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This Issue in the Journal

General practitioner attitudes to direct-to-consumer genetic testing in New Zealand
Sanyogita Ram, Bruce Russell, Mary Gubb, Rebekah Taylor, Cassandra Butler, Imran Khan, Andrew Shelling

The aim of the study was to explore the attitudes of general practitioners (GPs) towards Direct to Consumer (DTC) Genetic Testing and elicit their perceptions of the risks and benefits associated with DTC genetic testing. Misunderstanding of results and inadequate provision of information were perceived to be the greatest risks associated. Clinical validity of tests and counselling were thought to be the most important aspects to be regulated. Respondents considered convenience to be the greatest benefit for the individual requesting DTC genetic testing. The involvement of health professionals in the DTC genetic testing process will aid patients in making informed health decisions, and ensure increased benefit from recent advances in genetic information.

A Pacific population’s access to and use of health services in Dunedin
Faafetai Sopoaga, Lianne Parkin, Andrew Gray

There are Pacific people who do not have a regular GP/health service. It was surprising that many students were in this category, as there are heavily subsidised services for tertiary students. Pacific organisations can work together with primary care providers to encourage access to services. A ‘walk in’ health service provides for the needs of those whose GPs are not able to see them at short notice.

Improved stroke care processes and outcomes following the institution of an acute stroke unit at a New Zealand district general hospital
Nicholas G Burgess, Ritva Vyas, Jennifer Hudson, Olivia Browne, YC Lee, Sisira Jayathissa, Tom Thomson

A Stroke Unit is another way of saying: highly organised care for Stroke. It is proven to reduce mortality and dependency after stroke. In this paper we describe how we re-organise care for Stroke in our DHB showing marked improvements in process of care (number of patients who got aspirin within 48hours, number of patients who got a swallow test, reduction in delay in transfer to the rehabilitation ward) and some reduction in complications such as urinary infections. We show a trend towards a reduction in length of stay and reduction in mortality. Other similar size hospitals in Australasia could reorganise their services similarly without great expense and achieve substantial benefit for their patients.
Young ischaemic stroke in South Auckland: a hospital-based study
Teddy Y Wu, Ajay Kumar, Edward H Wong

We performed an audit looking at the risk factors and outcome of young strokes patients (age 15-45 years) admitted to Middlemore Hospital between June 2004 and December 2009. We found a relatively high proportion of patients to have hypertension (42.7%), high cholesterol (45.8%), obesity (36.6%) and were current tobacco smokers (42.7%) at the time of the stroke. There is an over representation of Pacific Island (41.2%) and Maori (30.5%) in this group of patients studied. We believe further research into ethnic appropriate healthy initiative is required.

An assessment of the Hua Oranga outcome instrument and comparison to other outcome measures in an intervention study with Māori and Pacific people following stroke
Matire Harwood, Mark Weatherall, Api Tale-maitoga, P Alan Barber, John Gommans, William Taylor, Kathryn McPherson, Harry McNaughton

The Hua Oranga instrument, developed for Maori people with mental illness, showed good responsiveness and adequate psychometric properties in Maori and Pacific people after stroke. Its simplicity, relative brevity, minimal cost and adequate psychometric properties should favour its use in future studies with both Maori and Pacific people. Suggestions are made for refinements to the measure. These should be tested in a new population before Hua Oranga is recommended for general use in a clinical setting.

Health-enhancing physical activity programme (HEPAP) for transient ischaemic attack and non-disabling stroke: recruitment and compliance
James Faulkner, Danielle Lambrick, Brandon Woolley, Lee Stoner, Lai-kin Wong, Gerard McGonigal

Sixty individuals who experienced a transient ischaemic attack (TIA; mini stroke) were successfully recruited and retained into a research trial. Participants were typically of European descent and lived within 20km of the study site. Distance to travel was largely reported as the primary reason for non-participation. A different approach is required to study interventions in Māori, Pacific Islanders, Asian and Indian populations. If the exercise intervention improves vascular risk factors and reduces recurrent vascular events, it could be applied to a large number of people who suffer a TIA or non-disabling stroke.
Carotid endarterectomy in octogenarians
Shaw-Hua Kueh, Vicki Livingstone, Ian A Thomson

Corrective surgery for carotid artery narrowing (carotid endarterectomy) to prevent stroke has previously been thought to be associated with increased perioperative complication rate amongst patients older than 80 years old (octogenarians). In our retrospective study over 9 year period, older age did not appear to be associated with significantly increased overall perioperative complication at 14% compared to 17% amongst younger patients.

Investigating the pathways in primary practice leading to the diagnosis of central hypothyroidism
Veronique Gibbons, Ross Lawrenson, Phillipa Sleigh, Tania Yarndley, John V Conaglen

Clinical diagnosis of central hypothyroidism is not always obvious. Endocrinologists and biochemists have suggested that the recommended first-line strategy of TSH alone rather than requesting additional thyroid hormone samples will lead to avoidable delays in diagnosis and treatment of patients with central hypothyroidism. Central hypothyroidism is rare and is associated with a varied and prolonged course of somewhat vague symptoms. Enquiring about symptoms related to other pituitary hormone deficiencies may be helpful in establishing a diagnosis.
Direct-to-consumer genetic testing: letting the genie out of the bottle?

Dee Mangin, Ben Hudson, Les Toop

The idea of a health crystal ball is superficially appealing, ‘find out if your child may be at risk for 40-plus conditions’ advertises one direct-to-consumer (DTC) genetic testing website.¹ However the availability and direct marketing of genome wide testing carries with it a raft of ethical and psychological consequences.

Genome-wide screening can falsely reassure and can generate needless health anxiety and unnecessary treatment in just the same way as any other screening tests. It is worthwhile again to reflect on Muir Gray’s famous quote “All screening does harm, some does good as well”.

Consideration of the interaction between DTC genetic testing in New Zealand and the role of primary care (in the accompanying paper² in this issue of the NZMJ by Ram et al) is timely as the number of Internet-based offerings and public awareness grows.

Several other countries are grappling with both the technology and the ability to access without the involvement of a learned clinician intermediary. Indeed, several European countries have legislated to control such direct access, and in the United States the Food and Drug Administration (FDA) have issued warnings following a damning report from the General Audit Office.³⁴

Impartial information needs to be provided about both potential benefits and harms of any test before the informed and considered decision to test is made. This is particularly important in an environment where there are difficulties and inadequate science to sensibly interpret the results, and even more so if there are a significant number of false positives or false negatives, potential hazards of further investigation and treatment and/or significant implications for quality of life from health anxiety that might be generated.

Results from DTC tests are typically conveyed impersonally and without support and those who have been tested may not appreciate the results’ significance, which may lead to false reassurance or more likely unnecessary anxiety.

It is one thing to apply imprecise and uncertain science to those who are unwell—there is a great deal more ethical responsibility and requirement for certainty, when diagnostic tests and treatments are applied to those who are well.⁵

Careful consideration against screening criteria is required (Box 1) and the majority of non-Mendelian genetic screening testing offered will not fulfil these currently.

DTC genetic testing uses genome-wide screening. This is different to specific testing in those with a family history of risk of a Mendelian genetic disease such as Huntingdon’s disease, familial adenomatous polyposis or Tay Sachs disease. These latter tests have high clinical validity, and are usefully offered within a public health system.
Box 1. New Zealand Screening Criteria (National Health Committee 2003)

| 1) | The condition is a suitable candidate for screening |
| 2) | There is a suitable test |
| 3) | There is an effective and accessible treatment or intervention for the condition identified through early detection |
| 4) | There is high quality evidence, ideally from randomised controlled trials, that a screening programme is effective in reducing mortality or morbidity |
| 5) | The potential benefit from the screening programme should outweigh the potential physical and psychological harm (caused by the test, diagnostic procedures and treatment) |
| 6) | The health care system will be capable of supporting all necessary elements of the screening pathway, including diagnosis, follow-up and programme evaluation |
| 7) | There is consideration of social and ethical issues |
| 8) | There is consideration of cost-benefit issues |

There is also inconsistent reporting of risk calculations even when two labs produce the same test result. Most have not been tested in the prospective longitudinal cohort studies required to determine their clinical validity (sensitivity specificity positive and negative predictive value), and the extent of increased risk, to enable informed discussion of the test implications.

