the community. We believe that our results are particularly relevant to physicians treating patients with severe gout in secondary care. The majority of patients with gout in our study had long-standing tophaceous disease, representing the more severe spectrum of disease that is typical of patients with gout referred to secondary care. However, our results do not indicate that high CVD risk is associated with severe gout, as defined by number of tophi, disease duration, or serum urate levels. Therefore, based on this analysis, we believe that all patients with gout should be formally assessed for CVD risk.

The high prevalence of established CVD in patients with gout is particularly interesting, given the expanding literature on CVD risk in inflammatory rheumatic disease, such as rheumatoid arthritis (RA).^{12,13} Absolute risk calculation using conventional risk factors based on Framingham data may underestimate the degree of cardiovascular risk in RA.¹⁴ Despite these observations, comprehensive screening for and treatment of traditional cardiovascular risk factors in RA is recommended.^{15,16} It seems likely that compared with RA, the mechanisms of CVD in gout may be more closely associated with traditional modifiable risk factors such as hypertension, obesity, diabetes, and dyslipidaemia.

A potential limitation to the general relevance of this study is that the many of our patients are of Māori or Pacific ethnicity, reflecting the high prevalence of severe gout in these populations.^{17,18} However, we have not identified differences in the prevalence of CVD or the metabolic syndrome in particular ethnic groups, suggesting that our findings can be generalised to other populations. Data from other units to confirm our findings would be of great interest. Furthermore, this study reports results from a single city, and clinical practice may differ in other geographical locations. However, these findings are in keeping with recent publications from the US and Europe indicating that management of patients with gout is frequently suboptimal.^{19,20}

The majority of our patients with gout also have the metabolic syndrome which is characterised by central obesity, hypertension, dyslipidaemia, impaired glucose tolerance, and associated with increased risk of CVD events and mortality.²¹ These results are consistent with previous reports of patients with gout.²²

The strong association with the metabolic syndrome should draw attention to investigation of other components of the metabolic syndrome in patients with gout. Lifestyle modification with weight loss and regular exercise is a cornerstone of management of the metabolic syndrome.²³

In an open pilot study of patients with gout, weight loss achieved by a moderate calorie/carbohydrate restricted diet was also associated with significant improvements in both hyperuricaemia and frequency of acute gout attacks.²⁴ Together, these observations emphasise the importance of weight management and dietary modification to manage articular disease and also CVD risk in gout.

Pharmaceutical management of CVD risk may be particularly challenging in this population. Due to the associated co-morbidities, polypharmacy is a frequent occurrence, and may lead to poor medication compliance.²³ Furthermore, treatment in patients with gout requires consideration of management of both hyperuricaemia and overall CVD risk. For example, when considering choice of anti-hypertensive agents, thiazide diuretics may contribute to hyperuricaemia, despite controlling hypertension.

The choice of losartan or amlodipine for both blood pressure and urate-lowering may be particularly beneficial for those with both gout and hypertension.^{25,26} Low-dose aspirin may contribute to hyperuricaemia by influencing renal tubular excretion of uric acid.²⁷ However, in recognition of the proven benefits of aspirin, we do not believe that the use of aspirin should be restricted in patients with gout at high risk of CVD events.²⁸

Our data indicate that screening for CVD risk and intensive management of modifiable risk factors should have high yield in patients with gout. A range of strategies including weight reduction, diet modification and appropriate pharmacotherapy should be considered when managing these patients. However, risk calculation and determination of appropriate treatment strategies can be time consuming in a busy clinic setting.

In this study, decision support software has provided a rapid method to quantify overall CVD risk and also determine guideline based therapy to minimise this risk.

In summary, patients with gout treated in secondary care are at high risk for CVD and have a large burden of modifiable risk factors. Management of this risk is frequently suboptimal. Implementation of CVD screening and management programs in these patients should have high therapeutic yield.

Competing interests: None known.

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A survey of thyroid function test abnormalities in patients presenting with atrial fibrillation and flutter to a New Zealand district hospital

David D W Kim, Simon Young, Rick Cutfield

Abstract

Aim Subclinical and overt hyperthyroidism is a known trigger of atrial fibrillation and flutter (AF). We wanted to see if thyroid function tests (TFT) were being requested appropriately in patients with atrial fibrillation or flutter at North Shore Hospital, and how common subclinical or overt hyperthyroidism was in our local inpatient population presenting with AF.

Method Clinical data on 250 patients admitted to North Shore Hospital with a history of AF was retrospectively analysed, including prior history of thyroid dysfunction, measurement of TFT and their results at the time of admission, subsequent management of subjects with abnormal TFT, and the association of amiodarone treatment or use of radiocontrast with TFT derangements.

Results Of the 250 patients analysed, only a small (7.2%) proportion had known thyroid dysfunction prior to admission, most of whom had hypothyroidism on thyroxine replacement. Although the majority (77%) of AF patients had had TFT checked either at the time of admission or in the prior 6 months, a significant proportion (23%) had not. Of the patients in whom TFT were performed, 82% were normal. Abnormalities included subclinical hyperthyroidism (2.1%), overt hyperthyroidism (3.1%), subclinical hypothyroidism (11%), and overt hypothyroidism (1.6%).

Conclusion Despite a relatively low frequency, hyperthyroid conditions in patients presenting to North Shore Hospital with AF were sufficiently prevalent to continue recommending TFT assessment in these patients. Although the majority of AF patients were being adequately screened with TFT, a significant proportion was not, and those with abnormalities were not well followed up.

Hyperthyroidism is a known risk factor for atrial fibrillation and flutter (AF),¹⁻³ and can aggravate ischaemic heart disease and heart failure.^{2,4} It is therefore generally recommended that thyroid function tests (TFT) be checked on a routine basis in patients with new onset AF, poorly rate controlled AF and recurrences of AF,^{5,6} since abnormalities are relatively easy to treat and may help control and stabilise cardiac disease. However, it is not clear how commonly AF is related to thyrotoxicosis in people presenting to hospital.

Amiodarone, a frequently used drug in the treatment of AF, can have direct toxic effects on thyroid cells and has high iodine content that can interfere with normal thyroid function. Both overactive and under-active thyroid dysfunction have been

well described with use of amiodarone.^{7,8} Therefore, when amiodarone is being considered, it is recommended to measure TFT before and during its use.⁹

Iodine-based radiocontrast similarly can cause thyroid dysfunction and the prevalence of its recent use in patients with AF is not well described.

This audit was conducted in patients with AF presenting to North Shore Hospital (NSH) in Auckland, New Zealand, to evaluate how often TFT were requested, the prevalence and subtype of thyroid disease, adequacy of management of thyroid dysfunction, and the possible relationship to the recent use of amiodarone and radiocontrast.

Method

300 consecutive patients were selected from the NSH AF registry. The registry was compiled in 2006 by the NSH Cardiology department for a study to review AF prevalence and management. Patients were retrospectively collected by screening discharge coding. These patients had been admitted to NSH between August 2005 and March 2006 with a diagnosis of atrial fibrillation or flutter. Of the 300, data of 250 patients who had 'active management issue of AF' during the encounter admission was included in the analysis. Active management issue of AF was defined as either; AF being the reason for admission; or a rate control issue during the admission; or a paroxysm or an episode of AF during the admission. The 50 who were excluded had chronic AF with adequate rate control, hence no routine indication for TFT.

Patients' computerised clinical records were retrospectively reviewed and analysed. The data collected include patient's age, gender, ethnicity, known thyroidal illness prior to admission, presence of TFT results, the actual TFT results, and concurrent use of amiodarone. If TFT were abnormal, the presence of thyroid auto-antibody results was sought, as well as records of recent (<3 months) radiocontrast use, and whether appropriate management of the abnormal TFT was undertaken (including a referral to or advice from endocrinology service, appropriate change in thyroid drug therapy, or a plan for appropriate follow up laboratory monitoring). The data analysed was that collected at the time of the admission from which the patient was enrolled into the AF registry.

Thyroid function results were interpreted and categorised into five groups. Subclinical hyperthyroidism if suppressed TSH <0.10 mU/L with normal T4 and T3; overt hyperthyroidism if suppressed TSH <0.10 mU/L with elevated T4 and/or T3; subclinical hypothyroidism if TSH >4.0 mU/L with normal free T4 (and T3 if performed); overt hypothyroidism if TSH >4.0 mU/L with depressed T4; and euthyroid if none of the above.

Finally, prevalence of thyroid dysfunction in our selected population was compared to other population survey data, and Chi-squared test was used to evaluate the statistical differences in the prevalence.

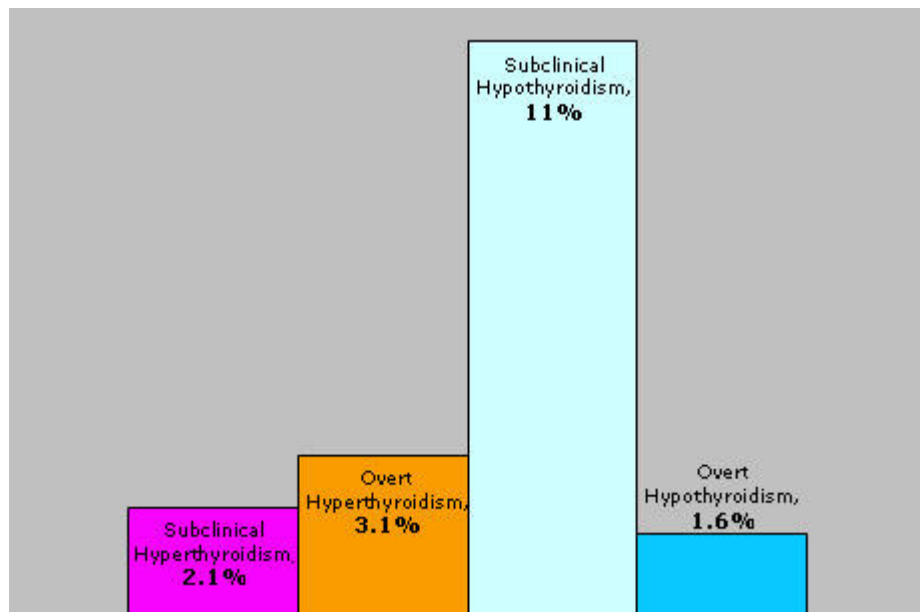
Results

Patients with AF had a mean age of 71 years (22 to 93 years) with a 50% male/female split. Ethnic breakdown showed a predominance of Caucasians with 62% being New Zealand European, 26% other European, 6.8% Maori/Pacific Islanders, 1.6% Asian, and 2.4% other ethnicity. This likely represents population characteristics of NSH catchment area for this age group.

Eighteen of 250 patients (7.2%) had a known background diagnosis of thyroid dysfunction prior to the admission. Sixteen of them had hypothyroidism on thyroxine replacement.

23% of patients had not had TFT recorded either during the encounter admission, or in the preceding 6 months. Of those who had thyroid function measured, 90% had them taken at the time of admission.

Figure 1. Types and percentage of thyroid function test abnormalities



Of the 192 patients who had TFT measured, 34 (18%) had some abnormality. Subclinical hyperthyroidism was noted in 4 (2.1%) and overt hyperthyroidism in 6 (3.1%). Of these 10 patients (5.2%), mean age was 67 years, male to female ratio was 1:2.3. Seven were newly discovered, while three had known hypothyroidism on thyroxine replacement. Subclinical hypothyroidism was noted in 21 (11%) with overt hypothyroidism in three (1.6%). Two of the 21 with subclinical hypothyroidism, and one of the three with overt hypothyroidism, had previously known hypothyroidism on thyroxine treatment.

Of the 34 patients with abnormal TFT, 2 (5.9%) had thyroid antibody checked, and 10 (29%) had appropriate management as defined in methods above.

Of the 250 AF patients, 12 (4.8%) were on amiodarone at the time of presentation. Of these, 11 (92%) had TFT checked during the encounter admission or prior 6 months. One patient was diagnosed with amiodarone induced hyperthyroidism, and this was thought to have contributed to poor rate control of AF. One of the 12 patients on amiodarone had known hypothyroidism and was biochemically euthyroid on thyroxine replacement.

Seven (21%) of the 34 patients with abnormal TFT had received recent (<3 months) radiocontrast. The majority were related to computed tomography (CT) scans. Of these 7 patients, 6 had subclinical hypothyroidism and one had subclinical hyperthyroidism.

Discussion

To our knowledge, this is the first published data describing the prevalence of thyroid dysfunction in patients with AF presenting to a general hospital in New Zealand.

The rates of newly diagnosed subclinical (2.1%) and overt hyperthyroidism (3.1%) in our study were higher than one would expect from general population prevalence surveys. These general population surveys,^{1,10–12} which looked at prevalence of thyroid dysfunction in community dwelling subjects of similar age group as our study, have shown prevalence of overt hyperthyroidism of 0.2–0.6% and subclinical hyperthyroidism of 1.3–2.1%. However, these studies did not look specifically at a population of patients hospitalised with AF like ours. The higher prevalence of overt hyperthyroidism was not surprising given the known effects of hyperthyroidism upon the cardiovascular system.

Nevertheless, as a possible contributing cause of AF in hospital patients, hyperthyroidism, overt or subclinical, was not present in 95%, and even in the 5% in whom it was found, it may not have been the only cause. We have no details on other possible contributing factors to the development of AF in these patients.

The significantly higher rate of subclinical hypothyroidism (11%), could have been a transient phenomenon in some cases in the context of non-thyroidal illness. However, it is of interest that a similar prevalence (15%) was found by Cappola *et al*¹ in a community survey of 3233 over 65 year olds in the United States. Our rate of overt hypothyroidism was 1.6%, slightly higher than that found in the community prevalence studies mentioned above.

In our survey, most patients with abnormal TFT were not followed up appropriately. While only a minority needed referral in some way to the endocrinology service, it is reasonable to expect at least arrangements for follow-up TFT, and many did not have this. Thyroid antibodies were rarely checked. While their measurement might not add much to clinical management, their presence helps confirm possible autoimmune thyroid disease and can help guide follow up, especially in those with subclinical hypo and hyperthyroidism.

Amiodarone was not commonly implicated as a cause of abnormal TFT in our study. Only 12 patients (4.8%) were on amiodarone and only one had overt hyperthyroidism. While recent exposure to radiocontrast was common (21%) in subjects with abnormal TFT, clinical relevance of this was not totally clear.

Our data shows that we would need to screen nearly 20 people to detect one case of either overt or subclinical hyperthyroidism in patients presenting with AF. This would cost about NZ\$200 if both TSH and T4 are used for screening.

Checking for hyperthyroidism in patients with AF is clinically important. While there is controversy over the management of subclinical hyperthyroidism, there is less disagreement in the setting of atrial fibrillation. Management of overt hyperthyroidism is uncontroversial in the setting of AF especially in the elderly.

In summary, our survey of a district general hospital showed that 5.2% of patients presenting with AF had clinical or subclinical hyperthyroidism. There was a significant prevalence of other types of thyroid dysfunction. It seems reasonable to continue to recommend TFT screening in patients presenting with AF.

Competing interests: None known.

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Bleeding events in patients receiving enoxaparin for the management of non-ST-elevation acute coronary syndrome (NSTEMACS) at Dunedin Public Hospital, New Zealand

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Abstract

Aim To determine the incidence of bleeding associated with the use of enoxaparin in NSTEMACS at Dunedin Public Hospital (DPH) and to identify bleeding risk factors in this patient group.

Methods A case-control retrospective review of clinical notes was undertaken. NSTEMACS admissions in 2005 where a bleeding event occurred were identified and matched with controls (matched for age and sex). The incidence of Thrombolysis in Myocardial Infarction (TIMI) minor and major bleeding, not related to cardiac surgery, was determined. Univariate and multivariate analyses were used to identify risk factors for all bleeding events.

Results There were 446 eligible NSTEMACS admissions (409 patients), of which 47 bleeding events (10.5%) were reported. Eight events (1.8%) were major according to the TIMI bleeding classification. Three risk factors were identified: renal function, the duration of enoxaparin therapy, and medical conditions involving haemostasis. Renal impairment and the duration of enoxaparin therapy were found to be significant predictors of bleeding ($p=0.036$ and $p=0.008$, respectively).

Conclusions The incidence of bleeding in NSTEMACS patients treated with enoxaparin at DPH is comparable to that reported in the literature. Renal impairment and prolonged treatment with enoxaparin were significantly associated with an increase in bleeding risk.

Enoxaparin is a low-molecular weight heparin (LMWH) with a mean molecular weight of 4500 Da.¹ LMWHs are parenteral anticoagulants used in the management of thrombosis. They work mainly by inhibiting activated factor X (Xa) thus interfering with the coagulation cascade.²

When compared with unfractionated heparin (UFH) in the treatment of venous thromboembolism and acute coronary syndrome, LMWHs have demonstrated greater effectiveness without an increased risk of complications such as bleeding.³⁻⁵ Consequently, LMWHs have been increasingly used due to their more predictable dose-effect relationship and higher subcutaneous bioavailability.⁶

In New Zealand, the treatment dose of enoxaparin is based on body weight (1 mg/kg) and the dosing frequency is based on renal function where an impaired function (creatinine clearance <30 mL/min) warrants a once daily dosing instead of twice daily.⁷ In Dunedin Public Hospital, individual doses are capped at 100 mg.

Non-ST-elevation acute coronary syndrome (NSTEMACS) is a cardiac condition that can lead to myocardial infarction and death.⁸ NSTEMACS has two clinical presentations: unstable angina (UA) and non-ST-elevation myocardial infarction (NSTEMI). LMWHs are currently recommended in the pharmacological management of NSTEMACS⁹ and have superseded UFH in this regard.¹⁰ Enoxaparin has become the LMWH of choice in this patient group due to supporting clinical trial evidence.^{11–13}

Haemorrhage is an important complication of heparin therapy. Major bleeding is reported as an independent predictor of short- and long-term rates of death in patients presenting with acute coronary syndrome.^{14,15} Bleeding is also associated with increased cost and longer duration of hospital stay.^{16,17} Evidence suggests an increased relative risk of major bleeding with enoxaparin compared to UFH.^{18,19} The incidence of major bleeding with enoxaparin in NSTEMACS management is reported at around 1–2%,^{4,20,21} whereas minor bleeding incidence is reported at around 9–12%.^{4,21}

Various bleeding risk factors have been identified in the literature including advanced age, renal insufficiency, co-administered non-steroidal anti-inflammatory drugs (NSAIDs), and cardiac catheterisation.^{17,22,23} The number of enoxaparin doses administered has been found to be independently associated with an increased bleeding risk.²³ A similar association was found with enoxaparin dose, where excessive dosing (defined as a weight-based dose over 1.05 mg/kg) resulted in an increased incidence of bleeding.²⁴ Also, dose-finding studies with enoxaparin, such as the Thrombolysis in Myocardial Infarction (TIMI) 11A trial²⁰, have illustrated that increasing the dose is associated with increased anti-Xa activity and an increased rate of major bleeding.²⁵ Furthermore, evidence suggests that lower mean arterial pressure increases the risk of major bleeding²² and procedural hypotension has been identified as a strong predictor of major bleeding;¹⁷ perhaps caused by a resultant organ hypoperfusion which can adversely affect the coagulation system and platelet function. However, bleeding itself may be associated with a decrease in blood pressure hence this evidence needs to be interpreted with caution.

Data from the GUSTO IV-ACS (Global Use of Strategies to Open Occluded Arteries in Acute Coronary Syndromes) analysis demonstrated that female sex was a predictor of major bleeding in NSTEMACS patients.²⁶ Additionally, a bleeding history was reported as an independent predictor of bleeding in this patient group.²²

The aims of this study were to determine the incidence of minor and major bleeding events not related to cardiac surgery in NSTEMACS patients at Dunedin Public Hospital where one or more treatment doses of enoxaparin were given; and to identify risk factors that may have contributed to bleeding in this patient group.

Methods

This retrospective chart review was conducted at Dunedin Public Hospital. It was approved by the Lower South Regional Ethics committee and the Otago District Health Board with consultation with the Maori Ngāi Tahu Research Consultation Committee.

The classification of bleeding was based on the TIMI 11B trial.²¹ Major bleeding was defined as overt bleeding resulting either in death; a bleeding in a retroperitoneal, intracranial, or intraocular location; a haemoglobin drop of ≥ 30 g/L; or the transfusion of ≥ 2 U of blood. Minor bleeding was defined as any bleeding episode other than major bleeding such as epistaxis, ecchymosis or haematoma, or macroscopic haematuria.

Ten patient and clinical characteristics were identified, *a priori*, as bleeding risk factors in NSTEMI patients who received one or more treatment doses of enoxaparin. These were: age; sex; blood pressure; medical conditions affecting haemostasis; concomitant drugs with a bleeding risk (antiplatelets, anticoagulants, NSAIDs, steroids, or alternative medicines such as garlic); enoxaparin dose and duration; renal function (using the Cockcroft-Gault equation); cardiac catheterisation; loading dose of clopidogrel; and co-administration of glycoprotein IIb/IIIa (GP IIb/IIIa) inhibitors. For each bleeding risk factor (i.e. variable), 10 positive subjects (cases) and 10 negative subjects (controls) were required to obtain sufficient sample size for logistic regression.²⁷

All NSTEMI admissions between 1 January and 31 December (2005) were identified using the programme PL/SQL (Procedural Language/Structured Query Language) and the International Classification of Diseases (ICD-10) coding system. Of these, admissions where a bleeding event occurred were identified by using ICD-codes for bleeding.

Admissions were categorised as minor bleeding, major bleeding, or excluded. Once all admissions were recorded, matched controls according to age and sex were obtained and patient and clinical data for these admissions were collected. A one-page data collection form was designed and used to collect this data.

In-house electronic databases, namely iSOFT (IBA Health Ltd) and CardioBase (Magnus Medical Software), were used to retrieve laboratory results and procedural reports when needed. Admissions were excluded if: no treatment dose of enoxaparin was administered; patient was under the age of 18 years; patient received a treatment dose of enoxaparin for a condition other than NSTEMI; enoxaparin was administered intravenously; bleeding occurred post cardiac surgery; and/or a bleeding event occurred but could not be attributed to NSTEMI treatment (e.g. bleeding from a stump following an amputation).

Univariate analysis was used to screen risk factors for significance at the $p < 0.2$ level. Risk factors with $p < 0.2$ in the univariate analysis were included in a multivariate logistic regression analysis to identify predictors of bleeding at the $p < 0.05$ level of significance. Data analysis was performed using SAS/STAT® software (SAS Institute Inc., Cary, NC, USA.).

Results

There were 684 admissions (603 patients) in 2005 at DPH where a NSTEMI diagnosis was made. Of these, a bleeding event was identified using the ICD-10 coding system in 187 admissions (169 patients). Forty-seven bleeding admissions (46 patients) were included in this study where a TIMI bleeding event could be attributed to enoxaparin treatment. The remaining 139 admissions did not meet the study criteria and were excluded. Reasons for exclusion are summarised in Table 1. The clinical notes of one admission were missing.

Table 1. Reasons for exclusion from the study

Reason for exclusion	Number of admissions excluded
No treatment dose of enoxaparin administered	82
Bleeding due to surgery (e.g. CABG*)	39
Patient anaemic or already bleeding prior to enoxaparin administration	16
NSTEMI diagnosis unconfirmed	1
Enoxaparin administered intravenously	1

*Coronary artery bypass grafting

No bleeding events were reported in 497 NSTEMI admissions (434 patients). Of these, 47 admissions (46 patients) were randomly matched with the 47 bleeding cases.

Matching was based on age and sex. The clinical and laboratory characteristics of cases and controls are presented in Table 2.

Table 2. Clinical and laboratory characteristics of cases and age- and sex-matched controls

Characteristics	Results: Median (range) or number (%)	
	Cases	Controls
Number of admissions (number of patients)	47 (46 patients)	47 (46 patients)
Age in years	71 (39–94)	71 (40–90)
Females	17 (37%)	17 (37%)
Māori	1 (2.1%)	2 (4%)
Body mass index in kg/m²	26.6 (18.6–39.1)	27.5 (16.3–41.1)
Diagnosis:		
UA	18 (38%)	20 (43%)
NSTEMI	29 (62%)	27 (57%)
Medical condition(s) involving haemostasis	8 (17%)	2 (4.3%)
Concurrent use of drugs affecting haemostasis:		
Antiplatelets	36 (76.6%)	35 (74.5%)
Anticoagulants	9 (19.1%)	2 (4.3%)
NSAIDs	4 (5.8%)	1 (2.1%)
Others (complimentary medicines)	0 (0%)	0 (0%)
Mean arterial pressure in mmHg	86.3 (68.3–13.3)	89.3 (65–120.3)
Creatinine clearance (CLcr) in mL/min:	54 (19–106)*	60 (14–123)
Enoxaparin dose and treatment duration:		
Dose in mg	80 (45–150)	80 (40–130)
Number of doses given	6 (1–22)	3 (1–14)
Treatment duration in days	4 (1–11)	2 (1–8)
Appropriateness of enoxaparin dosing:		
Inappropriate doses based on CLcr	2 (4%)	1 (2.1%)
Inappropriate doses based on actual weight:		
Underdosing (by more than 5 mg)	8 (17%)	12 (26%)
Excess dosing (by more than 5 mg)	5 (11%)	2 (4%)
Interventions:		
Cardiac catheterisation	37 (79%)	35 (74%)
Aspirin	34 (72%)	29 (62%)
Clopidogrel	28 (60%)	30 (64%)
GP IIb/IIIa inhibitors	8 (17%)	9 (19%)
Loading dose of clopidogrel:		
600 mg	6 (13%)	10 (21%)
Type of TIMI bleeding:		
Minor	39 (83%)	Nil (0%)
Major	8 (17%)	Nil (0%)

*One patient was excluded from the CLcr analysis due to a calculated value of 180 mL/min. This was considered to be an over-estimate of renal function as patient suffered from muscle atrophy due to multiple sclerosis.

Of the 684 NSTEACS admissions in 2005, 446 satisfied the inclusion criteria (enoxaparin was not administered in 237 admissions and clinical notes were missing for one admission). Bleeding was reported in 47 admissions (10.5%) of which 8 (1.8%) were classified as major bleeding and 39 (8.7%) as minor bleeding.

Four dose adjustments, based on CLcr, were made in each group (i.e. dose reduced to once daily when CLcr <30 mL/min). Two dose adjustments were required in the bleeding group but were not made (versus one in the control group).

As illustrated in Table 2, eight cases were given an underdose while 12 controls were underdosed. Underdosing was defined as a dose which was more than 5 mg below the recommended 1 mg/kg of body weight. Five cases were given an excess dose as opposed to two controls. Excess dosing was defined as a dose which was more than 5 mg above the recommended 1 mg/kg of body weight. One case was given 1.5 mg/kg once daily while another received an uncapped dose of 130 mg (weight was 125 kg).

Risk factors for any bleeding, based on a univariate analysis, are presented in Table 3. Models were conditional logistic regression models with the outcome being bleeding. There were four variables (in bold) that were considered to be of interest (p<0.2). These were: creatinine clearance, the number of enoxaparin doses given, the duration of enoxaparin therapy, and a haemostasis-related medical history.

Table 3. Risk factors for any bleeding (univariate analysis)

Predictor	OR*	Lower 95% CI	Upper 95% CI	p value
Mean Arterial pressure	0.977	0.938	1.017	0.254
Regular oral antiplatelets	0.867	0.412	1.823	0.706
Enoxaparin dose	1.000	0.970	1.030	1.000
CLcr	0.965	0.935	0.996	0.029
Number of enoxaparin doses	1.220	1.067	1.396	0.004
Duration of enoxaparin (days)	1.461	1.138	1.875	0.003
Medical history	7.000	0.861	56.895	0.069
Cardiac catheterisation	0.750	0.260	2.162	0.594
Clopidogrel loading dose (600 vs. 300 mg)	3.000	0.312	28.841	0.341
GP IIb/IIIa inhibitors	1.143	0.414	3.152	0.796
Stat dose aspirin	0.643	0.278	1.485	0.301
Acute diagnosis (UA vs. NSTEMI)	1.143	0.558	2.342	0.715
Body Mass Index	0.992	0.889	1.108	0.892
Regular anti-platelets + stat dose aspirin + clopidogrel treatment	1.031	0.634	1.677	0.901
Regular anti-platelets + stat dose aspirin + clopidogrel treatment + NSAIDs	1.122	0.700	1.797	0.633

*OR=odds ratio.

Due to small cell numbers, a stable model using regular oral anticoagulants as a predictor could not be constructed using standard or exact logistic regression analysis. The number of enoxaparin doses given and the duration of enoxaparin treatment were highly correlated (r=0.97); the duration of enoxaparin treatment in days was used in the multivariate analysis.

Using a forward stepwise logistic regression model starting with all the predictors from the univariate model, three variables were included in the multivariate analysis. These were: creatinine clearance, the duration of enoxaparin therapy, and a haemostasis-related medical history (Table 4). Both the duration of enoxaparin treatment and CLcr were found to be significant predictors of bleeding.

Table 4. Risk factors for any bleeding (multivariate analysis)

Predictor	OR	Lower 95% CI	Upper 95% CI	p value
Medical history	5.64	0.607	52.273	0.128
CLcr	0.95	0.911	0.997	0.036
Duration of enoxaparin (days)	1.43	1.10	1.86	0.008

Discussion

NSTEACS admissions in 2005 at DPH were reviewed. There were 446 admissions (409 patients) where a treatment dose of enoxaparin was given. A total of 47 admissions where a bleeding event occurred (10.5%) were reported. Thirty-nine events (8.7%) were identified as minor and eight events (1.8%) as major according to TIMI bleeding classification. These numbers are comparable to those reported in other studies.^{4,20–22}

The TIMI bleeding classification used in this study was similar to that used in the TIMI 11B trial²¹ which was one of the first trials to study bleeding complications associated with enoxaparin in NSTEACS patients. This classification lends itself to retrospective reviews because assessment of bleeding events is largely based on laboratory tests.

Cases were then matched with 47 admissions where a bleeding event was not reported. The two groups studied were matched for age and sex, thus analysis of the effect of age or sex on bleeding could not be carried out in this study. Cases and controls were matched for age and sex because these are well reported risk factors for bleeding,^{22,26} therefore other more subtle risk factors could be identified.

Minor and major bleeding events were combined because the number of events was too low for separate analyses. Previous trials that explored bleeding risk factors have reported either on all bleeding events (i.e. minor and major) or major bleeding events.^{17,22–24} However, one trial specifically identified cardiac catheterisation as a risk factor for minor bleeding.²¹

Renal impairment marginally increased the risk of bleeding (OR=0.95). This occurred despite the fact that CLcr-based dose adjustments were carried out in accordance to the product datasheet (only two necessary dose adjustments in the bleeding group were not made versus one in the control group). It raises the question whether the current dosing guidelines of enoxaparin in renal impairment are sufficient to prevent complications. The current guidelines view CLcr as a dichotomy where a patient with a CLcr of 29 mL/min will receive a dose once daily whereas a patient with a CLcr of 30 mL/min will receive a dose twice daily.

Eight cases and two controls had a medical history of prior bleeding which is considered a predictor of bleeding.²² However, the difference in this review did not reach statistical significance in the logistic regression analysis probably due to the small number of patients involved.

There was not enough data to test the impact of enoxaparin excess dosing on bleeding risk. Five cases were given an excess dose (versus two controls). Fixed-mass

difference approach was used instead of percentage-mass difference in order to compare current practice at DPH to the guidelines. Macie et al used a value of $\leq 10\%$ of body weight to define dose deviation in a retrospective study that is very similar to this review.²³ Using fixed-mass difference has its limitations, however, in that the disparity in dose deviation between extreme weights is a moving margin of error. A 5 mg difference of dose in a 100 kg person represents approximately a 5% difference whereas a 5 mg difference of dose in a 50 kg person represents a 10% difference. Further investigation on the impact of excess dosing in clinical practice would be of interest.

One case received an uncapped dose of 130 mg (weight was 125 kg). Dose capping was not examined specifically in this study but it is used routinely at DPH. Capping at 100 mg is arbitrary and may have been introduced following the dose capping of the LMWH dalteparin in the FRISC trial.²⁸ Dose capping is not recommended by the manufacturer of enoxaparin and is not supported by the literature.²⁹ Perhaps a more meaningful approach is to individualise the dose of enoxaparin based on patient's size. Individualising enoxaparin dosing based on patient's lean body weight and renal function was found to decrease bleeding and bruising events when compared to conventional dosing in a randomised controlled trial.³⁰

All patients included in this study were identified using the ICD-10 coding system. The patient records department uses the 3M Coding & Grouping application software (The Encoder) to process the codes allocated by the clinical coders from the documentation in the clinical records. There are validation procedures built into the Encoder software. In all admissions where a bleeding was identified using the ICD-10 coding system, a bleeding event was recorded in the patient's notes. Also, bleeding was not recorded in any of the admissions where a bleeding event was not coded for.

As this was a retrospective study, it was difficult to assess the nature of bleeding events recorded following cardiac catheterisation. Clinical notes did not always include an adequate description of the bleeding that occurred. For example, it was not always possible to verify whether a groin haematoma occurred at or distant to the site of sheath insertion following an angiography. A haematoma is expected to occur at the site of insertion and this was not considered a bleeding event for the purpose of this study.

In conclusion, renal impairment and prolonged treatment with enoxaparin were found to be significant predictors of bleeding. This should be interpreted within the clinical context and treatment should be individualised according to patient need for anticoagulation, but these findings suggest caution is needed when enoxaparin is administered to patients with renal insufficiency and/or for a prolonged period of time. Moreover, the current dosing guidelines in renal impairment may be inadequate to minimise bleeding risk.

Competing interests: None known.

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Acute rheumatic fever in the Waikato District Health Board region of New Zealand: 1998–2004

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Abstract

Aim To outline the epidemiology and clinical pathway of acute rheumatic fever (ARF) cases in the Waikato District Health Board (DHB) region of New Zealand.

Method An audit was carried out of the clinical notes of all recognised ARF cases from 1998 to 2004 (inclusive) residing within the Waikato DHB region at diagnosis. Cases were identified by using the hospital admissions coding system and the EpiSurv notification system. The case definition used was the New Zealand criteria for ARF diagnosis, which includes echocardiographic evidence of carditis as a major criteria.

Results A total of 77 ARF cases were found, 8 of which were recurrences. An annual rate of 3.0 per 100,000 initial cases or 3.3 per 100,000 population (initial and recurrent cases) was documented. Over 80% of the total initial ARF cases in the Waikato DHB were in the 5–14 year age group. The overall annual incidence in this age group was 12.9 per 100,000 (age specific incidence for Māori aged 5–14 years 39.6 per 100,000 and for NZ European aged 5–14 years 2 per 100,000). The majority of cases found were Māori (83%), and residing in low socioeconomic status (80% living at the time of diagnosis within the most deprived three deciles according to NZDep01).

Conclusion The presence of 77 cases in the Waikato DHB region from 1998–2004 compares unfavourably with other regions, and implies a significant burden from this disease. ARF is a preventable chronic disease with potential life-long sequelae. If the rate of ARF in Māori was reduced to that of non-Māori non-Pacific, then the burden of this disease to New Zealand communities and to the health sector would be virtually eliminated and inequalities improved.

ARF is a consequence of pharyngeal infection with Group A streptococcus, and can result in lasting damage to the heart, or Rheumatic Heart Disease (RHD).¹ It is often thought that ARF is rare in developed countries, and remains only a public health problem in developing countries.^{2,3} Yet, in New Zealand, ARF and RHD are significant causes of premature death, particularly among Māori and Pacific people.^{4–6}

The over-representation of Māori and Pacific people in poor socioeconomic conditions seems likely to be the predominant risk factor for ARF and RHD with additional contributions made by overcrowding, urbanisation, and inadequate access to medical services.^{7,8}

Secondary prophylaxis with long-term antibiotic delivery (commonly for a minimum of 10 years) to cases with diagnosed ARF/RHD prevents recurrent ARF, reduces future cardiac damage, and is also cost-effective.^{9–11} The maintenance of secondary prophylaxis is assisted by the establishment of a register to coordinate antibiotic

delivery and follow-up. Rheumatic fever registers have been effective in coordinating the prevention of ARF recurrences in many countries including New Zealand.^{12–16}

In 1977 a register for ARF and RHD cases was established in the Hamilton Health District with retrospective data collected back to 1973.^{17,18} In 1986, ARF became a notifiable disease in New Zealand. A national register was proposed but never initiated,¹³ and by the early 1990's the Waikato register had been discontinued, with subsequent loss of coordination of secondary prophylaxis. Without such a register in the Waikato, complete information was unavailable on the epidemiology of ARF in this region and delivery of prophylaxis became disorganised.

Therefore this study was proposed in order to collect 7-year incidence and epidemiology of ARF in the Waikato DHB region, including assessing the recurrence rate of ARF without an organised programme, and to explore further opportunities for ARF prevention and management in the Waikato region.