There is also insufficient evidence that they offer anything over traditional estimates of using phenotypic risk factors in major chronic diseases—type 2 diabetes is a good example.

Promotion and marketing of DTC genetic screening is largely for commercial gain rather than public good. Consideration of testing for an individual has implications beyond individual choice—wide uptake would lead to considerable flow on costs of further investigation and preventive treatments of dubious value for a public health system with a fixed health budget. This has implications for both distributive justice and equity in health care.

There is an ethical problem with offering a screening test where there are neither adequate resources for further investigation nor the availability of treatment that alters disease development or progression. Furthermore, by shifting the focus of disease prevention to an unproven high-risk approach, DTC genetic screening may also undermine well-established public health measures such as legislation to improve access to healthy environments, reduced access to alcohol and tobacco.

There is scant evidence that genetic testing will result in any lifestyle behaviour changes likely to lead to improved health outcomes, and some evidence to suggest that results lead to medicalisation of lifestyle issues.
One study showed that genetic testing identifying susceptibility to nicotine dependence resulted in smokers attaching less importance to willpower in quitting smoking. There is some evidence that alcohol and tobacco companies are already promoting the idea that harm only occurs in genetically susceptible individuals to counter attempts to reduce overall use in the population.9,10

While there are claims that DTC genetic testing companies allow for privacy that may seem to circle around the issues for health insurance and employment, a ‘positive’ test will trigger a visit to a health care professional so this is probably illusory. In addition, if one of the many companies performing the genetic tests fails or is on-sold, the new owners may have no obligation to maintain any privacy agreements offered by the original company.

Some of the most promising applications of genome testing are not in disease risk prediction but in predicting adverse reactions to drugs—such as warfarin sensitivity—where application could well be a cost effective measure in a publicly funded health system.

DTC genetic testing probably carries as much risk as direct-to-consumer advertising (DTCA) of prescription medicines, both in direct health anxiety and in adverse effects of subsequent further investigations and treatments.

Germany has gone the furthest in trying to put protections in place by banning predictive genetic testing except by geneticists or similarly qualified and specialised medical doctors. While difficult to control Internet-based testing, this may at least give a clear message. Suggesting regulation be organised in the same self-regulatory manner as prescription medicine DTCA offers little protection.

The regulation of DTCA for prescription medicines in New Zealand is manifestly inadequate and New Zealand remains only one of two countries anomalously allowing DTCA against almost universal professional and consumer opinion, simply through lack of political will.11

Enforcement in the face of strong commercial imperatives and subtly composed advertising has proved almost impossible, even in the much larger and more regulated US situation. It is important not to repeat the same mistakes.

Passing this difficult issue to GPs for ‘counselling’ as part of the DTC genetic testing process would be a failure to face the responsibility of this issue squarely: consideration of the issues and a clear response from the health community and consumers is required. Other major jurisdictions have clearly recommended against such testing until the harms and benefits are clearer. Similarly, passing the responsibility for discussion of the implications post test is ethically questionable.

There is insufficient evidence for most of these tests to offer any advice of real clinical value at present and it would be a pity if indiscriminate early use obscured assessment of the true potential of such testing to support more discriminate use of medical care in the future.
Generally recommending against DTC testing and advertising and offering screening and proven advice—in both disease risk prediction in appropriate clinical contexts (with suitably resourced pathways for treatment) and refinement in the precision of prescription medicine use with prediction of adverse event risks—would seem to be the sensible initial response to keeping the genie in the bottle until such time as its magic powers can be adequately assessed.

Competing interests: None known.

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The health of Pacific peoples in New Zealand

Jim Reid

Statistics New Zealand paints a sorry picture of the state of health of Pacific peoples in this country. Health care and the achievement of optimal health is fundamental right. Life expectancy for Pacific peoples in New Zealand (who are mostly of Samoan, Tongan, or Cook Islands origin) is about 4 years less than for the overall population, and their health is worse overall at all stages of life with morbidity from chronic and degenerative, infections and metabolic disorders.

Health and length of life expectancy reflect economic status and consequent material and social deprivation are contributing factors. Indeed, income and poverty, employment and occupation, education, housing, and ethnicity have been shown to have the greatest influence of health:

- 27% of Pacific peoples meet the criteria for living in severe hardship compared to 8% of the total population. In addition, 15% of Pacific peoples live in significant hardship, with only 1% enjoying ‘very good living standards’.
- Pacific peoples are more likely to live in overcrowded households.
- The Pacific unemployment rate is nearly twice the national unemployment rate.

Lifestyle factors, including values and preferences, can influence how Pacific peoples view health care.

Underutilisation of primary and preventative health care services by Pacific peoples and lower rates of selected secondary care interventions.

Pacific peoples die younger and have higher rates of chronic diseases, which are recognised as leading causes of this premature mortality and disability,1 for example:

- Cardiovascular disease is the principal cause of death for Pacific peoples, and cardiovascular mortality rates are consistently and significantly higher than for the general population.
- Mortality rates for cerebrovascular disease (stroke) are higher for Pacific peoples than for any other ethnic group.
- Ethnic disparities in cancer survival have increased in the past 25 years and are a major cause of premature mortality and disability.
- The prevalence of diabetes in Pacific populations is approximately three times higher than among other New Zealanders.
- Pacific men have higher rates of lung cancer and primary liver cancer, and Pacific women have higher rates of breast and cervical cancer than other New Zealand women.
• Pacific children have higher rates of hospitalisation for acute and chronic respiratory and infectious diseases than any other group in New Zealand.

• In 2006, the estimated life expectancy for Pacific men was 73.9 years and 78.9 years for Pacific women, more than 4 years less than for the total population.

• In 2002 and 2006, Pacific children were 1.5 times as likely to be admitted to hospital for gastroenteritis and 4.5 times as likely as European children to be admitted to hospital for serious skin infections.

• Pacific children and young people (aged 0–24 years) are nearly 50 times more likely than their European counterparts (and twice as likely as Māori) to be admitted to hospital with acute rheumatic fever (ARF). Poor and overcrowded housing is a contributing factor.

• Pacific young people are approximately twice as likely to have depression, anxiety issues, or to make suicide attempts as the rest of the population.2 Pacific peoples are exposed to higher levels of health risks and unhealthy behaviours, such as obesity and poor nutrition. Smoking patterns in young people are a key predictor of adult smoking patterns and future smoking-related disease. Both adult and child smoking rates among Pacific peoples are higher than those of Europeans. And smoking is the leading contributor to death in the Pacific population.

Pacific peoples drink less overall but are more likely to drink in a hazardous fashion. Similarly, they are less likely to gamble, but when they do, are more likely to be ‘problem gamblers’ and experience more severe gambling-related harm.

A better understanding of Pacific perspectives on health and culturally-competent services can improve responsiveness to Pacific health needs. Moreover, the development of the Pacific health workforce will contribute to more responsive health services for Pacific peoples.

Implementation of the Primary Health Care Strategy (Ministry of Health, 2001) and the development of Pacific providers have improved Pacific peoples’ access to primary care services. The quality of the care received has improved over time. The cultural competence of clinicians and services needs to be improved to enhance patient-centred care and improve health-care quality and consequent outcomes. Pacific peoples have high rates of vaccination but are under-represented in the coverage of the cervical and breast screening programmes.

From 2006 to 2007, 10% of Pacific peoples aged over 15 years were diagnosed with diabetes—approximately three times the diagnosis rate for the total New Zealand population.

Between 2002 and 2004, the rate for new cases of stroke in Pacific adults was 318 per 100,000, compared with 179 per 100,000 for the total population.3 In this issue of the NZMJ, Sapoaga, Parkin and Gray demonstrate that Pacific peoples’ understanding of the New Zealand health system was very limited. The study was conducted in Dunedin where the proportion of Pacific peoples is much lower than it is in northern cities. A significant number of participants in the study were university students, almost one-quarter of who did not have a regular doctor, or health service.
This is surprising as students in Dunedin have an excellent “on campus” student health facility. The issues also affect Pacific children—from 1990 to 1999 they were 3.7 times more likely to be admitted to hospital for a skin infection than children of other ethnicities. Between 2000 and 2007 this has increased to 4.5 times. Similar increases can be seen for admissions for asthma, chest infections, and gastroenteritis.

Sapoaga, Parkin and Gray also demonstrate the low health literacy among Pacific peoples. While this could be the source of an editorial in itself, those with low health literacy are less likely to use preventative services, less likely to recognise significant disease early, less likely to be adherent to treatment, more likely to be hospitalised by a chronic condition, and more likely to use emergency services.

Improving the health of Pacific peoples in this country has a long way to go, and has a multifactorial solution not always directly related to health itself. In addition to improvement in health delivery and health information, improvement of social, economic and educational status and wellbeing of Pacific peoples is required.

Competing interests: None known.

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General practitioner attitudes to direct-to-consumer genetic testing in New Zealand

Sanyogita Ram, Bruce Russell, Mary Gubb, Rebekah Taylor, Cassandra Butler, Imran Khan, Andrew Shelling

Abstract

Aim The aim of the study was to explore the attitudes of general practitioners (GPs) towards direct to consumer (DTC) genetic testing and elicit their perceptions of the risks and benefits associated with DTC genetic testing.

Method A postal questionnaire was mailed to a national random sample of 300 registered GPs from a list provided by the New Zealand Medical Council. Non-responders were followed up with an abridged survey questionnaire.

Results Responses were received from 38% of the GPs contacted. This consisted of 113 responses from the full questionnaire. The proportion of respondents who had heard about DTC genetic testing was 47.8%. Respondents considered convenience to be the greatest benefit for the individual requesting DTC genetic testing. Misunderstanding of results and inadequate provision of information were perceived to be the greatest risks associated. Lack of knowledge, experience and time were all considered barriers to GPs providing genetic counselling, and a genetic specialist was highlighted as the most appropriate to provide this. Respondents thought advertising of DTC genetic testing should be regulated in a similar manner to DTC advertising of prescription medicines. Clinical validity of tests and counselling were thought to be the most important aspects to be regulated.

Conclusions As public access to DTC genetic testing increases, the role of GPs knowledge and training to reflect this growth will become increasingly more important. The ‘Patient-Doctor-Counsellor Model of Delivery of Genetic Services’ may be more appropriate for the provision of this service than the current model of direct access by patients. The involvement of health professionals in the DTC genetic testing process will aid patients in making informed health decisions, and ensure increased benefit from recent advances in genetic information.

Genetic testing has expanded rapidly from the diagnosis of single gene disorders in a clinical setting, to the prediction of disease susceptibility of more complex genetic conditions including “lifestyle diseases” that may include some types of heart disease, cancer, and diabetes, for example, that may develop in the future.

Direct-to-consumer (DTC) genetic testing is defined as the “self-ordering of genetic tests by patients over the telephone or the Internet”. DTC genetic testing has escaped the rigorous testing and regulation that is usually synonymous with new medical technologies for the diagnosis of disease.

DTC is currently offered online and can be easily accessed by consumers who send their samples from either saliva or cheek swabs. The laboratory providing the DTC genetic test then sends the consumer their predicted risk for a variety of diseases directly. This makes the
laboratory directly responsible to the individual.\textsuperscript{2–4} Where a General Practitioner (GP), or other medical specialist, would be expected to follow-up their patient, a company may have no similar responsibility.\textsuperscript{3}

Presently, tests available range from those with high clinical validity and effective treatment (for example testing for familial adenomatous polyposis for which a prophylactic colectomy can be performed), to those which lack effective treatment (knowing one’s risk for Huntington’s Disease). There are also tests available which have low clinical validity with an associated preventative treatment.

Those with genetic susceptibility to developing potentially life-threatening haemochromatosis, are offered periodic phlebotomy. However a proportion will remain disease-free, in which case the preventative therapy is unnecessary. Further tests include those which have low clinical validity and no effective treatment and present with low relative risk.

Greater consumer access to DTC genetic tests creates discussion on the role of a GP in the provision of genetic counselling, and the continuing education for health care professionals so they can respond to patients’ inquiries about the benefits, risks and limitations of DTC services.\textsuperscript{5}

DTC genetic testing in New Zealand (NZ) currently fits the Patient-Lab (Commercial) Model, a genetic services delivery model identified by Gu and Warren.\textsuperscript{6} There are approximately 30 companies offering DTC genetic tests to individuals in NZ, however only a small proportion of these offer clinical health related tests.\textsuperscript{7}

Well-known companies include 23andMe, Navigenics and deCODEME. They offer susceptibility testing for common genetic diseases, ‘lifestyle diseases’ (such as cancer, diabetes, heart disease or obesity) that have a minor genetic component, and ancestry testing directly to the consumer via the internet.

DTC genetic testing is considered to provide a privacy advantage over testing through a healthcare provider,\textsuperscript{8–10} and can be carried out in a more comfortable environment.\textsuperscript{11} It may assist individuals in making independent decisions to reduce risk and improve their health and lifestyle.\textsuperscript{12}

As anyone can set up a website, there is a wide variation in the quality of services and level of support offered to clients. DTC companies face little barriers to market entry. Genetic tests with unconfirmed clinical validity and utility can be made available\textsuperscript{4,9,13} without the professional training and support that is usually provided by a medical practitioner.

Although some companies require the results to be sent directly to the individuals’ GP; there is concern that varying knowledge of genetics and the ability to communicate complex genetic information complicates the incorporation of genetic testing into primary care.\textsuperscript{13} Where clinical utility is uncertain, GPs face the added challenge of explaining why test results lack clinical consequences.\textsuperscript{14}

GPs attitudes toward DTC genetic testing, explored by Ohata et al (2009) found that the perceived benefits for patients were; convenience, confidentiality of information, promotion of preventative medicine, and provision of personalised medicines.
The perceived risks to the patient using these services were: understanding of the results; its advertising; the provision of information and counselling; potential information leakage; spread of genetic determinism; and the reliability of the results.\(^{11}\)

Morgan et al (2004) found that whilst a small number of GPs commented on the importance and benefits of genetic testing, the majority were more concerned with ethical issues and concerns.\(^{16}\)

Conversely, in the survey conducted by Hoop et al (2008), psychiatrists agreed that the development of genetic tests will benefit many patients and disagreed they will expose individuals to many risks.

Informed consent, confidentiality of results, pre- and post-test genetic counselling, and competency in interpreting results were found to be important ethical considerations.\(^{17}\)

Bathurst and Huang (2006) investigated the impact that developments in genetics has had on general practice, and the position Australian GPs have taken in implementing new genetic developments. Fifteen semi-structured interviews were conducted and themes found from qualitative data obtained.

Findings show respondents were certain they would be involved in counselling and management of genetic conditions in the future.\(^{18}\) Ethical and moral issues were raised, such as accuracy and interpretation of the results.

The information and training needs of NZ GPs in relation to genetic testing and counselling were explored by Morgan et al (2004). Many respondents indicated that their knowledge was limited in the areas of; genetic testing, genetic theory, appropriateness of different tests, access to tests, and availability and reliability of results. Most respondents also reported a lack of confidence in discussing positive test results with patients.