Method

A retrospective audit of the clinical notes of all Waikato resident patients identified in a Waikato District Health Board (DHB) hospital with a diagnosis of ARF between 1 January 1999 and 31 December 2004 was performed. The ICD-9 coding system was used to identify cases diagnosed prior to January 2000. From this date, the ICD-10 coding system was applied (ICD-10 Codes 100, 101.0, 101.2, 101.8, 101.9, 102.0, 102.9).¹⁹ All clinical notes were sought and reviewed of cases with an appropriate primary or secondary diagnostic code.

EpiSurv—the computerised local database held by the Public Health Unit staff for the national surveillance and control of notifiable diseases—was also searched to identify cases with an episode of ARF from 1998 to 2004 inclusive (verified by a hospital admission or clinic appointment related to ARF or RHD). Their notes were also reviewed. Cases were included in this study if they were identified from one or both of the databases.

Information from case notes were abstracted using a set template. The Jones criteria—with New Zealand modifications (particularly the use of echocardiography as a major criteria^{19–22} as defined by the New Zealand guideline for rheumatic fever diagnosis, management, and prevention²³)—was used as a basis for the decisions about ARF diagnosis.

Case definitions of recurrent, 'definite', 'probable', and 'possible' cases were also made according to the New Zealand guideline²³ (available at <http://www.nhf.org.nz>). Each case was geocoded according to their place of residence at the time of diagnosis.

Population statistics for comparison were obtained from the 2001 Statistics New Zealand Census of population and dwellings,²⁴ or from the Waikato DHB Health Needs Assessment (2005).²⁵ The New Zealand Index of Deprivation (2001) (NZDep01)²⁴ was used as an area measure of deprivation of the address where each case resided at the time of their diagnosis.

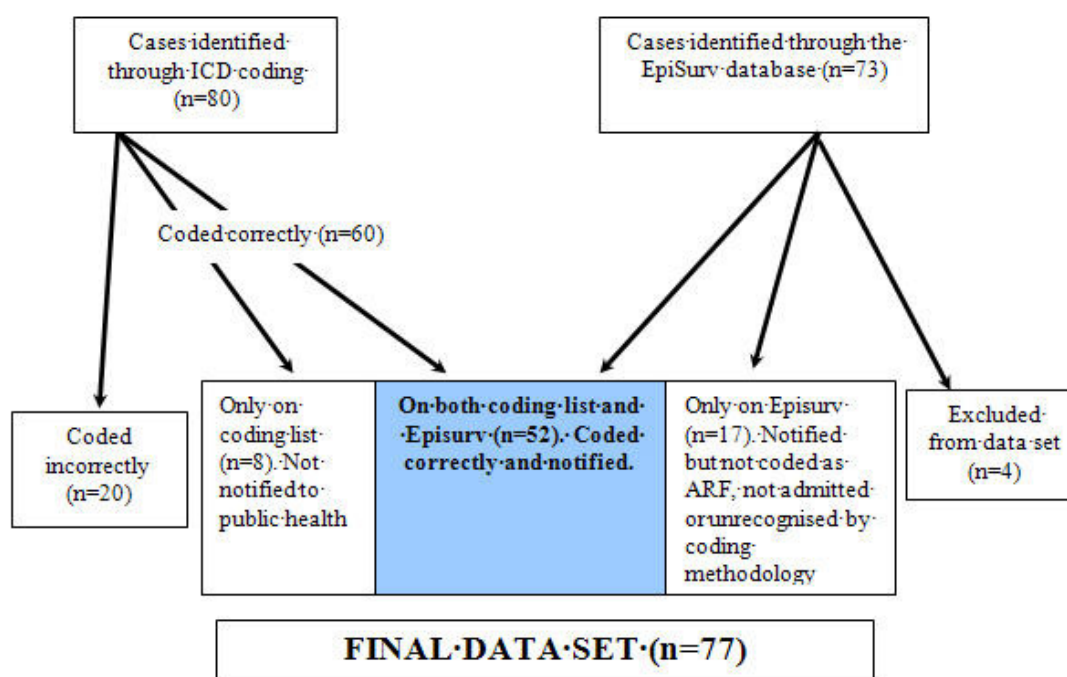
Results

A total of 77 cases were confirmed (Figure 1). Eighty patients were admitted to a Waikato DHB hospital from 1998 to 2004 inclusive, and were coded relating to ARF. After review of these notes, 60 were confirmed as having an episode of ARF in this time period. The 20 patients coded incorrectly were excluded from the study.

The EpiSurv database listed a total of 73 cases in the same time period. Of these, 52 were duplicates of the 60 ARF cases listed via the coding database (Figure 1). Twenty-one cases listed on the EpiSurv database did not correspond to any case on the coding list. All 21 of these cases' clinical notes were reviewed. Four were excluded on the basis of residence (n=2) and wrong diagnosis (n=2).

Of the 17 confirmed ARF cases found through the EpiSurv database, 14 had been admitted. Nine of these cases were coded without reference to ARF, and therefore were not picked up in the ICD search. The remaining five of these cases (two each diagnosed in 1998 and 2000, and one in 2004) should have been found by the ICD methodology, but were not. It is not clear why this occurred. Waikato implemented ICD-10 in December 1999 and it is possible that problems converting from ICD-9 to ICD-10 could have resulted in a loss of cases, and this may explain why two cases were not recognised in 2000 (although 12 cases diagnosed in 2000 were identified through the ICD system).

Figure 1. Identification of cases of ARF in the Waikato DHB between 1998–2004



Of the 77 ARF cases, 47% (n=36) were female. The mean age for initial cases was 12 years (range 4 to 32 years) (Figure 2). Seventy-four percent (n=57) of all cases occurred in the 5–14 year age group with 88% (n=68) aged between 5–19 years.

Of the 77 cases, 62 (80%) were Māori, 8 (10%) NZ European/Pakeha, and 7 (9%) Pacific (Figure 3). The incidence of ARF in Māori aged 5–14 years was 39.6 cases per 100,000 population. This compared to an incidence of 2 cases per 100,000 in NZ European/Pakeha aged 5–14 years.

Figure 2. Age distribution at diagnosis of ARF cases in the Waikato region 1998-2004

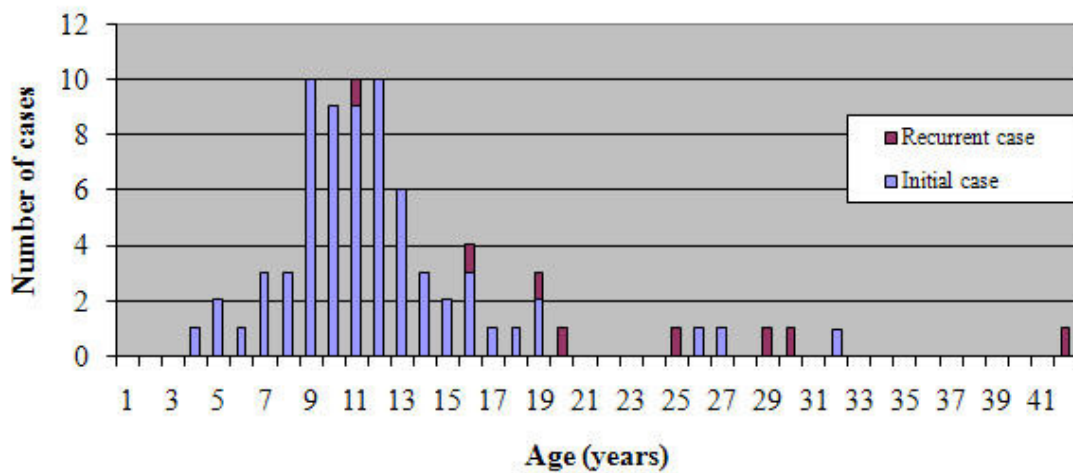
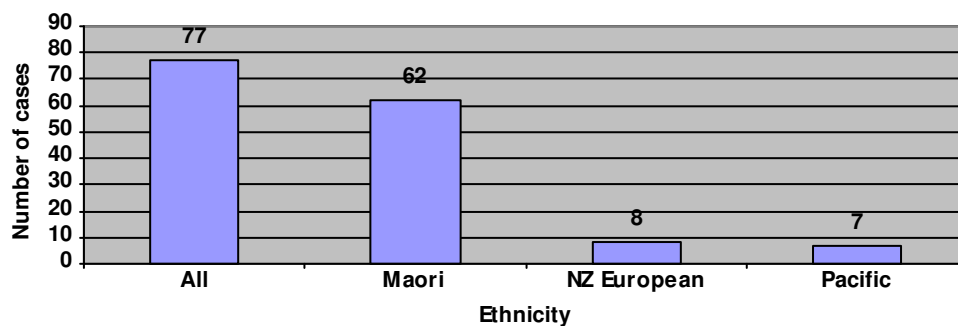


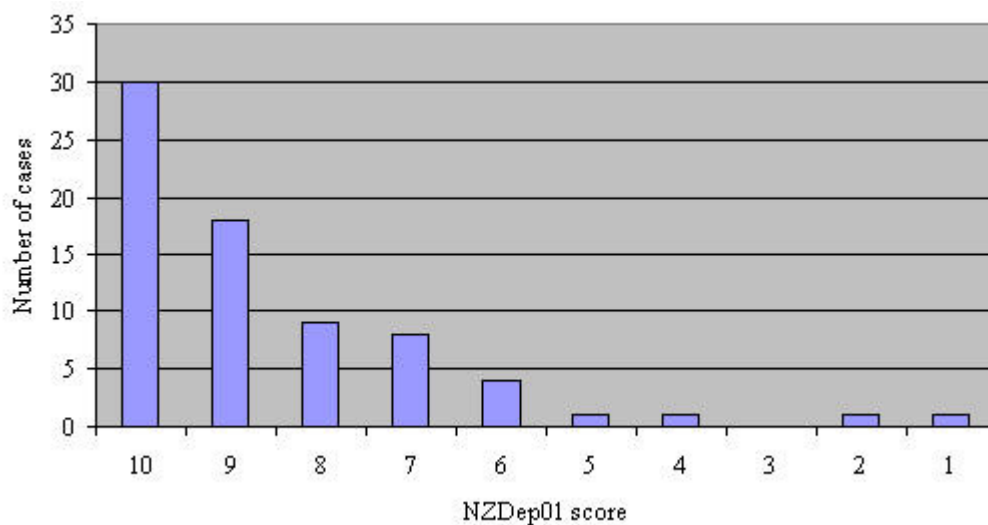
Figure 3. Ethnicity of Waikato ARF cases



Pacific=mostly of Samoan, Tongan, Niuean, or Cook Islands origin.

Of the 73 geocoded cases, 69 (94%) resided in the 5 most deprived deciles according to the New Zealand index of deprivation, 2001 (NZDep01);²⁴ 57 cases (78%) resided in the 3 most deprived deciles (NZDep01 score 8 to 10) (Figure 4).

Figure 4. ARF cases from the Waikato DHB (1998–2004) by NZDep01 score (10=most deprived, 1=least deprived)



Of those cases with their first attack of ARF and without chorea (n=67), a history of sore throat was found in 44 (66%) cases. Of these 44 cases, 30 (68%) had received no treatment for their sore throat at the time, and treatment history was unknown in a further 3 cases. Fifty five of these cases (82%) had the results of a throat swab recorded, and 12 of these were positive for Group A streptococci. All cases fulfilled streptococcal serology criteria (www.nhf.org.nz).

The frequency of major manifestations seen in the initial attacks of ARF found in this review are very similar to that seen nationally and internationally (Table 1).^{6,15,26–30}

Table 1. Number and percentage of initial ARF cases with one or more major criteria for ARF

Major criteria	Number of initial cases	Percentage of initial cases
Migratory polyarthrititis	39	57%
Carditis	31	45%
Chorea	12	17%
Erythema marginatum	3 (confirmed)	4%
Carditis and arthritis	18	26%
Carditis and chorea	6	9 %
Arthritis and chorea	2	3%
Carditis, chorea, and arthritis	1	1.4%

With regards to disease recurrence, 4 of the 77 patients found with ARF had a confirmed recurrence of ARF and a further 4 patients had a probable recurrence. Therefore, 8 recurrences (10%) were determined over the 7-year period. The mean age for the recurrent ARF cases was 24 years (range 11 to 42 years).

Of the 4 recurrence cases with a documented history of their initial ARF attack, a range of 10–19 years had passed between ARF episodes. Three of these cases had been compliant with penicillin prophylaxis—2 cases for 10 years, and 1 for 5 years of prophylaxis. The fourth case had been non-compliant with prophylaxis after 3 years. All 8 of the ARF recurrence cases had documented carditis during their recurrence episode.

Discussion

Seventy-seven cases of ARF with an overall population rate annually of 3.0 per 100 000, were found in this study. The age-specific incidence for all 5–14 year olds was 12.9 per 100,000. The predominance of ARF in 5–14 year olds is consistent with national and international literature.^{12,31–33} The Auckland ARF register recently documented an annual rate of 4.7 per 100,000 population (all ages), and 21.9 per 100,000 (ages 5–14 years).³¹

This study also showed a significantly higher annual incidence of ARF amongst the Māori and Pacific population of the Waikato DHB in comparison to European. The Pacific population in the Waikato is small though a number of cases occurred. Rates of ARF in Waikato Māori aged 5–14 years old in this study (39.6/100,000) are similar to levels seen in developing countries,³⁴ though not as high as those documented in Australian Aborigines.³⁵ ARF rates in Auckland (1993–1999) of Māori and Pacific aged 5–14 years were 41.2 and 83.2 per 100,000, respectively.³¹

It is likely the relatively high burden of this disease amongst the Māori and Pacific populations reflects high levels of exposure to group A streptococci because of overcrowding, poor living conditions, and poor access to medical care.^{15,36} In this study, as in other national and international analyses, the pattern of ARF and RHD correlates closely with socioeconomic status, poverty, and housing conditions.

From 1993–1999 in the Auckland rheumatic fever register, 5.5% of ARF admissions were for recurrences,³¹ compared to 10% recurrence found in this Waikato DHB. It is likely that disbanding of the Waikato register and a subsequent reduction in organised prophylaxis delivery had influenced these recurrence rates. Prior to the introduction of organised penicillin prophylaxis, 25–75% of ARF patients would experience at least one episode of rheumatic fever recurrence in their lifetime, and therefore significantly increase the risk of permanent cardiac damage.^{1,12,37,38}

In the Waikato, earlier studies of the incidence of ARF in the Hamilton Health District from 1973–1977 estimated an incidence of 88 per 100,000 per year in Māori, and 9 per 100 000 per year in non Māori aged 5–29 years.^{17,18} The equivalent incidence in this study in aged 5–29 year olds was 21 and 2 per 100,000 in Māori and non-Māori, respectively.

Both studies found a disproportionate weighting of ARF cases in Māori, and in those aged 5–19 years, and it is likely that there has been a decline in ARF incidence for both Māori and non-Māori in the Waikato over the last 2 decades, perhaps as a result of some general improvements in socioeconomic position and access to services. The earlier studies are likely to be a more complete record, as cases were identified through a number of sources including ICD coding, cardiology outpatient clinics,

admissions and records from Green Lane Hospital (the main cardiac referral centre at that time), and GP surveys.¹⁸

The review reported here is likely to underestimate the true incidence of ARF within the community, as it is a descriptive study based only on the available information from the Waikato DHB. Retrospective reviews of hospital records and rheumatic fever registers tend to underestimate the true prevalence of RHD in comparison to studies where the diagnosis is made by echocardiography and/or clinical examination by a cardiologist.^{2-4,29,38,39}

In addition, a sampling frame from secondary care is unlikely to give a complete picture of the true incidence of disease within the community, as some cases may not access medical care. Finally, this review noted significant gaps in the routine data collection process, and this is one of the important findings of this analysis. Improvements are required in the use of the ICD coding system as a tool for epidemiological study and in the notification of ARF and ARF recurrences.

The eight cases found only on the ICD coding system and not on EpiSurv are likely to be unknown to the district nursing services who coordinate prophylaxis delivery and to the Ministry of Health through ESR, affecting the completeness of national surveillance and epidemiology for this disease. Conversely cases known only to EpiSurv may not be linked to prophylaxis delivery or outpatient services. Strategies that raise the awareness of the medical staff involved, and that improve the Waikato DHB reporting system will improve the national surveillance of this disease. Effective management of this disease requires successful partnerships developed within health and community services.¹³

Allocation of resources for disease control should be made on the basis of disease incidence and prevalence, morbidity and mortality, opportunity for control, health equality, and cost to society. Under these conditions it is clear that the incidence and impact of ARF (and therefore the consequent RHD) in the Waikato, particularly for Māori, warrants attention.

ARF and RHD results in direct medical costs, time away from education and occupation, negative physical and psychological experience, disruption of lives, inability of patients and their families to realise their full potential, and often premature death. There are therefore considerable personal, community, and national costs associated with this disease.^{10,40}

Secondary prevention of ARF recurrence has been proven to be cost effective.⁹⁻¹¹ This disease therefore places a significant burden on the communities and resources of this region, and in particular on Māori, Pacific, and the socioeconomically deprived. Thus ARF also contributes significantly to health inequality.

ARF is preventable, and the results and recommendations of the clinical audit presented here should be used to inform the development and implementation of a programme aimed at reducing the rates of rheumatic fever in the Waikato DHB through enhanced primary and secondary prevention.

To this end, the Waikato DHB Rheumatic Fever Prevention and Management group has been developed. Key stakeholders (such as those from paediatrics, cardiology, public health, district nursing, Māori health, Pacific health, pharmacy, and primary

care) have already been drawn together and have expressed a commitment to reducing the burden of this disease in the Waikato DHB region. This group is tasked with ensuring that the next steps for rheumatic fever control, including primary and secondary prevention, and improved health care delivery, are actioned in the Waikato region.

Recommendations and information from this audit of cases and from the national guidelines on rheumatic fever diagnosis, management, and prevention will provide an important framework for this working group to move forward.

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“As-required” combination therapy with inhaled corticosteroids and long-acting beta-2 agonists for asthma: current evidence and recommendations

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Abstract

Although both inhaled corticosteroids and beta-agonists have been the mainstay of inhaled pharmacotherapy in the management of asthma for many years, as “preventers” and “relievers”, the advent of combination inhalers has prompted a revision of how these drugs ought to be used in practice. Studies to investigate their role, not only as regular treatment but also “as required” for relief of breakthrough symptoms, have recently been reported. The results are prompting a paradigm shift as to how inhaler therapy should be prescribed. In this review, the Executive of the Thoracic Society of Australia and New Zealand (New Zealand Branch) provide recommendations on maintenance and relief strategies based on currently available evidence. It is recognised that with further data these recommendations may require revision after three years.

Inhaled corticosteroids (ICS) and beta-agonists (BA) have been central to the pharmacotherapy of asthma for nearly 40 years. Other more recently developed treatments such as leukotriene antagonists or anti-IgE therapy have done little to shift the main emphasis.

A modification to the basic “preventer/reliever” treatment paradigm occurred in the early 1990s, with the introduction of long-acting beta-agonists (LABAs). These agents were subsequently shown to provide benefits in patients with moderate asthma which were greater than increasing the maintenance dose of ICS.^{1–3} This was in part based on positive interactions between corticosteroids and LABAs.⁴

The benefits of regular treatment with both of these agents paved the way for the subsequent development of single inhaler combination preparations (salmeterol/fluticasone and formoterol/budesonide), and these are now widely prescribed.⁵

More recently, a modification of this approach has been explored. It is to use a combination inhaler not only as maintenance therapy but with added doses “as-required (*pro re nata*: PRN)” in response to asthma symptoms. A principal sponsor of studies to investigate this approach has coined the term “SMART” (single maintenance and reliever therapy) to describe the regimen. However, in milder asthma the new strategy also includes using a combination inhaler PRN as sole therapy.

The approach follows on from earlier studies which confirmed the benefits of adjustable maintenance therapy using a combination inhaler along with SABA for relief of symptoms.^{6,7} The question is only relevant for those combination inhalers

which include a BA with a rapid onset of action (formoterol/budesonide and also salbutamol/beclomethasone).

Several arguments in favour of this strategy centre around how clinicians ought to optimise ICS treatment:

- Firstly, there is the natural history of asthma itself. Varying exposure to triggers causes variation in day-to-day asthma control. It is suggested that rather than depend on a fixed prescribed dose of anti-inflammatory treatment, increasing the dose of ICS along with “reliever” in response to a presumed increase airway inflammation ought to improve asthma control.
- Secondly, more severe asthma episodes often develop over a period of 2 to 3 days, and early intervention with ICS ought to minimise their severity. If a patient’s increased use of “reliever” is simultaneously accompanied by increased use of anti-inflammatory “preventer” then this ought to be advantageous.
- Thirdly, the majority of patients are non-adherent with regular ICS therapy^{8,9} and taking additional inhaled steroid at the same time as using bronchodilator ought to improve overall ICS use in non-adherent patients.
- Fourthly, the use of monotherapy with BAs (short or long-acting) is associated with an increased risk of asthma morbidity and even mortality; combined therapy may “protect” (by whatever mechanism) against the potential adverse outcomes associated with BA use.

On the face of it, these arguments are plausible and even persuasive. They are being advocated as the basis for the “new” asthma management of the 21st century. A shift to single inhaler therapy may reflect “what patients do in the real world”.⁵

Assumptions and hypotheses

There are a number of underlying assumptions and/or hypotheses when using ICS/BA in combination “as required”.

Firstly, there is the assumption that the patient has steroid-responsive airway inflammation. This may not be the case. The response to ICS therapy in asthma is heterogeneous.¹⁰ This may in part be due to the fact that a significant proportion of asthma is non-eosinophilic,¹¹ and steroid responsiveness is unlikely in this group.¹²

The second assumption is that the symptoms which prompt increased “as required” use of the combination inhaler are the result of increasing airway inflammation. Again, this may not be so. Studies have shown that inflammation and symptoms are, in general, poorly correlated.¹³ In some patients, even although the diagnosis of asthma may be secure, additional factors such as anxiety-hyperventilation, gastro-oesophageal reflux, or weight gain may provoke or exacerbate symptoms, and may be erroneously interpreted as primarily due to unstable asthma. In such circumstances “as-required” combination therapy is unlikely to be beneficial.

The third assumption/hypothesis is that by using additional ICS at the same time as BA reliever, the cumulative benefits of symptom-driven increases in ICS dose will in turn *reduce* the need for additional reliever in the future.

The fourth assumption/hypothesis follows on from the third, namely that this approach will result in comparable or even improved asthma control as well as reduced exacerbations *without risking the adverse effects of either BA or ICS over-use*.

Many, but by no means all of these issues have been addressed in the studies conducted to date. In this paper, we will address whether they provide a sufficient basis for a paradigm shift in the approach to asthma treatment which is currently gaining momentum. It is important to say that this is an issue in transition, and some remaining questions may be answered 2 or 3 years from now once further data (we hope) become available.

At a local level, although prescribing practices for LABAs as well as combination products are constrained by PHARMAC criteria for subsidising the cost of these pharmaceuticals to patients, it is still important that clinicians should be aware of new evidence which might alter therapeutic options in the management of chronic persistent asthma.

Recent randomised controlled trials

Mild asthma: patients on Step 1 or Step 2 treatment—It is reasonable to postulate that “as-required” combination therapy without regular maintenance anti-inflammatory therapy might be used to treat patients requiring either PRN short-acting beta-agonist (SABA) [Step 1] or low-dose ICS plus PRN SABA [Step 2]. This was addressed in the recent paper by Papi et al.¹⁴.

In that study, 455 adult patients were randomised to receive one of four treatments: (i) twice daily placebo plus combined beclomethasone 250 mcg / salbutamol 100 mcg PRN; (ii) twice daily placebo plus salbutamol 100 mcg PRN; (iii) twice daily beclomethasone 250 mcg plus salbutamol 100 mcg PRN; and (iv) twice daily combined beclomethasone 250 mcg / salbutamol 100 mcg plus salbutamol 100 mcg PRN. The first two groups essentially received Step 1 treatment, and the second two groups received Step 2 treatment. The primary outcomes were mean morning peak flows during the last 14 days, and exacerbations.

With the combination beclomethasone/salbutamol inhaler PRN, there was a significant reduction in the rate of exacerbations compared with salbutamol PRN (0.74 compared to 1.63 events per patient per year, $p=0.001$). Combination treatment PRN was comparable to regular twice daily inhaled beclomethasone (0.74 compared to 0.71 events per patient per year, $p=NS$).

Somewhat unexpectedly, regular combination therapy was no better than regular beclomethasone alone. However, for other measures of asthma control, the overall benefits of the PRN combination were limited. Although night time awakenings were lower in the PRN combination group compared to the PRN salbutamol group, and the number of symptom-free days was greater with regular beclomethasone than PRN salbutamol (as expected), there were no other significant between-treatment differences (daytime or night time asthma symptoms scores, symptom free days, or rescue bronchodilator use).

Of note, comparable overall outcomes were achieved with significantly lower cumulative doses of beclomethasone in the PRN combination group compared to the

other two groups which received beclomethasone regularly. For SABA, the cumulative consumption of salbutamol was understandably highest in the PRN salbutamol group, and almost identical in the other three groups. The overall conclusion was that PRN beclomethasone / salbutamol was comparable to regular treatment with beclomethasone, but using less anti-inflammatory drug.

Moderate asthma: patients on Step 3 treatment—The majority of relevant trials to date offer comparisons of various combinations of maintenance and “reliever” treatment. These permit assessment of the efficacy of “as-required” combination therapy in patients already taking maintenance treatment with either the same combination inhaler or with high doses of ICS.

In the large study by Rabe et al,¹⁵ comprising nearly 3400 patients, each patient received maintenance therapy with budesonide 160 mcg / formoterol 4.5 mcg twice daily for 12 months. Patients were then randomised to use one of three “relievers”: terbutaline 500 mcg, formoterol 4.5 mcg, or budesonide 160 mcg / formoterol 4.5 mcg—each via a Turbuhaler. The primary end-point was time to first exacerbation, and this was lowest in the group receiving combination PRN.

The risk of a severe exacerbation was reduced by 27% with budesonide/formoterol PRN compared to using formoterol alone ($p<0.004$), and by 45% compared to terbutaline alone ($p<0.001$). The same pattern of results was reported by O’Byrne et al¹⁶ in another large ($n=2760$) but somewhat more complex study.

The important comparisons were between the group receiving maintenance budesonide 80 mcg / formoterol 4.5 mcg twice daily and “as-required”, with budesonide 80 mcg / formoterol 4.5 mcg twice daily and terbutaline 400 mcg “as-required”. Again, the use of the combination inhaler PRN resulted in a significant reduction in the frequency of severe exacerbations (by 45%) compared to the next best treatment.

In a second paper by Rabe et al,¹⁷ maintenance plus PRN treatment with budesonide 80 mcg / formoterol 4.5 mcg was superior to high dose budesonide (320 mcg/day) plus PRN terbutaline, with a reduction in exacerbations of 54%. Thus the results across these major studies are consistent: the “as-required” use of a combination inhaler significantly reduces asthma exacerbation rates when added to maintenance therapy with combination inhalers. However, equally consistently, there appeared to be few other important benefits as far as other measures of asthma control are concerned.

In the first study by Rabe et al,¹⁵ there were no significant differences in asthma control days, night time awakenings, and the Juniper ACQ-5 composite score. Rescue bronchodilator use was reduced from a mean of 1.26 puffs/day in the PRN terbutaline group to 1.02 puffs/day in the PRN combination group ($p<0.0001$), but the magnitude of this change is not clinically significant.

Similarly, in the study by O’Byrne et al,¹⁶ there were no significant differences in asthma control days and night time awakenings. For those end-points where a statistically significant improvement was recorded, the magnitude of the effect was again, not clinically significant. For example, rescue bronchodilator use was reduced from 0.84 puffs/day with PRN terbutaline to 0.73 puffs/day with PRN budesonide / formoterol ($p<0.0001$). Details of these papers is provided in Table 1.

Table 1. Representative data from randomised controlled trials which have included “as-required” combination therapy either alone or in addition to maintenance treatment with the same combination inhaler in at least one treatment arm

Author and reference	n	FEV ₁ % predicted	Regular treatment (total daily dose in mcg)	PRN reliever	Results				
					Time to first exacerbation	Severe exacerbations (% patients)	Night awakenings (% nights)	Asthma control (% days)	Mean reliever use (puffs/day)
Vogelmeier et al 2005 (ref28)	2143	73	Bud 640 / Form 18	Bud 160 / Form 4.5	Longer for Bud / Form group p=0.005	15 p=0.008	Not stated	Not stated	0.58 p=0.001
		73	Flutic 500 / Salm 100	Salb 100		19	Not stated	Not stated	0.93
O’Byrne et al 2005 (ref16)	2760	73	Bud 160 / Form 9	Bud 80 / Form 4.5	Longest with M and R, Bud 160 / Form 9; p=0.001	11 p<0.001	21.8 NS	45 NS	0.73 p<0.001
		73	Bud 160 / Form 9	Terbutaline 400		21	20.2	44	0.84
			Bud 640	Terbutaline 400		19	20.6	37	1.03
Rabe et al 2006 (ref15) (Lancet)	3394	72	Bud 160 / Form 9 in all three groups	Bud 160 / Form 4.5	Longest with M and R, Bud 160 / Form 9; p=0.005	13 p=0.004	26.1 NS	29.3 NS	0.96 p=0.0001
		72		Formoterol 4.5		17	24.1	28.8	1.23
		72		Terbutaline 400		22	26.2	31.2	1.26
Rabe et al 2006 (ref17) (Chest)	696	75	Bud 160 / Form 9	Bud 80 / Form 4.5	Not stated	8 p<0.01	6.5 NS	38.8 p<0.001	1.04, p<0.001
		75	Bud 320	Terbutaline 400	Not stated	16	10.5	47.4	1.48
Bisgaard et al 2006 (ref19)	341 children aged 4-11	118	Bud 80 / Form 4.5	Bud 80 / Form 4.5	Longest with M and R p=0.02	8 p<0.001	2.4 p=0.004	57.0 NS	0.58 p=0.04
		117	Bud 80 / Form 4.5	Terbutaline 400		31	4.4	60.6	0.76
		106	Bud 320	Terbutaline 400		20	4.6	50.8	0.74
Papi et al 2007 (ref14)	455	88.5	Placebo	Beclo 250 / Salb 100	Equivalent for PRN combination and regular Beclo with PRN Salb	4.9 NS*	0.10	61.9	0.5
		88.9	Placebo	Salb 100		17.8	0.21	53.8	0.73
		88.8	Beclo 500	Salb 100		5.7	0.13	60.2	0.44
		87.2	Beclo 500 / Salb 200	Salb 100		10.1	0.14	56.8	0.51

All statistical comparisons are with the next best treatment. Beclo=beclomethasone; Bud=budesonide; Flutic=fluticasone; Form=formoterol; NS=not significant; M and R=maintenance and relief strategy using combination inhaler; PRN=as-required; Terb=terbutaline; Salb=salbutamol; Salm=salmeterol; *for the comparison with regular beclomethasone.

Overall, these data indicate that in patients requiring Step 3 treatment, the frequency of exacerbations can be significantly reduced by the “maintenance and relief” treatment strategy. But there appears to be only a limited impact on other aspects of asthma control and quality of life with no particular advantage gained. Why might this be?

The most likely explanation is in the strategy itself. If the cue for using additional inhaled steroid is breakthrough symptoms, then by definition a certain degree of poor control will persist before or until the patient uses additional treatment. Thus, although deterioration towards a frank exacerbation may be pre-empted, the dose of ICS which is necessary to achieve what would be considered optimum control may not necessarily be provided.

In fact this appears to be the case: the increase in the dose of ICS used by patients in the “maintenance and relief” groups in these studies is very modest (see below), although overall, comparable asthma control is achieved at lower doses of ICS using a combination inhaled as “reliever” compared to a conventional regimen.

In children, the issue has to be considered in the light of evidence that the addition of a LABA to ICS therapy may not be as effective in reducing asthma exacerbation rates compared to adults. In some individuals the risk of exacerbation may even be increased.¹⁸ Thus the scope for improved outcomes using PRN combination treatment in children should be anticipated cautiously.

Only one paediatric study has been published. This showed similar outcomes to the adult studies with respect to exacerbations.¹⁹ In 341 children aged 4 to 11 years with moderate asthma, the reduction in exacerbations was greater with the PRN combination treatment compared to a fixed (higher) dose of budesonide / formoterol plus PRN SABA.

As with the adult studies, some but not all other measures of asthma control also improved using the PRN combination regime compared to a fixed dose combination, yet with a reduced overall ICS dose requirement. Although these results suggest that the strategy may be as effective in children as in adults, more studies are needed.

Inhaled powder devices are not recommended for use under 5 years due to lower inspiratory flow rates so this approach is only feasible in older children.

(<http://www.paediatrics.org.nz/documents/2005%20documents%20denise/guidelines/Asthma%20endorsed.pdf>)

The potential problems of single inhaler therapy in “real life”

The question arises as to whether the results of these reported studies are generalisable. There are real concerns about whether the use of single inhaler therapy is appropriate or safe in patients for whom asthma management may be difficult, including patients who are poorly compliant.

High users—Of necessity, randomised controlled trials exclude patients whose adherence to a study protocol is going to be limited. This includes being a “high user” of PRN BA. This is relatively common: in an earlier investigation, 15% of patients taking formoterol as-required for symptom relief used 6 or more puffs per day and 2% used more than 12 puffs per day.²⁰ In the largest of the studies cited in the present

review,^{15–17} subjects who were high users of reliever BA were excluded, with an upper limit of 10 puffs per day at baseline or during run-in. Similarly, for reasons of safety, subjects were instructed to contact the study investigators if they required more than 10 puffs per day at any time during the study and were thereafter withdrawn. Thus owing to double selection bias, data on the risks associated with PRN combination therapy in high users must be regarded as limited.

In the study by Rabe et al,¹⁵ high users were defined as patients taking four or more inhalations per day on more than 100 days. Using this definition, the number of high users was lowest in the budesonide/formoterol group (6.3%), compared to 9.8% and 11.4% in the formoterol and terbutaline groups respectively. The comparable exacerbation rates were 0.33, 0.77, and 0.76 per patient per year.

In the other study by Rabe et al¹⁷ “high user” was defined as 8+ inhalations per day on more than 1 study day. 6.2% of patients receiving budesonide/formoterol as maintenance and relief were high users, and this compared with 15.5% in the group receiving budesonide 320 mcg/day plus terbutaline PRN. Four of 22 (18%) of the high users in the group receiving budesonide/formoterol as maintenance and relief had one or more severe exacerbations, compared to 37/53 (70%) in the budesonide plus terbutaline PRN group.

These data provide some measure of reassurance regarding the potential for excessive use using this treatment strategy, but they may not be entirely representative of high users in “real life”.

Problem asthma—There are two broad but overlapping categories of “problem asthma”. Firstly, there are those who are frequently symptomatic but poorly adherent. Often such patients take little therapy at all. In such individuals, there may be significant merit in taking combination therapy PRN. However, to date, the evidence to support this approach is unavailable. Secondly, poor adherence may be characterised by failing to take anti-inflammatory preventer medication but in contrast to the first group, they are over-reliant on “as-required” SABA for symptom relief. Such patients may use SABA to excess.

Intuitively, one might also expect that such patients may benefit from using PRN combination therapy, but only if their high use of SABA is indeed driven by uncontrolled steroid-responsive airway inflammation. If it is not, then there is the potential for excessive dosing not only with BA but also inhaled corticosteroid. Studies in this challenging group of patients are lacking.

The second category of problem asthma includes patients who probably (but do not always) have asthma, but also have supervening complications or comorbidities which contribute to apparently poor control. Examples include anxiety overlay with or without hyperventilation, vocal cord dysfunction, obesity, gastro-oesophageal reflux disease, or bronchiectasis. Clearly such individuals should be not be treated with higher doses of ICS whether given regularly *or* as-required. Rather the cause of their symptoms should be more clearly defined and treated.

The challenge is to identify such individuals, and avoid “as-required”: combination therapy. But this may be difficult to achieve—e.g. if there are financial barriers to obtaining clinical consultation. It is therefore not appropriate to employ a “maintenance and relief” strategy in problem asthma. This is a situation where it may

be beneficial to assess the true severity of airway inflammation objectively, for example using exhaled nitric oxide (F_ENO) levels.²¹

Costs, benefits and other considerations

Adverse effects due to ICS—The potential for adverse outcomes using maintenance and relief combination inhaler therapy was carefully monitored in the randomised controlled studies reviewed in this paper. There was no evidence of any increase in the frequency of steroid-related adverse effects, either local or systemic.^{14–17} In fact, in the study by Papi et al,¹⁴ the cumulative dose of beclomethasone in the PRN combination group was approximately 25% of the dose used in the other groups.