Respondents thought there was a lack of readily available information and resources for such issues. They expressed wanting more information and guidelines, to improve their skills in this area.\(^{16}\) Bathurst and Huang (2006) also found GPs were not familiar with and had limited knowledge of complex genetic diseases. They thought these were barriers to providing adequate genetic services. Respondents thought education and training should be more easily accessible and that there is a current lack of education in genetics.\(^{18}\)

Similarly, in a study of psychiatrists, Hoop et al (2008) found that respondents did not feel competent in providing genetic tests and interpreting the results, in this case for psychiatric illness. However, 70% indicated that they felt competent in providing genetic counselling to psychiatric patients and their families. Two-thirds of respondents had taken an undergraduate course in genetics and one-third a graduate course. Almost half of respondents had attended a continuing education course.\(^{19}\)

Given the rapid rise of the number of companies offering Direct to Consumer Genetic tests and the range of tests offered, a survey was administered to GPs to provide information on GP attitudes towards Direct to Consumer Genetic Tests in New Zealand.

Specifically, we wanted to determine the awareness and experience of New Zealand GPs of DTC genetic testing, their perceptions of DTC genetic testing, and how they viewed the future of DTC genetic testing in NZ.
Method

A postal questionnaire was mailed to a national random sample of 300 registered GPs from a list provided by the New Zealand Medical Council.

The questionnaire (Appendix 1) was designed to elicit GP awareness and experience of genetic services and information, the training and supporting resources available, perceptions and awareness and the future of DTC genetic testing.

Demographic questions including areas of practice and country of training were also included. The questionnaire was initially piloted through a group of 12 GPs and revised where appropriate.

Although the questionnaire was anonymous, envelopes were coded so that non-responders could be followed up with a reminder and another copy of the questionnaire. Non-responders to the first two mailouts were sent an abridged survey questionnaire. Ethics approval was granted by the University of Auckland Human Ethics committee.

Quantitative data was analysed using the statistical analysis software SPSS and thematic analysis was used to analyse qualitative data received through open-ended questions in the questionnaire.

Results

Characteristics of respondents—Results were based on 113 completed three-page questionnaires (37.7% of recipients) from the first two mailouts of the questionnaire. Where percentages do not add up to 100% (data missing), the missing percentages represent ‘Blank/no answer’ and/or ‘unusable’. A small number of GPs who completed the abridged one-page questionnaire in the third mailout (n=16; 5.3% of recipients). Six questionnaires were returned blank. See Table 1.

Table 1. Demographic characteristics of respondents (n=113), characteristics of questionnaire recipients (n=300), and characteristics of New Zealand GPs (NZ) from the NZMC statistics for the medical workforce in 2008

<table>
<thead>
<tr>
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<th>Respondents % (n)</th>
<th>Recipients % (n)</th>
<th>NZ GPs %</th>
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<tr>
<td><strong>Gender</strong></td>
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<td>70.8 (211)</td>
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<tr>
<td>Rural</td>
<td>40.7 (43)</td>
<td>29.2 (87)</td>
<td>–</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>0.9 (1)</td>
<td>–</td>
<td>11</td>
</tr>
<tr>
<td>35-39</td>
<td>4.4 (5)</td>
<td>–</td>
<td>12</td>
</tr>
<tr>
<td>40-44</td>
<td>13.3 (15)</td>
<td>–</td>
<td>15</td>
</tr>
<tr>
<td>45-49</td>
<td>17.7 (20)</td>
<td>–</td>
<td>17</td>
</tr>
<tr>
<td>50-54</td>
<td>26.5 (30)</td>
<td>–</td>
<td>14</td>
</tr>
<tr>
<td>55+</td>
<td>37.2 (42)</td>
<td>–</td>
<td>20</td>
</tr>
</tbody>
</table>
Exposure (knowledge and experiences with DTC genetic testing)—Respondents who trained in NZ and respondents who trained overseas had almost identical means for each statement, however, it was noticed that respondents who trained in NZ were more likely to strongly agree or strongly disagree than respondents who trained overseas. The only statistically significant difference between respondents who work in an urban medical centre and those who work in a rural medical centre was that urban respondents disagreed (3.5±0.8) that DTC genetic testing has a positive impact on the patient-doctor relationship whereas rural neither agreed nor disagreed with the statement (3.0±0.5; \( t =3.432; P=0.001 \); data missing=12).

When the statements about DTC genetic testing were further analysed it was seen that those who reported to have had genetic training were more likely to have stronger opinions about the statements. Respondents who had received genetic training disagreed that DTC genetic testing provides a useful service in the delivery of healthcare (4.0±1.1), which was significantly different from those who had not received genetic training (3.3±1.0; \( t =2.471; P=0.015 \); data missing=9).

In general, respondents were ambivalent about the proposed benefits, but agreed with proposed risks and barriers presented in the questionnaire. Similar trends were seen within subgroups however it appeared respondents that trained overseas agreed more with proposed benefits than respondents that trained in NZ, in particular convenience (\( X^2 =3.106; P=0.078 \); data missing=25).

The mean year registered for respondents who agreed confidentiality was a benefit was earlier than respondents who disagreed (1983.6±12.0 and 1988.0±8.5, respectively; \( t =-1.888; P=0.064 \); data missing=24).

When asked about potential benefits of DTC genetic testing in relation to the individual, those without reported training in genetics were more likely to agree with proposed benefits.

In particular, 72.0% (67/93) of respondents who had not received training agreed that convenience was a benefit, compared to 37.5% (6/19) of those with training (\( X^2 =16.735; P < 0.005 \); data missing=17). Also 46.2% (43/93) of respondents who had not received training agreed that provision of personalised service was a benefit, compared to 10.5% (2/19) of those with training (\( X^2 =16.735; P=0.002 \); data missing=19). Also 36.6% (34/93) of respondents who had not received training agreed that confidentiality was a benefit, compared to 15.8% (3/19) of those with training (\( X^2 =3.862; P=0.049 \); data missing=22).

As with perceived benefits, the main theme seen throughout comments about perceived risks was that respondents did not know enough about DTC genetic testing to be sure of what risks are associated with it (n=3). One issue raised was the potential risk of patients’ genetic information being used for inappropriate or other purposes (n=3).

Respondents who work in a rural medical centre were more likely to disagree that reliability of results is a risk (42.9%; 12/28) compared to respondents who work in an urban medical centre (23.9%; 16/67; \( X^2 =3.137; P=0.077 \); data missing=15).

When asked about potential risks associated with DTC genetic testing in relation to the individual taking the test, it appeared that those who reported to have genetic training were more likely to agree with proposed risks, however statistical significance was not evident (p>0.05). See Tables 2–6.
Table 2. Proportion of respondents who had heard about DTC genetic testing

<table>
<thead>
<tr>
<th></th>
<th>Heard (%)</th>
<th>Not Heard (%)</th>
<th>Statistical Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47.8</td>
<td>45.1</td>
<td></td>
</tr>
<tr>
<td>NZ trained</td>
<td>50.6</td>
<td>41.6</td>
<td>$X^2 = 0.885, P = 0.347, n=96$</td>
</tr>
<tr>
<td>Overseas trained</td>
<td>42.3</td>
<td>53.8</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>46.3</td>
<td>46.3</td>
<td>$X^2 = 0.108, P = 0.742, n=88$</td>
</tr>
<tr>
<td>Rural</td>
<td>42.9</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Mean year registered</td>
<td>1985.9±11.3</td>
<td>1986.4±8.8</td>
<td>$t=0.228, P=0.820, n=100$</td>
</tr>
</tbody>
</table>