In the studies of moderate asthma,^{15–17} the greatest increase in mean cumulative ICS dose was only 160 mcg/day (one extra dose of budesonide). Thus the margin of safety was substantial, given that the mean ICS dose was still well below the threshold for systemic effects associated with high dose inhaled steroid use.²²

There was the further advantage that the use of oral prednisone was significantly reduced with combination PRN owing to the reduction in the frequency of exacerbations requiring oral steroid treatment. In the study by Bisgaard et al, growth in children was significantly greater in the “maintenance and reliever” group.¹⁹

In a more recent open label study, somewhat inconsistently, oral prednisone supplements were unchanged using the “maintenance and relief” strategy despite a reduction in hospital and emergency room attendances.²³

Regular or excessive use of SABA is known to result in poorer asthma control. The argument that PRN combination therapy (as opposed to PRN SABA) will reduce the risk of the adverse outcomes associated with unopposed beta-agonist use is based on the observations made in a recent study evaluating the safety of *regular* salmeterol.²⁴ This suggested that the increased mortality associated with use of salmeterol occurred predominantly in patients who were not taking simultaneous ICS. It is therefore suggested that the use of PRN combination LABA/ICS ought to avoid the risks of taking “unprotected” monotherapy with BA.

Reassuringly, there are recent data which indicate that induced sputum eosinophilia is no greater when using “maintenance and relief” combination treatment than when using a more conventional strategy.²³ However, particularly in patients with “difficult asthma”, it is by no means clear that the simultaneous use of ICS does indeed protect against the worsening of asthma and excess mortality which may be associated with BA use, particularly where it is excessive.²⁵

In the study by Sears et al, worsening asthma control with regular fenoterol was just as frequent in patients taking ICS as those who were not.²⁶ Similarly, Aldridge et al reported that the magnitude of the increase in airway hyper-responsiveness to hypertonic saline associated with regular terbutaline as monotherapy was similar whether patients were taking budesonide as when taking placebo.²⁵

These data provide a warning that the alleged benefits of combination therapy PRN do not necessarily include “protection” against the possible adverse effects of BA. This must be considered all the more relevant in high users.

Economic costs—It appears a single dose of the combination inhaler currently available in New Zealand (Symbicort) is much more costly than other “relievers” such as terbutaline or salbutamol (50 cents, 9 cents, and 4 cents respectively). However, the overall cost of using PRN combination therapy should take account not only of drug costs but also the benefits of reduced exacerbation frequency which results from PRN combination. Attention should also be given to the costs of the comparator treatment, which may vary widely.

In two studies designed to evaluate the cost-effectiveness of adjustable maintenance therapy using a budesonide/formoterol inhaler, a reduction in direct costs was approximately 25%.^{23,27} In other studies comparing the maintenance and relief strategy with “usual” Step 3 treatment (fluticasone/salmeterol plus salbutamol PRN),^{28,29} the “SMART” (single maintenance and relief therapy) strategy was less expensive overall.

In the study by Price et al,³⁰ SMART therapy reduced the frequency of exacerbations but with an overall cost which was similar to both of the two other “standard therapies”. Thus it seems likely that the newer approach will at the very least be judged “no more expensive”, yet with important clinical gains. There are caveats. In low income countries the price of combination inhalers will probably put them beyond the reach of most of the population. Further pharmacoeconomic studies are awaited.

Patient education—Asthma education is an integral part of patient management, including the use of self-management plans for acute exacerbations. The introduction of single inhaler therapy will require existing educational material to be revised. Above all, patients need clear guidance as to how deteriorating asthma should be managed. Although this is not inherently problematic with PRN combination therapy, it will require greater effort on the part of nurse educators and GPs to ensure that self-management plans for acute exacerbations are appropriately constructed.

The Asthma and Respiratory Foundation of New Zealand is currently revising patient self-management strategies with this in mind. The draft self-management plan is currently being evaluated in field studies (see Figure 1).

PHARMAC criteria for subsidy of ICS/LABA combination inhalers

Current prescribing habits in New Zealand are frequently adjusted to comply with prescription subsidy criteria issued by PHARMAC (the government’s drug purchasing agency). Although it is understandable that this is the case, it should be emphasised that the PHARMAC criteria *do not represent a treatment guideline*. They are essentially based on data that must now be considered obsolete—i.e. that optimum outcomes in asthma are achieved by adding a LABA to moderate or high doses of ICS. This approach has led to excessive doses of ICS being prescribed in New Zealand, with increased costs.

The emergence of substantial new evidence regarding the use of combination ICS/LABA inhalers as “maintenance and relief” ought to prompt an urgent and thorough review of the subsidy criteria for both LABAs and ICS in New Zealand, including combination products.

Figure 1. Draft asthma self-management plan of Asthma and Respiratory Foundation of New Zealand (ARFNZ) ©2008

Your Asthma Self Management Plan															
	ASTHMA SYMPTOMS	YOUR MEDICATION IS CRUCIAL													
FEELING GREAT	Your asthma is under control when • you don't have asthma symptoms most days (wheeze, tight chest, breathlessness, or a cough) • you don't wake at night with asthma symptoms • you can continue with all your usual activities • you use a reliever less than 3 times per week your peak flow reading is above: _____	<table border="1"> <tr> <td>Preventer</td> <td>puffs: morning and night every day</td> </tr> <tr> <td>Symptom controller</td> <td>puffs: as needed</td> </tr> <tr> <td>Reliever</td> <td>puffs: morning and night every day</td> </tr> <tr> <td>Exercise management</td> <td>puffs: 5-10 minutes before exercise</td> </tr> <tr> <td>Emergency Reliever</td> <td></td> </tr> </table>	Preventer	puffs: morning and night every day	Symptom controller	puffs: as needed	Reliever	puffs: morning and night every day	Exercise management	puffs: 5-10 minutes before exercise	Emergency Reliever		MEDICATION ALERT • If you regularly need to take more than 6 puffs of reliever every day, see your doctor as there is a risk of harmful side effects • If you regularly take more than 3 doses of reliever a week you should be taking regular preventer medication		
Preventer	puffs: morning and night every day														
Symptom controller	puffs: as needed														
Reliever	puffs: morning and night every day														
Exercise management	puffs: 5-10 minutes before exercise														
Emergency Reliever															
GETTING WORSE	Caution – your asthma is getting worse when • you are waking at night with asthma symptoms; or • you are very breathless or wheezy; or • exercise or daily activities are becoming difficult because of asthma symptoms; or • you are using more reliever than usual; or • your reliever lasts a much shorter time your peak flow reading is below: _____	Let's keep calm, but get prepared... • continue with your regular medication • take your reliever as required (up to a maximum of 12 puffs in 24 hours) _____ • if you have been prescribed prednisone begin as follows: <table border="1"> <tr> <td>prednisone</td> <td>mg</td> <td>for</td> <td>days</td> </tr> <tr> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>and then</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </table>	prednisone	mg	for	days	_____	_____	_____	_____	and then	_____	_____	_____	MEDICATION ALERT • If you are not improving within 1 hour of taking your reliever or your symptoms worsen, move to the emergency zone • If you need to take more than 12 puffs of reliever in 24 hours, see your doctor today; or • If you have no prednisone see your doctor or pharmacist today • If you are no better after 1–2 days of commencing prednisone, see your doctor • If you require 2 or more courses of prednisone see your doctor
prednisone	mg	for	days												
_____	_____	_____	_____												
and then	_____	_____	_____												
EMERGENCY	EMERGENCY • you have severe breathlessness; or • you are finding it hard to speak; or • you feel faint or are frightened; or • your reliever is not working your peak flow reading is below: _____	• dial 111 for an ambulance and explain you are having severe asthma • sit upright and relax your shoulders • take 2–6 puffs of your emergency reliever every 5–10 minutes until the ambulance arrives. Use a spacer if available	<table border="1"> <tr> <td>Best peak flow:</td> </tr> <tr> <td>Plan prepared by:</td> </tr> <tr> <td>Date prepared:</td> </tr> <tr> <td>Review date:</td> </tr> <tr> <td>GP:</td> </tr> <tr> <td>Doctor's signature:</td> </tr> </table>	Best peak flow:	Plan prepared by:	Date prepared:	Review date:	GP:	Doctor's signature:						
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Summary and recommendations

The use of “as required” corticosteroid at the same time as “as-required” beta-agonist using combination inhalers represents a significant shift in the therapeutic model for asthma management. Randomised controlled trials have shown that this approach achieves a significant reduction in the frequency of exacerbations across most grades of asthma severity in adults, but more studies are required in children.

Because the strategy depends on the advent of breakthrough symptoms, it fails to achieve consistent benefits in terms of other measures of asthma control. However, *similar* degrees of control to conventional strategies can be achieved using PRN combination therapy but at lower overall doses of ICS.

The potential for improved management using PRN combination therapy where patients are poorly adherent and/or have problem asthma is unproven. Great caution should be applied in such individuals. There is a gap in the evidence precisely because such patients are not enrolled in clinical trials. Some of these patients may not have steroid-responsive airways inflammation. There is a responsibility on all our parts to prescribe in ways which reduce and do not add to the overall economic burden of asthma.

Table 2. Summary of recommendations for using “as-required” ICS/LABA combination inhaler either alone, or in addition to regular maintenance therapy with a combination ICS/LABA inhaler in asthma

Indications	<i>Patients with mild steroid-responsive asthma</i> PRN combination therapy is as good as regular ICS treatment at reducing exacerbations in patients with mild asthma. For the time being, such a strategy does not qualify for reimbursement in New Zealand <i>Patients with moderate or severe steroid-responsive asthma</i> PRN combination therapy in addition to regular maintenance therapy is of proven benefit in reducing the frequency of exacerbations. The strategy is likely to be effective in patients with a history of frequent or severe exacerbations. Other aspects of asthma control will in general benefit comparably using either a conventional regimen or a “maintenance and relief” strategy. In both severity groups, the benefits of PRN combination in terms of other measures of asthma control e.g. daily activity levels should be assessed individually.
Contraindications	1. High “reliever” users: in such individuals the cause for high use needs to be carefully assessed. 2. “Problem asthma”. In patients with unstable / difficult to control asthma, including brittle asthma, the clinician should assess other contributors such as anxiety-hyperventilation, vocal cord dysfunction, the effects of obesity, and smoking (tobacco and cannabis). Alternative treatment will be required for each of these coexisting problems. Specialist referral may be appropriate.
Caveats and other recommendations	1. Self-management plans for asthma exacerbations should still emphasise the use of oral prednisone at an appropriate threshold. Reliance should not be placed on inhaled therapy. 2. Prescriptions, self management plans, and product information should include a clear instruction/warning that PRN use of greater than six (12) doses per day (equivalent to an additional 2400 µg/day and 72 µg/day formoterol over and above maintenance doses) may pose a risk of either steroid-related or beta-agonist side effects. 3. Although a short-acting beta-agonist (SABA, e.g. salbutamol) may not require to be used routinely as “reliever” in patients taking “maintenance and reliever” therapy with a combination inhaler, a supply of SABA should be made available for use in emergency situations—e.g. where self-management plan instructions suggest using 1–2 puffs every 10–15 minutes (“emergency reliever”).

It may be that prescribing an inexpensive inhaled steroid regularly and simultaneously permitting the patient to use a combination inhaler “as-required” may be the best option, but this particular permutation has not been tested in a clinical trial.

Finally, currently PHARMAC does not fund the use of a combination inhaler at low total doses of ICS. The present re-imbursement guidelines need to be revised urgently in the light of new approaches to treatment.

Recommendations are summarised in Table 2, and represent the current views of the Executive of the TSANZ in New Zealand. These are subject to revision within a period of 3 years.

Competing interests: Professor Taylor is Medical Director of the Asthma and Respiratory Foundation of New Zealand. Professor Asher was a member of the Board of the Asthma and Respiratory Foundation from 2003–2005. She has received funding support for research from GlaxoSmithKline, AstraZeneca, Merck Sharp and Dohme, and Neolab (UK).

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Hybrid management of an unusual presentation of acute ischaemic ventricular septal defect

Matthew J Boyle, Amul K Sibal, Peter N Ruygrok, Mark Edwards, Peter Alison

Abstract

Acute ischaemic ventricular septal defect (VSD) is a severe complication of acute myocardial infarction. We present the unusual case of a 66-year-old man with a haemodynamically stable acute posterior basal ischemic VSD, who was managed successfully with hybrid primary coronary artery bypass grafting followed by delayed percutaneous VSD closure, with an excellent intermediate-term outcome. We feel this management strategy should be considered in selected patients with acute posterior VSDs and stable clinical status.

Acute ischaemic ventricular septal defect is a life-threatening mechanical complication of acute myocardial infarction with a declining incidence.¹⁻³ Patients commonly present within the first week after infarction with a rapidly worsening haemodynamic status and cardiogenic shock.¹

Mortality rates are high; reportedly 94% with medical management, 47% with surgical repair, and 41% with percutaneous closure.^{2,4} Acute VSDs of the posterior septum account for 20–40% of cases and are associated with an especially poor prognosis (even with surgical repair) when associated with shock.⁵

Case report

A 66-year-old man, with no history of coronary artery disease, was admitted to hospital with an acute inferior myocardial infarction (troponin T 0.93). He was haemodynamically stable with no murmurs or signs of congestive heart failure.

Coronary angiography on Day 1 post-infarction revealed a 65% left main stem lesion and an occluded mid right coronary artery. A transthoracic echocardiogram performed 2 days following admission showed severe hypokinesis of the basal to mid inferior left ventricular wall and inferior septum with preserved biventricular function, mild mitral incompetence, and no evidence of a VSD.

Eight days later he developed unstable angina which settled on nitroglycerine infusion and was accepted for surgical coronary revascularisation. A new precordial murmur was detected preoperatively and was attributed to worsening mitral regurgitation in light of new ischaemia, as the patient remained stable with no clinical signs of heart failure.

During the scheduled revascularisation operation the following morning, a planned post-induction transoesophageal echocardiogram revealed a thin and dyskinetic basal inferior wall with a 1.2 cm tortuous postero-inferior VSD shunting left to right. The shunt fraction was calculated 3:1 using oximetry. There was normal biventricular function, no pulmonary hypertension and no mitral regurgitation.

The echocardiogram also showed the inferior wall to have a contusion indicative of acute infarction. As the patient remained haemodynamically stable, a considered decision was made to proceed with coronary artery bypass grafting and manage the VSD with percutaneous device closure at a later date provided clinical stability persisted.

Without complication three bypass grafts were applied to the left anterior descending artery, obtuse marginal branch of the circumflex artery, and the right coronary artery. Post-operative transoesophageal echocardiography showed no worsening of the left to right shunt or of ventricular function.

The patient made an uneventful recovery from surgery, remaining haemodynamically stable. A pre-discharge transthoracic echocardiogram revealed no enlargement of the VSD or deterioration of biventricular function. He was discharged home on postoperative Day 8, 18 days after initial presentation.

The patient remained well while at home, despite experiencing pitting pedal oedema and class II dyspnoea. Five weeks after discharge he was electively admitted for a planned device closure of the VSD. He was in NYHA class II with atrial flutter. Transoesophageal echocardiography revealed a 1.8 cm VSD on the left ventricular aspect following a circuitous route through to a 0.8 cm defect on the right ventricular side of the septum, with left to right shunting. There was also a suggestion of some small additional sieve-like septal defects. The main VSD channel was 1 cm from the mitral annulus.

The patient underwent successful percutaneous closure of the main defect using a 20 mm Amplatzer septal occluder 53 days after initial presentation under general anaesthesia with radiographic and transoesophageal echocardiographic guidance. A trivial residual shunt, probably through the additional small defects, persisted. Apart from an iatrogenic superficial femoral artery injury requiring surgical repair, he recovered well and was discharged home on Day 6 post-VSD closure.

At last follow up, 18 months following VSD closure, the patient remained well, in New York Heart Association Class I, and was back to working full-time at his previous occupation. Transthoracic echocardiography revealed a well-seated Amplatzer device with a tiny residual shunt, no mitral regurgitation and normal biventricular function.

Discussion

Historically, the management of acute VSD has primarily been surgical, with medical management indicated in poor surgical candidates. Percutaneous closure of an acute post-myocardial infarction VSD is a relatively recent development.

The suggested indications are: those patients requiring short term haemodynamic stabilisation before urgent surgery; those requiring an interim measure to allow myocardial strengthening by scarring before definitive surgery; and in those requiring a permanent alternative to primary or revision surgery.⁶ Clinical experience with percutaneous closure of an acute VSD is relatively limited.

Acute VSDs have become increasingly uncommon in the age of reperfusion therapy for acute myocardial infarction. They are still associated with a high mortality rate.

Posteriorly located defects (especially when close to the mitral annulus as in our patient) are amongst the most dangerous, generally being associated with rapid clinical decline and requiring technically difficult surgical management.⁵ These may be the subset of patients who when stable could be managed with our hybrid strategy.

Descriptions in the literature of haemodynamically stable posterior acute VSDs are scarce. Tokui et al⁷ described a patient in 2001 with an acute VSD involving the superior posterior septum who remained haemodynamically stable, allowing surgical intervention 19 days after infarction. Koh et al⁸ similarly described a patient in 1992 with an acute VSD involving the posterior septum who remained in a stable condition, allowing successful surgical intervention 43 days after myocardial infarction.

It should be noted that an acute VSD with surrounding necrotic muscle is unlikely to initially provide an ideal substrate bed for device stabilization. In this situation, if clinical stability persists it is likely to be beneficial to delay VSD closure until the necrotic muscle bed fibroses.

It is also important to note that our technique will not be applicable to all patients. A VSD with demanding anatomy, for example—such as a VSD with multiple significant components, formed by septal avulsion from the ventricular wall, or with a particularly tortuous course—may be unsuitable for our technique.

As a further word of caution, we feel early discharge from hospital cannot be recommended with these patients—as infarct extension (with potential for increasing shunt size and congestive heart failure) is the described natural course of this pathology.

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Lymphangitis carcinomatosa mimicking miliary tuberculosis

John Welch, Geoffrey Welsh

On 17 September 2007, a 36-year-old Thai woman attended a local doctor for an immigration medical. Through an interpreter she was noted to have had tiredness for 2 months and a cough for 2 weeks. She denied haemoptysis.

Physical examination was normal as were her routine blood tests.

The community radiologist commented on an earlier chest X-ray (CXR), similar to Figure 1 CXR but with nodules on that examination being of slightly smaller size:

...the likely diagnosis is widespread miliary tuberculosis however small metastases from other diseases such as thyroid, stomach etc cannot be excluded from this single radiograph.

Figure 1. Chest X-ray



The patient was referred to the local hospital for further investigations. The hospital notes documented weight loss, tiredness, and loss of appetite. The patient had been in New Zealand for about 1 year and was married with two children.

Physical examination was unremarkable apart from a cervical gland on the left side of the neck and she was afebrile. A list of 31 close contacts was noted. Routine blood tests showed an elevated ESR (85) and CRP (80). HIV test was negative.