Table 3. Respondents’ opinions toward statements about DTC genetic testing

<table>
<thead>
<tr>
<th>DTC Genetic Testing</th>
<th>Mean±sd*</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides a useful service in the delivery of healthcare</td>
<td>3.4±1.1</td>
<td>1.8%</td>
<td>18.6%</td>
<td>26.5%</td>
<td>28.3%</td>
<td>16.8%</td>
</tr>
<tr>
<td>Results encourage patients to take responsibility for their health</td>
<td>2.9±1.0</td>
<td>5.3%</td>
<td>25.7%</td>
<td>36.1%</td>
<td>16.8%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Encourages patients to get unnecessary genetic tests carried out</td>
<td>2.1±1.0</td>
<td>30.1%</td>
<td>35.4%</td>
<td>21.2%</td>
<td>4.4%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Encourages patients to get unwarranted procedures done based on the results of genetic tests</td>
<td>2.2±1.0</td>
<td>22.1%</td>
<td>39.8%</td>
<td>24.8%</td>
<td>4.4%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Puts a strain on health resources that could be more effectively utilised</td>
<td>2.2±1.0</td>
<td>23.0%</td>
<td>37.2%</td>
<td>23.9%</td>
<td>7.1%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Positively impacts the patient-doctor relationship</td>
<td>3.3±0.8</td>
<td>0.9%</td>
<td>8.8%</td>
<td>54.0%</td>
<td>20.4%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Negatively impacts the patient-doctor relationship</td>
<td>2.6±0.8</td>
<td>7.1%</td>
<td>21.2%</td>
<td>54.0%</td>
<td>9.7%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

*On a 5-point Likert scale where 1=strongly agree, 2=agree, 3=neither agree nor disagree, 4=disagree, and 5=strongly disagree

Table 4. Proportion of respondents who have had training on providing genetic testing and/or counselling

<table>
<thead>
<tr>
<th></th>
<th>“Training” (%)</th>
<th>No “Training” (%)</th>
<th>Statistical Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>16.8</td>
<td>82.3</td>
<td></td>
</tr>
<tr>
<td>NZ</td>
<td>18.2</td>
<td>81.8</td>
<td>$X^2 = 0.041, P = 0.839, n = 102$</td>
</tr>
<tr>
<td>Overseas</td>
<td>19.2</td>
<td>76.9</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>17.9</td>
<td>80.6</td>
<td>$X^2 = 0.001, P = 0.970, n = 94$</td>
</tr>
<tr>
<td>Rural</td>
<td>17.9</td>
<td>82.1</td>
<td></td>
</tr>
<tr>
<td>Mean year registered</td>
<td>1986.0 ± 10.7</td>
<td>1986.3 ± 10.5</td>
<td>$t = -0.109, P = 0.914, n = 107$</td>
</tr>
</tbody>
</table>
Table 5. Perceived benefits and risks of DTC genetic testing, and perceived barriers for GPs providing genetic counselling

<table>
<thead>
<tr>
<th>Benefits</th>
<th>General</th>
<th>Where Trained</th>
<th>Area Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Convenience</td>
<td>54.6</td>
<td>19.5</td>
<td>62.3</td>
</tr>
<tr>
<td>Promotion of preventative medicines</td>
<td>31.9</td>
<td>52.2</td>
<td>28.6</td>
</tr>
<tr>
<td>Provision of personalised service</td>
<td>38.8</td>
<td>43.4</td>
<td>39.0</td>
</tr>
<tr>
<td>Confidentiality of results</td>
<td>32.7</td>
<td>47.8</td>
<td>29.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risks</th>
<th>General</th>
<th>Where Trained</th>
<th>Area Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Reliability of results</td>
<td>59.3</td>
<td>31.9</td>
<td>62.3</td>
</tr>
<tr>
<td>Misunderstanding of results</td>
<td>92.2</td>
<td>2.7</td>
<td>88.3</td>
</tr>
<tr>
<td>Inadequate provision of information</td>
<td>91.2</td>
<td>3.5</td>
<td>89.6</td>
</tr>
<tr>
<td>Potential leakage of information</td>
<td>50.4</td>
<td>38.1</td>
<td>51.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barriers</th>
<th>General</th>
<th>Where Trained</th>
<th>Area Worked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Time</td>
<td>91.4</td>
<td>14.2</td>
<td>83.1</td>
</tr>
<tr>
<td>Experience</td>
<td>91.2</td>
<td>3.5</td>
<td>90.9</td>
</tr>
<tr>
<td>Knowledge</td>
<td>89.4</td>
<td>6.2</td>
<td>87.0</td>
</tr>
</tbody>
</table>

Table 6. Proportion of respondents who thought a GP should be involved in the DTC genetic testing process

<table>
<thead>
<tr>
<th>General</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>Unsure (%)</th>
<th>Statistical Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ</td>
<td>52.2</td>
<td>11.5</td>
<td>33.6</td>
<td></td>
</tr>
<tr>
<td>Overseas</td>
<td>51.9</td>
<td>11.7</td>
<td>33.8</td>
<td>$X^2 = 0.276, P = 0.671, n = 100$</td>
</tr>
<tr>
<td>Urban</td>
<td>53.8</td>
<td>15.4</td>
<td>30.8</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>46.3</td>
<td>14.3</td>
<td>40.3</td>
<td>$X^2 = 2.156, P = 0.340, n = 91$</td>
</tr>
<tr>
<td>Mean year registered</td>
<td>1985.3 ± 10.7</td>
<td>1986.3 ± 6.7</td>
<td>1987.5 ± 10.0</td>
<td>$F = 0.535, P = 0.587, n = 105$</td>
</tr>
</tbody>
</table>
Perceptions of DTC genetic testing—When asked who would be the most appropriate to provide genetic counselling to the patient following a DTC genetic test; 61.1% (69/113) of respondents thought a genetic specialist, 12.4% (14/113) thought the company providing the test, 5.3% (6/113) thought GPs themselves, whereas 4.4% (5/113) did not know (data missing, 19). From both the respondents who had heard about DTC genetic testing, and those who had not, the majority thought a genetic specialist would be most appropriate.

The majority of respondents (69.9%; 79/113) believed resources regarding DTC genetic testing were not easily accessible, whereas 6.2% (7/113) thought they were. Although there was no such option in the questionnaire, 20.4% (23/113) of respondents commented they did not know if resources were easily accessible (data missing, 4).

When asked if GPs will have a more active role in the DTC genetic testing industry in the future; 53.1% (60/113) of respondents were unsure, 35.4% (40/113) thought they would have, and 10.6% (12/113) thought they would not (data missing, 1).

Just over half of those who thought a GP should not be involved in the DTC genetic testing process disagreed (53.8%; 7/13) that GPs would have a more active role in this industry in the future. Those who either agreed or were unsure of whether GPs should be involved in the DTC genetic testing process (52.5%; 31/59; and 57.9%; 22/38, respectively) were unsure whether they would have a more active role in the future.

Future of DTC genetic testing in New Zealand—Most of the respondents (78.8%; 89/113) agreed that advertising of DTC genetic tests should be regulated in a similar way to DTC advertising of medicines.

Figure 1 shows the aspects that respondents thought would be important to be regulated if DTC genetic testing were to be regulated.

Figure 1. Aspects of DTC genetic testing respondents selected to be regulated

![Figure 1: Aspects of DTC genetic testing respondents selected to be regulated](chart.png)
The majority of respondents (57.5%; 65/113) were unsure if DTC genetic testing was going to be an area of growth in NZ, however 34.5% (39/113; data missing=1) thought it would be. When respondents were asked to make additional comments relating to DTC genetic testing the comments made were mostly negative for example ‘don’t let it happen’ and ‘I don’t really see a place for it’ (respondents 83 and 24).

**Discussion**

Only half of the respondents had heard about DTC genetic testing, which may seem surprising considering how frequently the developments in this field are discussed in popular science journals and health media. However, this was similar to findings from Ohata et al. (2009), the most common avenue through which they heard was ‘the media’.

One in six respondents reported to have received training on provision of genetic services, whereas the proportion who had personally researched this service was minimal. All GPs will have received some training in “genetics” as part of their medical training at University, so it is clear that they do not feel they have had sufficient training to provide their patients with the interpretation of genetic test results. Consistent with findings from Morgan et al. (2004), it appears that there is a perception that a lack of easily accessible resources exists.

When presented with potential benefits in relation to the patient, respondents generally thought benefits were limited, with the exception of “convenience”, which was also found by Ohata et al (2009). Those who made additional comments thought their lack of knowledge concerning DTC genetic testing made it difficult to form an opinion on potential benefits.

Convenience may be perceived to be the greatest benefit of the Patient-Lab (Commercial) Model\(^\text{14}\) of genetic testing. Consumers are able to order tests at home in privacy and in their own time, without the hassle of accommodating a visit to see and pay for visit to a health professional.

As with benefits, some respondents commented their lack of knowledge regarding DTC genetic testing did not allow them to assess the potential risks presented to them. While it has been postulated that DTC genetic testing provides a privacy advantage for the consumer,\(^\text{2,16,17}\) this was not strongly recognised by respondents.

Many companies offering this service do not disclose whether or not, or how, patients’ information will be protected. Who can access the results is also a concern, with the risk of ‘genetic victimisation’ (respondent 36), especially in consideration of whether this information could form part of personal insurance information. This concern has been addressed in the USA with the passing of the Genetic Information Non-discrimination Act 2008, providing an example for other countries to perhaps follow.

Overall risk perceptions were consistent with findings from Ohata et al (2009) with patient misunderstanding and inadequate provision of information recognised as major risks. These factors could lead to the inappropriate use of preventative measures, such as the use of medications and demand for prophylactic surgery.

While respondents acknowledged that DTC genetic testing may encourage patients to take responsibility for their health, they also agreed it encourages patients to get unnecessary tests and for the potential that unnecessary and potentially expensive procedures to be carried out. This could put a strain on health resources that could be more effectively utilised elsewhere.
In contrast, a patient may make poor health decisions if they are under the impression they are not at risk of developing a certain disease, perhaps by avoiding routine screening for breast or prostate cancer, or not following widely established dietary and exercise advice.

Although genetic test results can be used to aid treatment decisions, there is an absence of guidance from a GP or genetic counsellor in the current delivery model of DTC genetic testing, as they are not routinely involved in the test. The patient alone may not be able to contextualise the information to make appropriate health decisions, especially concerning the evaluation of the risks of the disease and an understanding of susceptibility of potential disease developing.

The concern that some of the test results may not be reliable, and open to current scientific evidence and interpretation, also complicates outcomes for the patient.

A significant difference in opinion was seen where respondents with no reported genetic training placed more emphasis on the proposed benefits of DTC. It appeared those with training in genetics placed more emphasis on potential risks. Although training was self-reported, it could be supposed that those without training are less aware of the risks involved with DTC genetic testing.

Increased genetic training and awareness may allow for better appreciation of the complex issues involved. This could explain why respondents with reported training had a negative view regarding the usefulness of the service in healthcare. If the delivery model of DTC genetic testing were to be different, the perceptions of the benefits and risks associated with this service may change.

With an increasing number of websites and companies offering testing, it could be assumed there is a consumer demand for this service. However, many sites do not offer ongoing genetic counselling and support. This raises the question, if consumers are not going to their GPs for counselling, where are they going?

Of concern is that they may not be getting adequate support for dealing with potentially significant health risks identified by these genetic tests. This could have possible unexpected consequences, such as increased anxiety of individuals who have only a minor increased risk, and also the possibility that some would assume protection from conditions that they still have a significant risk of development.

Respondents considered experience, knowledge and time to be major barriers to GPs providing adequate genetic counselling. Australian GPs also identified that lack of knowledge is a barrier (42). These barriers could influence respondents’ opinions that DTC genetic testing negatively impacts the patient-doctor relationship.

Respondents who worked in a rural medical centre were more ambivalent in their views of the effect of DTC genetic testing on the patient-doctor relationship. Given that respondents chose a genetic specialist to be the most appropriate to provide genetic counselling, but also wish to be involved in the process, it is unclear where GPs fit into the model of delivery.

On one hand, they recognise that they don’t have the right training and skills to provide the information to their patients, but on the other hand, most see that they have an important role in the provision of primary health care as a result of these genetic tests.

The future of DTC genetic testing in New Zealand—Currently DTC genetic testing does not require a medical professional such as a GP to be involved in the process. Under pressure
from medical professionals, some companies are now making a genetic counsellor available if required, although this is not compulsory. Although some companies require results to be sent directly to the patient’s GP, variation in knowledge of genetics and relevant training may affect the effective communication of this information to the patient. This raises the question, is the current model of delivery of DTC genetic testing appropriate?

Few respondents had personally seen advertising of DTC genetic tests and fewer had had a patient come to them after seeing such advertising. It is currently unclear how many New Zealanders are using these types of test, although it is clear that there has been some appreciable take up. Some respondents made the comment that advertising was misleading and unbalanced. If consumer’s exposure to this service is through DTC advertising, the internet and the media, they may not be provided with adequate information on the risks and benefits involved.

Respondents believed advertising of DTC genetic testing should be regulated in a similar way to DTCA of prescription medicines. However previous studies highlighted that even under regulation, GPs found advertising of medicines was unbalanced and of variable quality.

Respondents in this study expressed the need for advertising of DTC genetic tests to be more stringently regulated. If the process of DTC genetic testing was to be regulated, respondents felt the most important aspects to be controlled were the need that the tests had clinical validity and genetic counselling was provided. In 2008 Hoop et al found psychiatrists thought regulating access to such tests was important, and that the sale of testing kits online and over-the-counter should be restricted.

Recently, the FDA took steps toward regulating the sale of these tests over-the-counter in the USA. Interestingly, respondents in this study did not place the same level of importance on regulating access to DTC genetic testing.

Based on findings from this study and those from previous research, a more appropriate model of delivery for DTC genetic testing appears to be the ‘Patient-Doctor-Counsellor Model of Delivery of Genetic Services’. Patients would be required to involve their GP in order to access tests from DTC genetic testing companies.

Primary responsibility for pre- and post-test counselling would lie with a genetic counsellor, who would then liaise with the GP. The GP would then be responsible for the ongoing care and follow up of the patient, providing increased safety for all involved. One implication of this model, is the need for increased training of GPs in genetic disease, and more genetic counsellors being available to facilitate this process.

With regards to the future, over half of the respondents were uncertain whether DTC genetic testing will be an area of growth in NZ. This viewpoint is surprising, given the many predictions made in scientific and popular literature, it might be expected that GPs may have seen a greater future for this technology.

There does appear to be widespread consensus that genetic testing for medical conditions is going to become more important in the future, with the advent of whole genome sequencing becoming more available in the health care system. However it might be that under the current delivery model, GPs do not perceive the DTC genetic testing industry to be an area of growth in NZ.
If genetic testing was provided in a safer and more regulated manner, the promise of improved health care as a result of new advances in genetics may be realised.

**Competing interests:** None known.

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**References:**


A Pacific population’s access to and use of health services in Dunedin

Faafetai Sopoaga, Lianne Parkin, Andrew Gray

Abstract

Background Pacific peoples in New Zealand (mostly of Samoan, Tongan, or Cook Islands origin) have poor health compared to the total New Zealand population. Understanding their access to and use of health services is important in resolving this.

Method A survey of Pacific peoples in Dunedin obtained information about their access to and use of health services.

Results 372 questionnaires were analysed. Approximately one-quarter did not have a regular doctor or health service. At least 50% used hospital emergency services for non-urgent illnesses. Nearly two-thirds used a “walk-in” primary care service.

Discussion A significant proportion of Pacific peoples did not have a regular GP or health service in Dunedin. It was surprising students were more likely to be in this category because student health services should be more affordable. A “walk-in” primary care facility has a role in the delivery of primary care services. Pacific organisations can assist primary care providers to encourage access to and the appropriate use of health services.