The provisional diagnosis was miliary tuberculosis; and as she was unable to produce sputum, she went on to have a bronchoscopy. The aspirate did not show any acid fast bacilli, and *Mycobacterium tuberculosis* complex DNA was not detected. She was given standard anti-tuberculous treatment and discharged on 24 September 2007 under the care of the public health nurse.

On 16 October 2007, the public health nurse brought the patient back to the emergency department (ED) because of rectal bleeding. On examination the patient was emaciated, clinically dehydrated, and appeared to be in respiratory distress. She was afebrile, pulse 124, respiratory rate 36, and oxygen saturation was 96% on room air. The repeat CXR (that in Figure 1) showed findings of widespread pulmonary nodules.

The hospital radiologist was of the opinion that these were more typical of carcinomatosis rather than miliary tuberculosis. He had not seen the CXR at first presentation.

A CT examination was reported by a second hospital radiologist as follows:

...necrotic lymph nodes in the neck and abdomen, large destructive vertebral lesion, and gross miliary changes throughout the lungs are most likely due to severe tuberculosis. Diffuse malignancy cannot be excluded but seems much less likely.

The previously noted cervical gland was biopsied and the histology showed adenocarcinoma. A rectal examination revealed a nodular mass consistent with a rectal carcinoma.

The patient continued to deteriorate and died from respiratory failure on 19 October 2007.

Discussion

The expansion of Marlborough vineyards has led to an influx of foreign workers. Many do not have English as a second language and they seldom have medical insurance. Local general practitioners are unable to accommodate these people as patients, and the burden of care falls on the ED of the local hospital.

The initial diagnosis of miliary tuberculosis was reasonable. The large number of contacts was of concern as a public health issue. The patient's treatment was supervised in the community, and the treatment was free of charge under public health provisions relating to tuberculosis.

Despite 2 weeks of standard treatment for tuberculosis, the patient remained unwell and it was clearly necessary to consider alternative diagnoses such as carcinomatosis, with the primary malignancy typically being from breast, thyroid, a sarcoma, melanoma, prostate, pancreas, bronchus, or gastrointestinal (GI) tract.

Following haematogenous spread to the lungs, the malignant cells seed into the pulmonary interstitial tissues and lymphatics. The pathophysiology is similar to the process leading to miliary tuberculosis.

The patient's care was problematic due to language difficulties; a recurring theme for ED presentations of foreign workers. The perceived threat of infection caused social isolation and the interpreter was reluctant to spend time with the patient.

At the time when power of attorney (POA) became necessary these difficulties became worse and involved communications with the patient's father in Thailand. The POA was received written in the Thai language. During the last part of the patient's life it was necessary to research and accommodate her Buddhist beliefs.

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Chronic abdominal pain

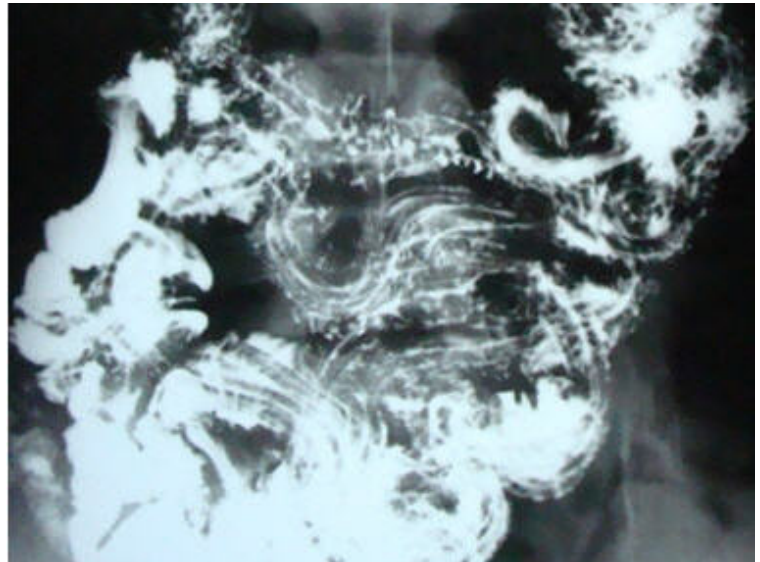
Ankit Shrivastav, Jyotirmoy Pal

A 25-year-old female from a rural area presented to our hospital with symptoms of abdominal pain and discomfort lasting 1 year. Physical examination and all routine investigations were normal. Ultrasonography of the abdomen and an upper gastrointestinal endoscopy were done; findings were also within normal limits. The symptoms persisted with the patient requiring anti-spasmodic drugs intermittently. A barium meal follow-through was performed (Figures 1 and 2).

Figure 1



Figure 2

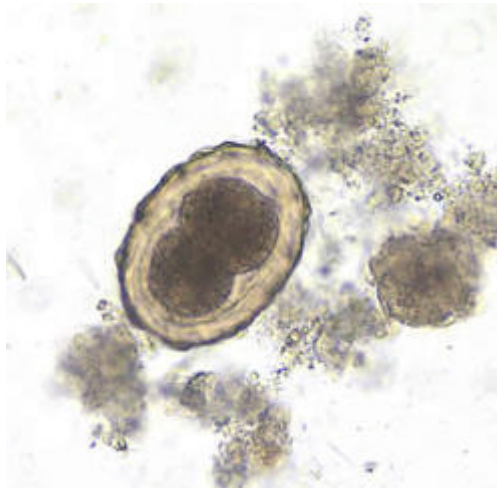


What is the diagnosis?

Answer

The barium meal follow-through showed a large number of parasitic worms in the jejunum with tram-track appearance² and string sign² suggestive of *ascariasis* infestation. A stool examination was done for the patient which revealed *Ascaris lumbricoides* eggs (Figure 3). She was administered albendazole 400 mg.

Figure 3. *Ascaris lumbricoides* fertilised egg with embryo in the early stage of development, in a wet mount (magnification: ×200)



The patient became symptom-free within a week and a stool examination 2 weeks later showed no eggs.

Discussion

This case highlights the importance of basic and low-cost investigations like stool examinations which would have lead to the diagnosis initially; other (more expensive and complex) investigations could have been avoided. Stool examinations are especially relevant in developing countries and for patients from rural areas.

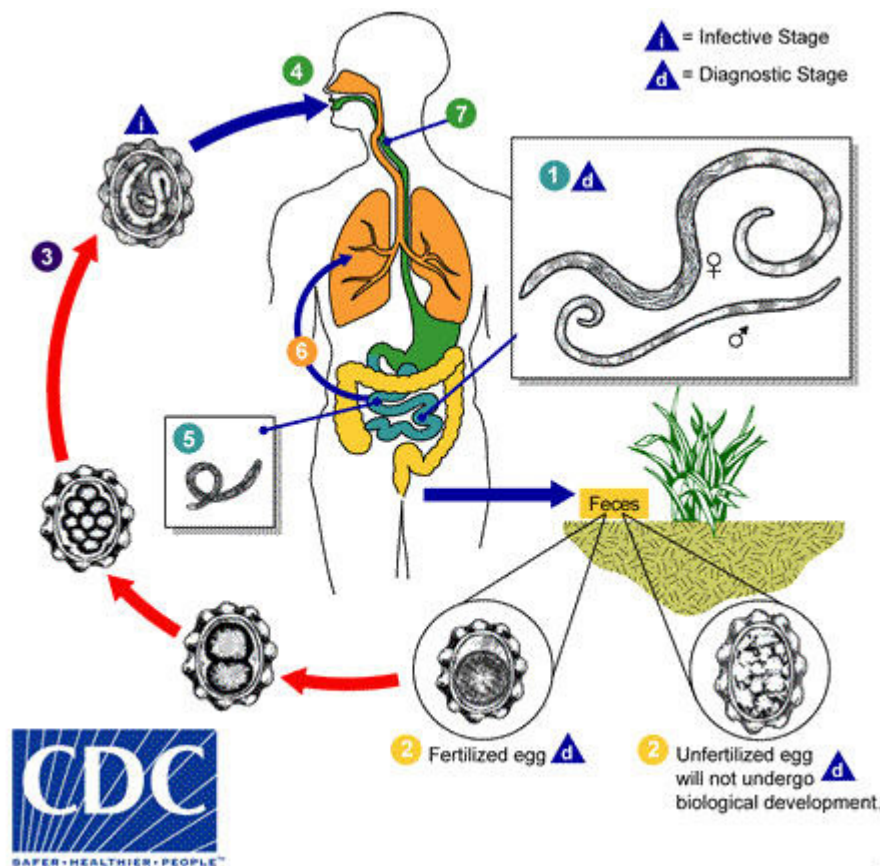
Ascariasis is an infection with *Ascaris lumbricoides*. It is a cosmopolitan parasite inhabiting the gut of one-fourth of the world's population.¹ The highest prevalence is in malnourished people residing in the developing countries¹ and the jejunum and ileum are its preferred habitats. It is particularly common in India, though incidence is falling due to government-sponsored large-scale de-worming in the community.

A. lumbricoides is a large, lumen-dwelling nematode contracted by the ingestion of its larva via eggs. Eggs of *A. lumbricoides* are not immediately infective after leaving the infected host. They require a holding period in a suitable environment and become infective once second-stage larvae have developed in the eggs.

As shown in Figure 4 the larvae hatch from the eggs. Larvae are swallowed and most grow to adulthood in the small intestine where they mature, copulate, and lay eggs in the intestines. Adult worms may live in the gut for 6–24 months. However they can also penetrate the small intestine wall and migrate through the lymphatic system and

bloodstream to the liver, and then to the lungs where they enter the alveoli. There they pause for at least 2–3 weeks and molt, giving rise to allergic bronchopneumonia in previously infected and sensitised individuals. Later, they wander up the bronchi and trachea, giving rise to bronchitis with bronchospasm, urticaria, and occasionally larvae in the sputum.

Figure 4. Life cycle of *Ascaris lumbricoides* and routes of infection



The adult worms are up to 30 cm long and 4 mm wide, and may cause mechanical problems (especially in children) because of their size and cause severe nutritional deficiency due to their numbers and mass. A temperature elevation to 39°C, certain drugs, and some unknown influences may cause the worms to congregate, sometimes resulting in intestinal obstruction and migration out of the gut into the bile duct, oesophagus, mouth, pancreatic duct or appendix, and occasionally the liver causing biliary and pancreatic duct blockages and even obstruction of the appendix.³

The migration leaves necrotic tracts in the liver with hypersensitive inflammation produced by adults and eggs. Adult worms may perforate the intestine and pass out of the gut, leading to peritonitis.

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Bertillon's Nomenclature of Disease and of Cause of Death (part 3)

Written by Dr Colquhoun, Dunedin, and published in N Z Med J. 1907;5(23).3.

Continued from part 2 at <http://www.nzmj.com/journal/121-1284/3319>

If we next look at the forms for Death Certificates which are issued to medical men, we will see little to commend.

Who knows what is meant by first and second cause of death? Does “First” mean the direct or immediate cause of death, or does it mean the essential disease which killed the patient? Take the instances already cited, Apoplexy, Bright’s, General Paralysis and Pneumonia; which should come in the first heading and which in the second? I have spoken to many medical men on this subject and there is nothing like unanimity of opinion about it.

Is there any value to be attached to the column under “Time from attack till death,” and is any use made of it? I should say that in the majority of cases it is filled in, if at all, at a random guess, and no one would dream of using the result obtained for any scientific purpose.

If we turn to the Bertillon system, we see that it follows the English—but it has been simplified and enlarged with the advance of knowledge in medicine and surgery.

“General Diseases” include 59 conditions which may cause death and be necessary for morbidity tables. These appear in our Statistics under such headings as “Miasmatic,” “Septic,” “Constitutional,” etc. The other headings are chiefly anatomical and are self explanatory.

A very full list of Synonyms is added, useful both to the practitioner and to the lay registrar of deaths. Under each disease the most-frequent complications are given. It would be tedious and unnecessary to examine in detail the whole list which numbers 178 diseases.

My object is to ask this branch of the Association to decide if in their opinion, the present system of registration is satisfactory, and if not, to have it altered. There can be only one way to do this and that is to endeavour to get the New Zealand authorities to unite with those of the Commonwealth in adopting the International system.

As the revision of the list is fixed for 1910, there will be plenty of time to decide upon any suggestions the profession in New Zealand might wish to offer, either as to nomenclature or form of certificate.

[The Registrar General for New Zealand, Mr Von Dadelszen, in reply to a question as to the view taken of the Bertillon system by the New Zealand authorities, stated that it is intended to begin statistics in the Bertillon system at the end of this year.]

“Readers will be glad to know that our esteemed correspondent, Dr Colquhoun, has been recently elected a Fellow of the Royal College of Physicians.”



Urgent aspirin to prevent or minimise myocardial infarction

Disaggregation of platelet emboli is achievable within a few minutes of ingestion of aspirin. As such emboli are often relevant in the evolution of a myocardial infarction it is obvious that aspirin is an appropriate treatment. The authors of this editorial recommend 300 mg of aspirin in such patients even if they are already taking low dose aspirin. They point out that aspirin has a half life in the blood of 30 minutes so there will be fresh sensitive platelets aggregating and the top up dose is appropriate. They also point out that after thrombolysis there is heightened platelet activity so these patients also need additional aspirin. So they strongly recommend that doctors and ambulance workers are aware of this. "Moreover all persons at risk, including older subjects, should be advised to carry their own aspirin." Convinces me.

Postgrad Med J 2008;84:337–8.

Another use for the wonder drug—aspirin vs dementia?

Cerebrovascular disease is involved in the development and progression of mild cognitive impairment and dementia. Aspirin is of proven value in mitigating transient ischaemic attacks and strokes and observational studies have shown an association between the use of aspirin and reduced odds of cognitive impairment. So says an editorial on this topic. So what about a prospective randomised trial to test this theory? Well here it is—3350 Scottish men and women aged 50 years and older were randomised to low dose aspirin (100 mg daily) or placebo for 5 years.

And the results—unfortunately for all of us low dose aspirin does not prevent cognitive decline in middle aged to elderly people at moderately increased cardiovascular risk.

BMJ 2008;337:525–6 & 554–8.

Domestic fatal medication errors

Adverse drug reactions, some fatal, occur in hospitals and have caused concern. In this paper the causes of death in the US between 1983 and 2004 have been reviewed. 224,355 of 50 million deaths were due to fatal medication errors.

The point made in this paper is that there has been an alarming increase in such deaths in the domestic setting. The largest increase (3196%) occurred when prescribed medication was combined with alcohol and/or street drugs. Other relevant factors include polypharmacy, over the counter drugs, and discharge from hospital with reduced professional oversight. I suspect that pressure for early (?too early) discharge from hospital and the increasing age of patients are also relevant factors. However, in this report, the highest increase in such fatalities was in the 40–59 year age group suggesting that alcohol and/or street drugs were important.

Arch Intern Med 2008;161(14):1561–6.

Depression in elderly men and testosterone (or lack of it)?

Variation in sex hormone levels are blamed for menopausal symptoms in women—is there an analogous situation in males? Some observational studies suggest that testosterone deficiency in elderly males may be associated with depression.

This study attempts to elucidate by studying 3987 men, aged between 71 and 89 years, 203 of whom had mental depression. Those who were classified as depressed had significantly lower total and free testosterone concentrations than nondepressed men ($P < .001$ for both). However, they were also more likely to smoke and to have low educational attainment, a body mass index categorised as obese, a Mini-Mental State Examination score less than 24, a history of antidepressant drug treatment, and greater concurrent physical morbidity.

After adjusting for these confounders, it appears that the relative risk is 1.55 and 2.71 for lower total and free testosterone levels. Convincing? Apparently not, as the authors recommend a randomised controlled trial to prove the point.

Arch Gen Psychiatry 2008;65(3):283–9.

Mild hyponatraemia—a risk for falls in the elderly?

Severe hyponatraemia is a well known neurological hazard. But what about mild hyponatraemia (mean serum sodium chloride 131 mEq/L), does it pose health risks?

This study from Belgium reviews 513 patients, aged 65 years or older who have fallen and sustained fractures and compares them with age and sex matched controls who have no history of fractures. They found that the prevalence of hyponatraemia was 13.06% in the fracture cohort and 3.9% in the control group.

The overall risk in the hyponatraemic subject was 4.16. So mild hyponatraemia is not good for you. And, unfortunately, over half of the hyponatraemia was medication induced—diuretics 36% and selective serotonin reuptake inhibitors 17%. Take home message—check your patient's electrolytes, particularly if you have prescribed drugs that may cause the problem.

Q J Med 2008;101:583–8.



Open access journals and a case of phytophotodermatitis

Anyone involved in research has probably faced the frustration of not being able to access certain journal articles, whose particular subscription is not held by one's institution. For example, university libraries need to perform a *triage* and only subscribe to a limited number of publications as permitted by their financial resources.

Following the exponential increase in internet use, access to research literature has now become considerably easier. An increasing number of organisations and academics support the notion that research information should be freely available to all,¹⁻³ especially 'open access' to scholarly articles. According to the Budapest Open Access Initiative:¹

By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited.

Note that, according to the above (and widely accepted) definition, even when articles are immediately available for free download to all, a journal would not qualify as open access if it holds copyright for all material published.

Considerable controversy and debate remains on the pros and cons of open access.⁴⁻⁸ Some of the arguments against the open access model revolve around the long-term financial feasibility of the system. Recent initiatives such as the Open Journals Systems have been able to overcome such monetary limitations,⁹ making it possible for a scholarly journal to be published with virtually no resources needed to support it.¹⁰

Barbour & Patterson from the Public Library of Science (PLOS) opened their article with a 19th Century quote from Sir Antonio Panizzi (Principal Librarian of the British Museum):⁵

I want a poor student to have the same means of indulging his learned curiosity, of following his rational pursuits, of consulting the same authorities, of fathoming the most intricate inquiry as the richest man in the kingdom.

This quote is somewhat appropriate in a world with many inequalities. As a South American, I understand the financial difficulties faced by many (if not most) universities and research institutions in the developing world.

Stokes & Pandey highlighted that open access publishing is a valuable resource for the synthesis and distribution of essential health care information,¹¹ particularly in low and middle income countries. John Willinsky's book in particular (*The Access Principle: The Case for Open Access to Research and Scholarship*) makes a compelling case for open access,¹² leaving little doubt in the reader's mind that this approach provides valuable access to information in poorer countries, otherwise not

possible under the traditional 'user pays' system. Furthermore free online access to journals seems to significantly increase research usage and impact.⁷

Some journals have adopted a compromise in the absence of open access and, while they still hold copyright for the published material, they offer free download after an embargo period. One such case is the *New Zealand Medical Journal (NZMJ)*, which adopts a 6-month embargo. Although not ideal, this is a considerable improvement on the 3-year embargo period adopted by other journals in this country, such as those published by the Royal Society of New Zealand.