Pacific peoples living in New Zealand comprise approximately 7% of the total population. The three largest ethnic groups originate from Samoa, Cook Islands and Tonga. The Pacific population is over-represented in poor health statistics compared to the total population. These inequalities can, at least in part, be attributed to differences in social, cultural and economic determinants of health.

The Ministry of Health has responded to these health disparities through efforts to improve access to primary care, and encourage the appropriate use of health services. For example, recommendations about Pacific cultural competency in the Health and Disability sectors have been developed, and Pacific health is the focus of a national health and disability plan. However, there is little published information about Pacific peoples’ use of health services in New Zealand.

Dunedin is the eighth largest city in New Zealand with an urban population of around 120,000 people. The main campus for the University of Otago is in Dunedin and students comprise approximately 20% of the total population. Pacific peoples make up 1% of the Dunedin population.

We undertook a survey of Pacific peoples in Dunedin to obtain information about their access to and use of health services.

Methods

Pacific peoples in Dunedin aged 15 years and over were invited to participate in this study from July 2007 to July 2008. The inclusion criteria was having Pacific heritage and aged 15 years and over. Recruitment was opportunistic, and was carried out using standardised
instructions, by Pacific community and student leaders. Those who attended organised
Pacific community and student events during the study period were invited to participate. All
who were thought to be eligible were given an information sheet and invited to complete a
questionnaire.

The questionnaire contained questions relating to age, sex, ethnicity, language, religion,
education, income, employment, and having a community services card (a subsidy card for
low income earners, which reduces medical and pharmaceutical costs). Questions were also
asked about the use of primary care and hospital emergency services.

Data obtained were entered into a spread sheet and checked for possible duplication.
Participants without a recorded Pacific ethnic identity were excluded from analyses. Income
source was prioritised for cross tabulations with Salary, Benefit, Student allowance and
Other categorised in this order.

Associations between categorical variables were explored using Chi-squared tests, with
Fisher's Exact test used where expected cell counts were low (more than 20% of cells having
expected cell counts below 5). All analyses were performed using Stata (version 11) software
with p<0.05 considered statistically significant in all cases.

Ethical approval was granted through the University of Otago Human Ethics approval
process at the departmental level.

Results

Four-hundred and ninety-three people were approached and invited to participate in this
study. Although the recruiters and the information sheet clearly explained the inclusion
criteria, some people completed the questionnaire but were later found to be ineligible.

Fifty-five people filled in the questionnaires but were excluded because they were aged less
than 15 years, had no date of birth, or did not identify with at least one Pacific ethnicity. At
most, 438 people were eligible for inclusion in this study. Of these, 378 completed
questionnaires. There was no evidence of data duplication. Six forms were misplaced by the
community-based recruiters, resulting in 372 analysable questionnaires. The response rate
was therefore 85%.

Table 1 shows the sociodemographic information of all participants, with data from the
Census for the Dunedin Pacific population aged ≥15 years shown where available for
comparison. Our sample had comparatively more people aged 15–29 years, receiving
allowance/scholarships or with a highest qualification of either a graduate or post graduate
degree. Most (87%) were able to speak well in English.

Approximately 60% earned less than NZ$15,000 and 42% had a community services card
which entitled them to increased subsidies on prescriptions, some doctor visits, and some
other healthcare services. One-third of all participants did not know whether they were
eligible for a community services card.
Table 1. Sociodemographic details of study participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study participants total=372</th>
<th>Total Dunedin Pacific † population aged ≥15 years Total=1692</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–29</td>
<td>221(59)</td>
<td>(51)</td>
</tr>
<tr>
<td>30–44</td>
<td>81(22)</td>
<td>(27)</td>
</tr>
<tr>
<td>45–59</td>
<td>42(11)</td>
<td>(15)</td>
</tr>
<tr>
<td>60+</td>
<td>28(8)</td>
<td>(6)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>153 (41)</td>
<td>(51)</td>
</tr>
<tr>
<td>Female</td>
<td>219(59)</td>
<td>(49)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samoan</td>
<td>155(42)</td>
<td>(44)</td>
</tr>
<tr>
<td>Cook Islands</td>
<td>77(21)</td>
<td>(28)</td>
</tr>
<tr>
<td>Tongan</td>
<td>95(25)</td>
<td>(15)</td>
</tr>
<tr>
<td>Other Pacific</td>
<td>70(19)</td>
<td>(19)</td>
</tr>
<tr>
<td><strong>Languages spoken well</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English only</td>
<td>82(22)</td>
<td></td>
</tr>
<tr>
<td>English &amp; Pacific language</td>
<td>241(65)</td>
<td></td>
</tr>
<tr>
<td>Pacific language only</td>
<td>46(12)</td>
<td></td>
</tr>
<tr>
<td>Missing (n=3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Income source ‡</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>211(52)</td>
<td>(68)</td>
</tr>
<tr>
<td>Benefit</td>
<td>62(15)</td>
<td>(20)</td>
</tr>
<tr>
<td>Allowance/Scholarship</td>
<td>84(20)</td>
<td>(12)</td>
</tr>
<tr>
<td>Other</td>
<td>48(12)</td>
<td>(22)</td>
</tr>
<tr>
<td>None</td>
<td>55(14)</td>
<td>(11)</td>
</tr>
<tr>
<td>Missing n=5</td>
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<td><strong>Level of income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$&lt; $15,000</td>
<td>209(62)</td>
<td></td>
</tr>
<tr>
<td>$15,000–$30,000</td>
<td>62(18)</td>
<td></td>
</tr>
<tr>
<td>&gt;$30,000 – $60,000</td>
<td>58(17)</td>
<td></td>
</tr>
<tr>
<td>&gt; $60,000</td>
<td>8(2)</td>
<td></td>
</tr>
<tr>
<td>Missing (n=25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Highest qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>169(48)</td>
<td>(51)</td>
</tr>
<tr>
<td>Graduate/Postgraduate</td>
<td>110(31)</td>
<td>(16)</td>
</tr>
<tr>
<td>None</td>
<td>61(17)</td>
<td>(24)</td>
</tr>
<tr>
<td>Other</td>
<td>13(4)</td>
<td>(9)</td>
</tr>
<tr>
<td>Missing (n=19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enrolled in education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>159(43)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>206(56)</td>
<td></td>
</tr>
<tr>
<td>Missing (n=7)</td>
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<td></td>
</tr>
<tr>
<td><strong>Type of enrollment</strong></td>
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<td></td>
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<tr>
<td>Full time</td>
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<td></td>
</tr>
<tr>
<td>Part time</td>
<td>15(11)</td>
<td></td>
</tr>
<tr>
<td>Missing n=17</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Community services card</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>152(42)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>213(58)</td>
<td></td>
</tr>
<tr>
<td>Missing (n=7)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Percentages may not add up to 100% due to rounding; **total responses, so % add to more than 100; †NZ Census 2006; ‡Participants could nominate income from more than one source.

Table 2 shows the participants’ characteristics in relation to having a regular general practitioner (GP) or health service. One hundred and two (28%) of the 366 participants who answered the question reported they did not have a GP or health service they attended on a regular basis. Those who were enrolled in an education institution and in full time study were less likely to have a regular GP or health service, as were those who did not have access to a community services card.
Age, highest qualification, income source and level of income were also statistically significantly associated with whether or not a participant had a regular GP or health service.