This letter hopes to raise awareness and emphasise the usefulness of open access to the general public. Marius Rademaker and I published a case report regarding human exposure to a fig tree (*Ficus carica*) in the *NZMJ* in August 2007, which illustrated that cases of phytophotodermatitis resulting from contact with this tree can be severe.¹³

I was recently contacted via email by a 45-year-old man from Southern California (USA). He described that he moved a young fig tree within his property, and a day or two later he noticed some red 'scratches' on the shoulder where he cradled the tree during transport. Some hours later, the two larger 'skin marks' began to blister, which led him to carry out a Google search for "fig tree blister". This search returned our *NZMJ* article,¹³ which was already freely available since this had been published more than 6 months prior. After reading the content, he immediately sought medical attention, taking a printed copy of the article to the attending physician at the hospital. This early intervention, with supporting information, meant that timely mitigating action had some effect, preventing further aggravation of the symptoms.

I have no doubt that this person's experience is just the tip of the iceberg regarding the potential impact of online free access to scholarly information. I hope that the *NZMJ* will make an even greater contribution, and eventually move to immediate free access to all of their articles. This may be possible through the adoption of the Open Journal Systems interface.⁹

While I consider the debate on the whether the *NZMJ* should continue to hold copyright for all material published is yet to be resolved, I have no doubt that it should become a free-to-all publication.

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NZMA response

The *New Zealand Medical Journal* is already largely a free-to-all publication. All items more than 6 months old are freely available to anyone in the world who has internet access. It is only the most recent 6 months that is password-protected, and for two important reasons:

Firstly, the *Journal* of the New Zealand Medical Association is a member benefit for those doctors who chose to belong to their professional association. Most societies and associations have their own publications, and it is due to the high quality of the *NZMJ* that many non-members are also keen to read it. The *NZMJ* is largely funded by the annual membership subscriptions paid by doctors to belong to the NZMA.

The second reason is also financial. Six years ago the NZMA Board made the difficult decision to cease paper publication of the *NZMJ* and move to complete online publication. Due to increasing overheads, the *NZMJ* was costing the Association hundreds of thousands of dollars annually which was not being offset fully by advertising or subscription income. The decision to go online was not welcomed by all, but was made in order to secure the future of the *NZMJ*. The NZMA continues to earn substantial income from subscribers, particularly large institutions (such as universities) both in New Zealand and overseas. If the publication was free-to-all, there would be no reason for them to subscribe, with a subsequent loss of income.

While the idea of being free-to-all is an altruistic one, the reality is not so simple. Many other journals have similar practices. The online *BMJ*, for example, is password-protected for the first year of publication. There is no stopping any eligible person from either subscribing to the *NZMJ* or joining the NZMA.

A 1-month subscription costs only \$NZ30 (for a New Zealand subscriber), which is around the same price many prestigious overseas journals charge per item. If a person contacts us wanting only one item, we will usually give it to them at no charge.

Cameron McIver

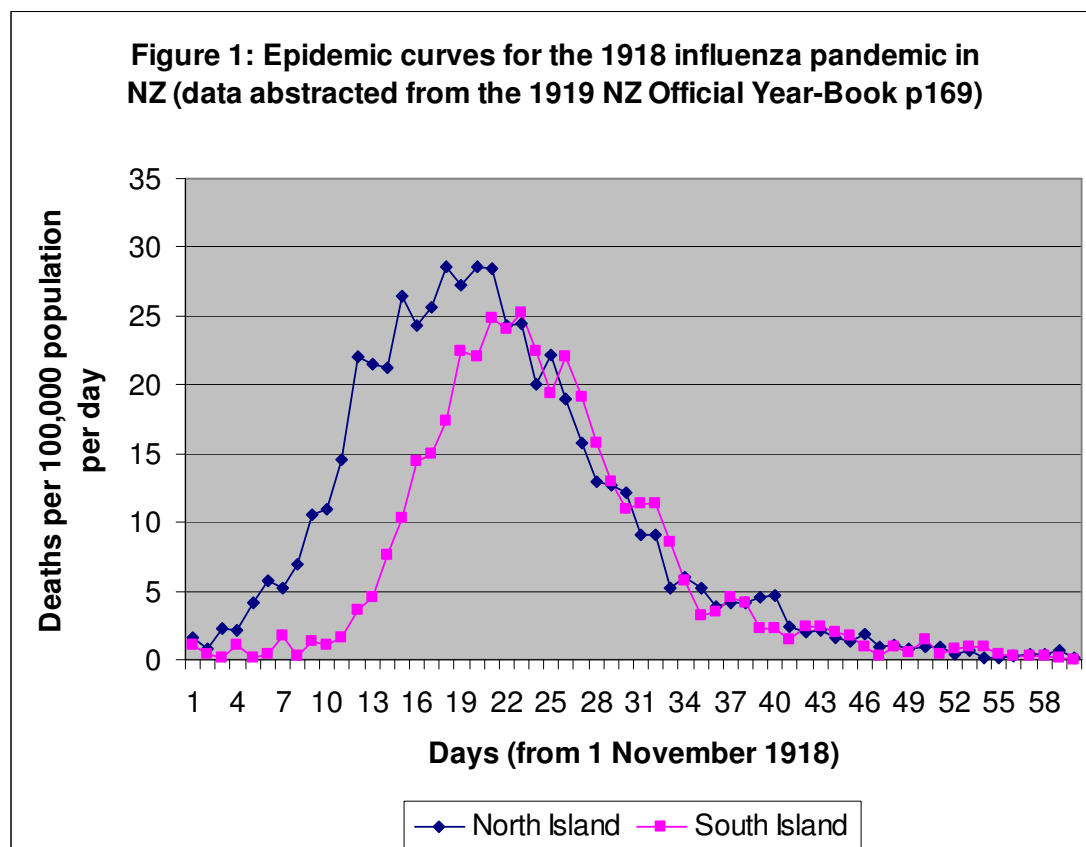
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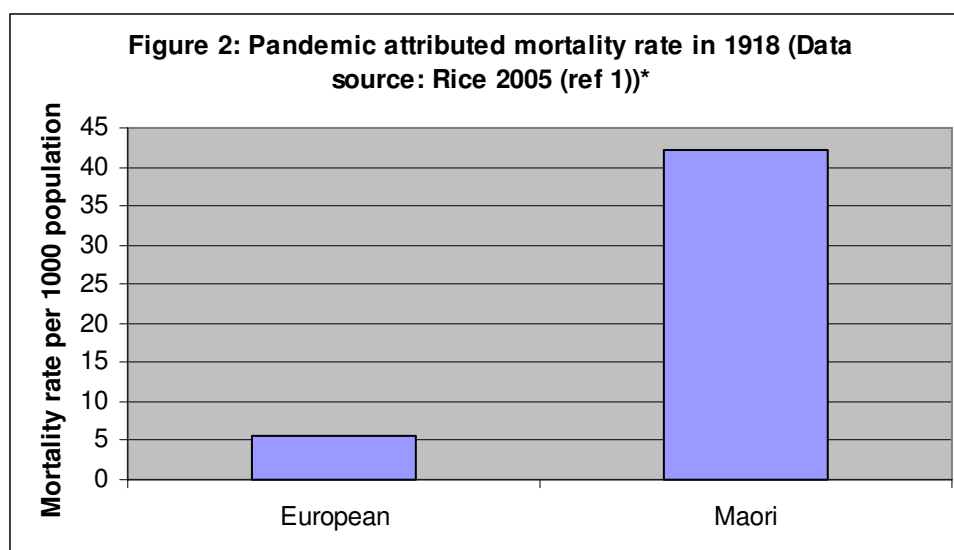


Ninety years on: what we still need to learn from “Black November” 1918 about pandemic influenza

The 1918 influenza pandemic remains the worst single human health disaster in recorded New Zealand history. Here we take the opportunity of the 90th anniversary of this epidemic to summarise the impact of this event and the need for further research.

The second wave of the pandemic probably arrived in New Zealand in October 1918 and peaked in mid-November in the North Island, leading the South Island by about a week (Figure 1). There were over 8000 deaths.¹ Māori were particularly hard hit with a mortality rate at least seven times that of Europeans (Figure 2).





* Hundreds of probable pandemic-influenza-related deaths amongst New Zealand military personnel overseas (First World War in Europe) are not included in these rates (with work on clarifying this mortality currently underway by us). Nevertheless, these rates more accurately reflect the total disease burden than the Year Book data in Figure 1 (which was based on only 5516 pandemic-attributed deaths).

As influenza pandemics are infrequent (at around three per century or fewer), we need to look carefully at this event to extract all possible lessons. Furthermore, understanding this disaster may inform societal preparations for future disasters such as those associated with climate change or other events.²

In a recent editorial we argued that as part of a research agenda on pandemic influenza we need to learn more about the epidemiology of this pandemic in New Zealand.³ This research work needs to build on previous work by historians,^{1,4,5} demographers,⁶ and public health workers.⁷⁻¹¹ But many other gaps remain as we suggest in Table 1.

Table 1: Research domains that continue to need development with regard to the 1918 influenza pandemic in New Zealand

Research domain	Plausible research funders	Comment
Epidemiology	Health Research Council (HRC), Ministry of Health (MoH)	As detailed elsewhere, ³ there are knowledge gaps around the mortality differentials by ethnicity and socioeconomic position (for civilians and military personnel). The epidemiology of the disease in military camps and troop ships is also largely unexplored. Factors contributing to lower mortality rates in some communities could be investigated, as has been done elsewhere. ¹²
Māori history	Te Puni Kōkiri, Department of Internal Affairs, Marsden Fund	A Māori perspective on the impact and response to the 1918 pandemic is important given the very much larger mortality rates documented for Māori (Figure 1). ^{1,6}
Social history	Department of Internal Affairs, Marsden Fund	Some high quality work has been done (e.g. by Rice ¹ and others) so the next step is probably a review that integrates all the work to date. Such a review could incorporate work from unpublished theses (listed by Rice ¹) and local histories e.g. for Wellington. ¹³

Research domain	Plausible research funders	Comment
Military history	Department of Internal Affairs, Ministry of Defence, Marsden Fund	The pandemic influenza experience of the NZ Expeditionary Force has never been described in detail. A good model for such a study has recently been provided by a US-based historian. ¹⁴
Disaster sociology/ psychology	HRC, MoH, Marsden Fund	No sociologist or social psychologist has published anything on this pandemic disaster in New Zealand.

We hope that, by the time of the 100th anniversary of this pandemic, New Zealand research funders will have supported new work on this important topic. We also hope that New Zealand society will have a much deeper understanding of this disaster and that more of its lessons can be built into emergency plans and preparedness infrastructure.

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Ninety-six percent of New Zealand smokers support smokefree cars containing preschool children

New Zealand and international research shows that smoking in cars, even with the windows down, produces dangerous levels of pollutants.^{1,2} These levels are far higher than World Health Organization air quality guidelines for particulates in ambient air.³

While at least 10 Australian and North American jurisdictions (including California) have banned smoking in cars carrying children,⁴⁻¹³ New Zealand officials have been reported as hesitant about considering such a move.¹⁴ Perceived questions about public support appear to have contributed to lack of progress on this issue in New Zealand.¹⁴

In a number of areas of Australia and North America, support from smokers (85% or over) and non-smokers (90% or over) has been reported for banning smoking in cars with children inside.¹⁵⁻¹⁸ In a 1997 Wellington area survey, 94% agreed that cars with children in them should be smokefree (86% of smokers).¹⁵ In a 2004 New Zealand wide survey, 76% disagreed that it is “okay” to smoke around non-smokers inside cars even when there are windows down.¹⁶

New NZ data on smokers’ attitudes—Between March 2007 and February 2008 we surveyed a national sample of 1376 New Zealand adult (18+ years) smokers. A specific question included: ‘Do you think smoking should be allowed in cars with pre-school children in them’? Further detail on the survey methods is available elsewhere.¹⁷

Results weighted to reflect the national population of smokers showed that 95.9% disagreed (95%CI: 4.7%–97.1%) and only 3.0% agreed with this question. That is, there appears to be almost universal support for not allowing smoking in cars carrying children, from smokers themselves.

New Zealand advocates and policymakers now have evidence of strong support by smokers for pursuing the safety of children from tobacco smoke pollution in cars.

A smokefree car law should be a priority for the new government.

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Competing interests: Three of the authors (GT, NW, RE) have undertaken work for health sector agencies working in tobacco control.

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European melanoma incidence: a response to Professor Shaw's melanoma editorial

The editorial by James Shaw (*Melanoma in New Zealand: a problem that is not going away*. NZMJ. 2008;121(1279):6–9. <http://www.nzma.org.nz/journal/121-1279/3187>) provides commentary on our paper¹ published in the same volume of the *Journal*.

Although we all agree that melanoma is a significant problem in New Zealand, and Shaw is supportive of our work, some reported differences need to be clarified and explained.

Shaw quotes his published² incidence rate of melanoma in Caucasians living in Auckland as 78 per 100,000 in 1995 (525 new cases) and questions the difference between his figure and our national age-standardised incidence rate (ASR) of 40.3 per 100,000. Apart from the two reasons given in his paper (the accuracy of 12 [sic] years of national data collection versus 1 year of local data, and the latitude gradient of melanoma incidence), there are several other reasons for this discrepancy which need to be clarified:

- The 1995 incidence rate for Auckland of 78 per 100,000 is a crude rate. The ASR for Auckland quoted in the Jones et al paper² was 56.2 per 100,000, and that of Martin and Robinson³ 35.6 per 100,000 for 1995–1999, whereas our national ASR for 1995 was 40.3 per 100,000. We did not provide regional figures.
- Both these other studies^{2,3} used Segi's standard population for direct standardisation whereas our rates were standardised to the WHO standard population.
- Population denominators vary according to the data used. Population *counts* enumerate people on census night. Population *estimates* provide population data between census dates using the most recent census data as a base and are usually higher than the census night counts. If population *counts* were used in the denominator, this would result in an inflation of the incidence rate.
- Statistics New Zealand produces national population estimates for the *usually resident* population. Prior to 1996 the population estimates related to the *de facto* population. Use of the usually resident population results in slightly higher population estimates (and thus lower incidence rates) than the *de facto* population. NZHIS uses the estimated mean usually resident population for the year ended 31 December XXXX.
- Jones et al² restricted the denominator population counts to Caucasians or Europeans. If ethnic prioritised counts were used to calculate the population data, this undercounts the total Caucasian/European population and results in an inflation of the incidence rate.
- Changes to the census ethnicity questions have resulted in some data that are not consistent between 1991 and 1996, particularly for the European and

Māori ethnic groups. These 2 years were used by Jones et al² to calculate the 1995 Auckland Caucasian population.

Table 1 in Shaw's editorial also contains some important issues which need to be clarified:

- The collection and categorisation of ethnicity data in the census has changed in the 3 periods given. In particular, in 2006 'New Zealanders' (11.1% of the total) were not included in the 'European' category as in the previous censuses and have been omitted from the table, resulting in a reduced denominator and thus higher rates for Europeans.
- Changes to the wording of the ethnicity question in 1996 resulted in a greater than expected increase in Māori and a decrease in Europeans. The wording in 2001 was similar to that of 1991.
- Historically, population data have been published by Statistics NZ as total responses and prioritized counts. In 2006, only total population responses were published so they should not sum to 100%. The proportion of people choosing multiple ethnicities has increased over time. For comparative purposes it is important to use the same population data consistently over time.
- The overall melanoma incidence figures provided in Table 1 for 1996 and 2001 appear to be WHO ASR from our paper. The provisional WHO ASR for 2006 from NZHIS is 39.2 (22/10/2008). It is unclear where the 2006 overall incidence estimate of 37 per 100,000 comes from.
- As the overall melanoma incidence figures quoted appear to be ASR it is inappropriate to divide by an overall population fraction to get a figure for Europeans. Therefore the figures in the line 'European melanoma incidence' do not measure what is claimed.

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The importance of zinc: a response to Dr Davidson's letter

In response to Dr Davidson's letter *Are practitioners of "alternative" therapies competent to practise medicine? Should the Medical Council take action?* (NZMJ 17 October 2008;121(1284). <http://www.nzma.org.nz:8080/journal/121-1284/3324>) I wish to briefly discuss the example of zinc, as it was the first on his list of unnecessary lab tests ordered by general practitioners (GPs).

The importance of zinc was highlighted in a leading article in the NZMJ¹ which remains in my view compulsory reading for anyone with an interest in the importance of this trace element. The only inaccuracy that has emerged in the 10 years since it was published is that the number of metalloenzymes for which zinc is an essential cofactor has grown from 200 to 300. The author describes zinc as an "essential trace element for optimal human growth and development, normal reproduction, immune and sensory function, antioxidant protection, the stabilisation of membranes and gene expression."

An expansion in our understanding of the role for zinc has occurred around the function of zinc fingers in various epigenetic mechanisms that regulate gene expression, and the regulation of receptor binding.² There are concerns that zinc deficiency in pregnancy and infancy may have adverse neurocognitive and developmental consequences.

Studies have shown that suboptimal levels of zinc are very common in all age groups and it was estimated in an Australian survey that 85% of women and 65% of men do not receive the recommended daily intake (RDI) for zinc in their diets.³

Numerous dietary, environmental, and genetic factors impact on the availability of this nutrient. Diets high in alcohol or sugar are known to significantly increase urinary zinc excretion, whilst diets high in phytic acid (prevalent in grains and cereals), calcium-fortified foods, coffee, and tartrazine are all inhibitors of zinc absorption.

A number of commonly used drugs either increase zinc excretion (thiazides, ace-inhibitors, corticosteroids); interfere with absorption (tetracyclines, drugs that reduce gastric acid); or cause redistribution of zinc in body compartments (oestrogens, and of course the oral contraceptive pill).⁴

Environmental toxins such as heavy metals and xenoestrogens also influence zinc availability. In addition to all of the above many disease processes as well as normal physiology influences zinc utilisation and distribution.

That Dr Davidson thinks that testing this trace element "should almost never be required in general practice" suggests we are reading not only different text books, but different versions of the NZMJ. The fact that a growing number of GPs (whose job it is to unravel and treat complex illnesses) are taking an interest in the zinc status of their patients is a positive sign that a more comprehensive view of essential human physiology, biochemistry, and nutrition is being incorporated into our understanding of individual health and disease.

The issue we should really be discussing is how better to assess zinc status and the most relevant application of that testing. We can all agree that the vagaries of serum zinc, with some important exceptions, may misrepresent the clinical importance of this vital nutrient.⁵ The evidence around the usefulness of serum zinc as an indicator of zinc deficiency was recently reviewed by Gibson⁶ and found to support the value of the test.

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Practice nursing in New Zealand

The editorial by Docherty et al¹ in the 17 October 2008 issue of the NZMJ raises several issues about the position of practice nursing within the *Primary Health Care Strategy*. In doing so it makes a number of assumptions; chiefly, that the role of the practice nurse has changed little since the Practice Nurse Subsidy was introduced 40 years ago.

It goes on to assert that the main reason for this is that practice nurses remain employees, and are unable to access capitation funding in their own right.

We agree that there are many issues facing practice nursing, including the fact that it has an ageing workforce with no standardised career pathway, as pointed out by Docherty et al. The general practitioner workforce, however, suffers from exactly the same problems.

There continues to be a misunderstanding about what capitation actually is. It is a subsidy on behalf of the patient, to reduce the amount that they pay for a consultation. The quantum of the formula was initially calculated on the basis of GP consultation rates and the subsidy amount. Subsequent tranches of increased capitation have been brought in with a requirement that the increased subsidies would be passed on to the patient (and a fees review process was brought in to ensure this).

It is important to recognise that the capitated subsidies relate to consultations within the practice, and do not discriminate between consultations by general practitioners and practice nurses. The old Practice Nurse Subsidy was incorporated into capitation and was meant to provide a subsidy for practice nurse consultations, though was also expected to assist practices by funding predominately practice nurse activities like recall programmes that do not involve a direct patient contact.

Unless capitation rates were increased, any further diversion of the capitated subsidies would be an effective reduction in the subsidy for that consultation and, therefore, result in an increase in patient co-payments.

The NZMA strongly supports advancement of the practice nurse role. While we accept that the increased potential of practice nurses has not yet been recognised in all practices, it has increasingly become so, as has the need for practice nurses to be involved in clinical governance arrangements. There is good evidence that the role of the practice nurse has changed in the last few years.^{2,3}

That these innovations are occurring shows the value of teamwork within General Practice that needs to be nurtured and promoted, and that teamwork and clinical governance are much more important than whether funding is “ring fenced” for nursing or what the employment arrangements of practice nurses (and GPs) are.

Mark Peterson

Chair

NZMA General Practitioner Council

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David Simpson Cole

David Simpson Cole, Dean of the Auckland School of Medicine, died on 8 September 2008, aged 84 years.



David Cole was a natural leader. This was apparent throughout his life, in his student days at Otago University, as a cardiovascular surgeon at Greenlane Hospital, as Dean of Medicine, and in his retirement years he helped to develop the U3A (University of the Third Age) in New Zealand.

He was a gardener, a builder, an innovator, and dedicated but indifferent golfer.

Both David's parents were medically trained. His father was a general surgeon and his mother Elizabeth was a health educator working with mothers and children.

David, developed an interest in medical research when he completed a BMedSc with Professor Jack Eccles at Otago Medical School. In 1948, as a member of the Student Council, he enthusiastically initiated the re-establishment of the Capping Concert and Procession in Dunedin.

While training to become a surgeon, he worked a year as a Demonstrator in Anatomy with Professor Bill Adams, in Otago. In 1955, he went to England to train in general surgery at Colchester Hospital. He then trained in Thoracic Surgery with Sir Russell Brock at The Brompton Hospital in London.

David returned to New Zealand to continue his training with Sir Douglas Robb and Rowan Nicks who had started thoracic surgery at Greenlane Hospital. At the same time Sir Brian Barrett Boyes returned home from the United States, very keen to start open heart surgery in Auckland. One of the six Melrose Heart and Lung machines made in London was adapted by Syd Yarrow for use in Auckland. Animal studies on sheep were undertaken to develop the techniques for human bypass surgery.

Fifty years ago the first open heart surgery was undertaken to close successfully a ventricular septal defect in a 9-year-old girl. Hundreds of successful bypass operations have since been performed at Greenlane Hospital. David had a particular interest in peripheral vascular surgery and developed several new techniques in this field.

The National Heart Foundation was established by a group of Auckland business men in 1958. David played a major role in the development of the educational programmes which were implemented by Sir David Hay, the first Medical Director of the Foundation.

In 1942, Americans on war service in the 39th General Hospital from Johns Hopkins Hospital held postgraduate medical education meetings with local physicians at Auckland Hospital. After the war, Sir Douglas Robb (Chancellor of the University of

Auckland) proposed that a Postgraduate Medical Committee be created and David Cole was appointed Associate Dean of Graduate Studies.

A Senate Medical Advisory Committee was established in 1964 to develop the School of Medicine in Auckland. David Cole was an active member of this committee developing the curriculum and policies for the new Medical School. Professor Cecil Lewis was appointed the first Dean at the Auckland School of Medicine in December 1966. Over the next 6 years David Cole established many postgraduate courses. In 1974, he was appointed Dean of the School of Medicine.

As Dean, David led the School for 15 years through a period of great growth. The annual student intake grew from 60 to 120 students, and the teaching programme expanded to include the new academic units at Greenlane Hospital, Middlemore Hospital, and later Waikato Hospital. Many new academic appointments were made in orthopaedic surgery, plastic surgery, ophthalmology, geriatrics, and general practice funded by private donations.

David Cole was a gifted teacher who enjoyed sharing his thoughts both in lectures and informal talks. He retained his interest in clinical bedside teaching, and introduced new methods for evaluating student competence which are still used today. During his time as Dean, undergraduate education was refined to include a graduate trainee year where senior students were directly responsible for patient care. This was a great success and was adopted by the Otago Medical School. Under his leadership the Auckland School of Medicine matured into a well-funded research-based institution.

David Cole was an active member of the Medical Council, he was a prolific writer, and developed medical standards for monitoring clinical performance and processes for working with practitioners failing to meet the standards required for safe clinical practice.

In his retirement David Cole as Emeritus Professor maintained a keen interest in the Auckland School of Medicine as it expanded into the School of Health Sciences. He is remembered with warmth by both staff and graduates.

But David Cole was much more than a medical leader, he was the loved husband of Margaret and valued father of his five children. Above all, David enjoyed his family life, spending time at Anawata their holiday home on the wild West Coast above Piha.

He had a rich life with his extended family and many friends. David Simpson Cole leaves a wonderful legacy. David we salute your passion for life, your enthusiasm, your wide range of interests, and the way you have enriched our lives.

Professor Derek North and Dr Gavin Glasgow wrote this obituary.



Keith Richards Simcock

15 June 1916 – 15 September 2008

Keith Simcock, who graduated in 1950 from Otago Medical School, died recently, aged 92. He had lived in his own home in Mission Bay until his last 2 weeks in Auckland Hospital.



Keith was born in Hamilton (as the last of 4 children) in the middle of the First World War. Keith (or Mick as he was known by family and friends until enrolling for med school in 1945) was educated at Hamilton High School; an academic student but also a very competent sportsman, a champion miler, and rugby captain

He finished school in the middle of the Depression which had caused his family severe financial hardship. There was no chance of going to university as Mick would have liked. “You must get a job—any job” he was told. He ended up as a shop assistant in House and Daking, a drapery shop whose owner took a shine to Mick.

The owner asked Mick to accompany his own (somewhat wayward) son to London where they both ended up working in major department stores.

When war broke out, Mick very quickly joined an anti-tank regiment made up of about 120 New Zealanders living in London. He was the second-to-last survivor of this group when he died this year. He saw action in Tobruk, Greece, Crete, Alam el Halfa, and El Alamein before he was wounded in that battle in September 1942 and invalided back to New Zealand.

As a returned serviceman, he was eligible for a student scholarship so Keith was finally able to study medicine. After 5 great years in Dunedin, where he fell in love with (and married) the daughter of the professor of surgery (Sir Gordon Bell), he and Alison moved to Howick where he was in general practice for the next 33 years.

As well as making house calls to Whitford and Maraetai, he delivered many babies at the Howick Obstetric Hospital and was the doctor for the Howick Geriatric Home. Former patients still greet his family with “Are you related to Dr Simcock? He helped our family so much.” In the early 70s he published “Dear Elizabeth”, a guide to young people struggling with adolescence through to getting married. Keith became a Fellow of the English and New Zealand Colleges of General Practice.

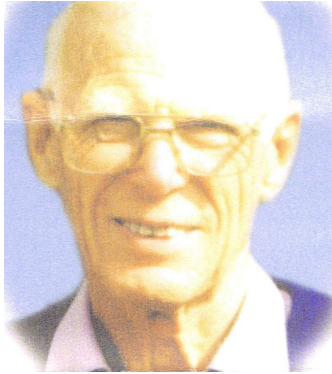
On retirement, Keith and Alison moved to Mission Bay where they lived for more than 20 years. They were both very active participants in U3A and Keith’s inventive mind saw a constant stream of furniture made in his workshop and insightful ideas of how to improve the world tested on his friends. Alison died in 2005. He is survived by sons David and Andrew and his daughter Claire.

David Simcock (Keith’s son) wrote this obituary.



Philip Gladstone Downey

Phil was born in Tokomaru Bay, East Cape in 1923. His childhood was spent on a remote East Cape farm and involved going to school on horseback.



His secondary education was as a boarder in Auckland.

He graduated Otago Medical School 1947 and spent his House Surgeon years in Wellington where he met Ngaire. He married Ngaire in Wellington in 1949.

He then moved to Christchurch in early 1950s where he commenced part-time General Practice and part-time Anaesthetic Practice. During this time he developed an interest in counselling. He undertook training for the Priesthood in 1961/62/63.

In 1964 he moved to Auckland to take up Marriage Guidance Counselling under the auspices of the Department of Justice. Not long after he returned to General Practice where he was in part-time practice with Dr Bill Brabazon and also returned to part-time anaesthetics at Auckland's Greenlane Hospital.

His interest in counselling went deeper and he started part-time study for the Department of Psychological Medicine under the auspices of the Auckland University in the early 1970s working at the Auckland Hospital.

Once his Diploma was completed he left General Practice and Anaesthetics and took up psychogeriatrics working in the Buchanan Clinic at Carrington Hospital from 1976–88 eventually becoming the Unit Head. He retired as Unit Head in 1988 but continued part-time psychogeriatrics in to the early 1990s. Following this, he commenced volunteer services at the North Shore Hospital and because of staff shortages he came out of retirement in 1995 as a Palliative Care Physician until finally retiring in 1998.

His hobbies included computing, jewellery, flute, and (in his early years) skiing and campervan holidaying.

He was diagnosed with non-Hodgkins lymphoma in January 2008 and died on 14 July 2008. He was pre-deceased by his son Mark (1984) and is survived by his wife Ngaire and children Peter, David, Paul, and Elisabeth.

Dr David Downey wrote this obituary.

Footnote by Dr Bill Brabazon—Dr Phil Downey joined me in my Glen Innes practice in 1969, and stayed there for 9 years. While indulging his special interests in anaesthesia and counselling, he did his full share in the wider GP role, and was a trusted and loyal colleague.

Our professional paths were to cross again later when I was working part-time in a geriatric hospital, and Phil was available as a psycho-geriatric consultant. His wise and compassionate approach in this role was admired by patients and staff alike.



David Malcolm McIlroy

David was born in Christchurch on 9 December 1920. Until 1938 he attended Christchurch Boys' High School, where he was a prefect and hooker for the First XV.



Immediately after leaving school he started training as a pilot, in the Civil Reserve, and wanted to enlist in the RNZAF at the outbreak of war in 1939. His parents refused to sign the papers until 1940, when he joined the RNZAF. After 6 months' training he was shipped to England, via Iceland, arriving in September 1941. Three months later he flew two missions over Germany (aged just 21) and early the next year was transferred to India near the border with Burma, where he was occupied dive-bombing Japanese sites. He had many fascinating stories to tell of the excitement, fear, and boredom of those years.

He returned to NZ in January 1945, and a month later he and Joyce were married. 1945 and 1946 were Intermediate years, following which Dave entered Medical School, passing all examinations and graduating in 1951.

He worked as a house surgeon at Christchurch hospital for 2 years, then joined Dr Laurence Scott in Practice at Waltham Surgery. During this time, with little money, he and Joyce also began raising their family. Dave dearly loved his five children: Julie, Robert, Jane, Elizabeth, and Sarah (an airline pilot).

He was a fine GP with whom I had the privilege of working at Waltham until his retirement in 1987. He delivered over 2000 babies and seemed to remember them all! He worked long hours—before the days of After Hours Services—initially being on-call one night in two, later one night a week and alternate weekends.

Dave's son Robert, a GP in Wellington, recalls “many phone calls, many hours of work, much of it unpaid, tales of humanity, dedication, a man to be admired by his son and others.”

His leisure hours, few as they were, allowed Dave to indulge his passion for roses. He had a large garden devoted to them and was well known as a grower, participant in, and judge at many shows. He taught me much about medicine, golf, and the arcane art of rose pruning.

Dave was a good golfer, playing for years at Shirley club. Though short of stature, he hit a long straight drive, playing with a handicap of 9.

Those were the days that GPs might work all night yet have to be bright next day; it is appropriate also to pay tribute to the many unpaid hours and much lost sleep that Joyce gave willingly in support of David.

David and Joyce retired to Blenheim, where he was able to continue with his roses, golf, and interest in medicine, attending clinical meetings at the Wairau Hospital. Over the past few years he was afflicted by dementia and required nursing-home care.

I, and many who knew and admired Dave, are grieved by his loss and extend our sympathy to the family.

Brian Jones (Retired GP Christchurch) wrote this obituary.



Ashton Fitchett

(27 January 1926 – 11 October 2008; OBE)

Ash Fitchett was a Brooklyn GP for 32 years. It goes without saying that he assisted hundreds of Brooklyn residents at their births, attended them in childhood, in their teens, as they became parents themselves and, when their lives drew to a close, did his best to ease the passage of their last days.



A lanky and good-humoured individual with a pronounced sense of duty to his patients, Dr Fitchett was a neighbourhood doctor who not only made house calls day and night.

He followed his patients to hospital, visited them when they returned home, and monitored their conditions long after their afflictions had subsided or vanished.

He practised from rooms built at the front of his house at 151 Ohiro Rd. Its position had the added benefit of convenience for an important member of his staff: his wife, Ruth, was practice nurse and administrator while also attending to family duties.

Her husband was a product of Wellington College, Victoria University College, and Otago University's medical school, from which he graduated in 1952.

In 1955 he opened his first rooms in rented Brooklyn premises before having a home and rooms built nearby. "When I qualified there was no special training for general practitioners," he said on his retirement in January 1990. "We learned on the job."

Training for GPs became one of his missions. It would doubtless have been of help when he was fined in 1957 for disclosing the nature of a woman patient's illness to her partner. The finding caused the British Medical Association to issue a warning that medical doctors "are obliged to observe strictly the rule of professional secrecy by refraining from disclosing information about their patient to any third party, even if that party is a husband or a wife". Dr Fitchett took it on the chin. It was a lesson learned, he said.

He sat on numerous medical boards, training boards, advisory committees, was a member of the NZ Medical Association, and a lecturer in medical practice. By 1965 he was a member of the Royal College of General Practitioners, and nine years later a member of its New Zealand equivalent. He was made a fellow of the New Zealand college in 1977 and was an influential figure in the movement to establish the Royal New Zealand College of General Practitioners, of which he became member No 1. In 1994 he was made an honorary fellow, the college's highest award.

If that wasn't enough, he also found time to be divisional surgeon for the St John Ambulance Brigade, he chaired Scout groups and Wellington College's parents' association, its board of governors and community health organisations. He also founded the Brooklyn Community Trust, which provided holidays for children of needy families. He was made an OBE in 1984.

Dr Fitchett suffered a stroke a week prior to his death. He is survived by his wife, their two daughters and son.

Peter Kitchin wrote this obituary under the heading *Brooklyn doc came from the old school*; it appeared in the 16 Oct 2008 edition of *The Dominion* newspaper (Wellington). Sources: A Fitchett, Royal NZ College of GPs, Wellington Central Library. We thank staff of *The Dominion* for reprint permission.

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Erratum

Lester Calder, Jane Rivers, Michael Hayhurst, Jeff Brown, Andrea Forde, Lou Gallagher, Patrick O'Connor. *A school and community outbreak of tuberculosis in Palmerston North, New Zealand*. N Z Med J. 2008 July 25;121(1278).

<http://www.nzma.org.nz/journal/121-1278/3165> and
<http://www.nzma.org.nz/journal/121-1278/3165/content.pdf>

One of the authors, who was unable to check the article prior to publication, notified the *NZMJ* with 7 minor (mostly numerical) corrections.

Please refer the above URLs to view the corrected copy.



Practical Cardiology (2nd edition)

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I was pleased to finally read in a cardiology textbook that “Left main stem stenosis is increasingly being managed with angioplasty and stenting...In experienced centres, the outcomes are as good as those for CABG” (page 192). Regardless of the truth or otherwise of this passage, I will quote it at our next combined Cardiology/Cardiothoracic Surgery conference, and reference it from a respected Australasian author/practitioner in adult physician training and continuing medical education.

Keeping up-to-date in cardiology can be a challenge. Textbooks can seem quickly out of date, or quaint from the perspective of real-world contemporary practice. Annual handbooks/compendiums of randomised controlled trials were once commended to me as the only necessary reading in cardiology but “most recent” can merely amount to “most fashionable”. Numerous professional body guidelines (ACC/AHA, CSANZ, NHF, NICE, etc.) and self assessment programs (ACC ACCSAP) also exist which are frequently updated, comprehensive, focused on practical action, and closely referenced to the scientific evidence base. Often they are better than equivalent standard textbook chapters but can be voluminous (164 pages for the current ACC/AHA STEMI guidelines) and disorientating for students or readers without the requisite background knowledge.

This book for medical students, basic physician trainees (or GPs as mentioned on the back cover) finds favour in outlining important background knowledge, and signposting the fundamental, enduring, or classical. Chapters are organised around common problems (chest pain, palpitations, dyspnoea) useful for case-based learning. Common clinical cases are outlined, which should be understood in depth (aortic stenosis, atrial fibrillation, ischaemic heart disease) even by undergraduates.

I enjoyed the edified chapter on ECGs, highly recommendable as a succinct primer, but also highlighting some commonly misconstrued yet important points (2:1 heart block can be either Mobitz type 1 or 2; pre- vs. post-divisional LBBB; significance of lateral Q waves in LBBB), and discusses a number of interesting eponymous signs (Wellens' warning signifying proximal LAD disease).

There is an included CD-ROM with 40 or so angio cine and echo loops illustrating common representative pathologies.

Overall, at 372 pages this is an excellent contemporary introduction to a solid breadth of cardiology in an easily digested format, and a good foundation to whet the appetite of those want to proceed to greater depths of understanding and practice.

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