Table 2. Participant characteristics in relation to having a regular GP or health service

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Regular GP or health service*</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>264(72)</td>
<td>102(28)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–29</td>
<td>129(59)</td>
<td>89(41)</td>
</tr>
<tr>
<td>30–44</td>
<td>67(85)</td>
<td>12(15)</td>
</tr>
<tr>
<td>45–59</td>
<td>42(100)</td>
<td>0(0)</td>
</tr>
<tr>
<td>60+</td>
<td>26(96)</td>
<td>1(4)</td>
</tr>
<tr>
<td>Languages spoken well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English only</td>
<td>57(70)</td>
<td>25(30)</td>
</tr>
<tr>
<td>English &amp; Pacific language</td>
<td>168(71)</td>
<td>69(29)</td>
</tr>
<tr>
<td>Pacific language only</td>
<td>38(84)</td>
<td>7(16)</td>
</tr>
<tr>
<td>Enrolled in education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>99(62)</td>
<td>60(38)</td>
</tr>
<tr>
<td>No</td>
<td>164(80)</td>
<td>42(20)</td>
</tr>
<tr>
<td>Type of enrolment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>71(56)</td>
<td>56(44)</td>
</tr>
<tr>
<td>Part time</td>
<td>14(93)</td>
<td>1(7)</td>
</tr>
<tr>
<td>Highest qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>110(65)</td>
<td>59(35)</td>
</tr>
<tr>
<td>Graduate</td>
<td>77(70)</td>
<td>33(30)</td>
</tr>
<tr>
<td>None</td>
<td>55(92)</td>
<td>6(8)</td>
</tr>
<tr>
<td>Other</td>
<td>11(85)</td>
<td>2(15)</td>
</tr>
<tr>
<td>Income source (prioritised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>142(78)</td>
<td>40(22)</td>
</tr>
<tr>
<td>Benefit</td>
<td>46(98)</td>
<td>1(2)</td>
</tr>
<tr>
<td>Student allowance</td>
<td>19(37)</td>
<td>33(63)</td>
</tr>
<tr>
<td>Other</td>
<td>20(69)</td>
<td>9(31)</td>
</tr>
<tr>
<td>None</td>
<td>33(65)</td>
<td>18(35)</td>
</tr>
<tr>
<td>Level of income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; $15,000</td>
<td>132(64)</td>
<td>74(36)</td>
</tr>
<tr>
<td>$15,000 – $30,000</td>
<td>47(77)</td>
<td>14(23)</td>
</tr>
<tr>
<td>$30,000 – $60,000</td>
<td>52(90)</td>
<td>6(10)</td>
</tr>
<tr>
<td>$60,000+</td>
<td>8(100)</td>
<td>0</td>
</tr>
<tr>
<td>Community services card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>127(85)</td>
<td>23(15)</td>
</tr>
<tr>
<td>No</td>
<td>132(63)</td>
<td>78(37)</td>
</tr>
</tbody>
</table>

* The number of respondents for each characteristic may be less than 366 due to missing data; † P-value from Chi-square test; ‡ P value from Fisher’s exact test.

Table 3 shows the participants’ characteristics in relation to the reasons for using hospital emergency services in the previous 12 months. Thirty percent (106) of all participants had used these services in this period. Of those who used hospital emergency services, 47% indicated they felt at the time their illness was an emergency. Age was the only factor which was close to being statistically significantly associated with the reason for attending hospital emergency services.
Table 3. Participant characteristics in relation to the reasons for accessing public hospital emergency services in the previous 12 months

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Reason for using the hospital emergency services*</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Illness an emergency</td>
<td>GP unavailable</td>
</tr>
<tr>
<td></td>
<td>n=50(47)</td>
<td>27(25)</td>
</tr>
<tr>
<td>Age</td>
<td>15–29</td>
<td>23(43)</td>
</tr>
<tr>
<td></td>
<td>30–44</td>
<td>10(38)</td>
</tr>
<tr>
<td></td>
<td>45–59</td>
<td>9(56)</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>8(80)</td>
</tr>
<tr>
<td>Languages spoken well</td>
<td>English only</td>
<td>9(45)</td>
</tr>
<tr>
<td></td>
<td>English &amp; Pacific language</td>
<td>28(42)</td>
</tr>
<tr>
<td></td>
<td>Pacific language only</td>
<td>13(68)</td>
</tr>
<tr>
<td>Enrolled in education</td>
<td>Yes</td>
<td>17(45)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>33(45)</td>
</tr>
<tr>
<td>Type of enrolment</td>
<td>Full time</td>
<td>11(48)</td>
</tr>
<tr>
<td></td>
<td>Part time</td>
<td>3(43)</td>
</tr>
<tr>
<td>Highest qualification</td>
<td>Secondary school</td>
<td>20(47)</td>
</tr>
<tr>
<td></td>
<td>Graduate</td>
<td>14(54)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>12(48)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>3(43)</td>
</tr>
<tr>
<td>Income source (prioritised)</td>
<td>Salary</td>
<td>20(40)</td>
</tr>
<tr>
<td></td>
<td>Benefit</td>
<td>14(61)</td>
</tr>
<tr>
<td></td>
<td>Student allowance</td>
<td>7(70)</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>2(29)</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>4(33)</td>
</tr>
<tr>
<td>Level of income</td>
<td>&lt;$15000</td>
<td>26(45)</td>
</tr>
<tr>
<td></td>
<td>$15,000-$30,000</td>
<td>8(57)</td>
</tr>
<tr>
<td></td>
<td>$30,000-$60,000</td>
<td>8(44)</td>
</tr>
<tr>
<td></td>
<td>$60,000+</td>
<td>2(50)</td>
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<tr>
<td>Community services card</td>
<td>Yes</td>
<td>28(49)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>21(47)</td>
</tr>
</tbody>
</table>

* The number of respondents for each characteristic may be less than 106 due to missing data; ‡ P-value from Fisher’s exact test.

Table 4 shows the participants’ characteristics in relation to the reasons for using the Urgent Doctors (“walk-in service”) in the previous 12 months. Approximately 40% (146) had used this service in this period. The unavailability of their GP was the main reason most people (65%) attended the Urgent Doctors, and one fifth did so because it was convenient. Age, highest qualification, income source and level of income were statistically significantly associated with the reason for accessing the Urgent Doctors.
Table 4. Participant characteristics in relation to the reasons for accessing the “Urgent Doctors” in the previous 12 months.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Reason for using the “Urgent Doctors”*</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GP unavailable</td>
<td>95(65)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–29</td>
<td>41(59)</td>
<td>15(21)</td>
</tr>
<tr>
<td>30–44</td>
<td>38(83)</td>
<td></td>
</tr>
<tr>
<td>45–59</td>
<td>11(65)</td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td>5(38)</td>
<td></td>
</tr>
<tr>
<td>Languages spoken well</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English only</td>
<td>22(71)</td>
<td>4(12)</td>
</tr>
<tr>
<td>English &amp; PI language</td>
<td></td>
<td>64(67)</td>
</tr>
<tr>
<td>PI language only</td>
<td>9(50)</td>
<td>8(44)</td>
</tr>
<tr>
<td>Enrolled in education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>34(60)</td>
<td>11(19)</td>
</tr>
<tr>
<td>No</td>
<td>60(69)</td>
<td>19(22)</td>
</tr>
<tr>
<td>Type of enrolment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>21(54)</td>
<td>9(23)</td>
</tr>
<tr>
<td>Part time</td>
<td>8(73)</td>
<td>1(9)</td>
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<td>Highest qualification</td>
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</tr>
<tr>
<td>Secondary school</td>
<td>30(59)</td>
<td>10(20)</td>
</tr>
<tr>
<td>Graduate</td>
<td>39(76)</td>
<td>5(10)</td>
</tr>
<tr>
<td>None</td>
<td>19(61)</td>
<td>11(35)</td>
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<tr>
<td>Other</td>
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</tr>
<tr>
<td>Income source (prioritised)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>61(79)</td>
<td>7(9)</td>
</tr>
<tr>
<td>Benefit</td>
<td>10(53)</td>
<td>9(47)</td>
</tr>
<tr>
<td>Student allowance</td>
<td></td>
<td>8(53)</td>
</tr>
<tr>
<td>Other</td>
<td>3(21)</td>
<td>6(43)</td>
</tr>
<tr>
<td>None</td>
<td>10(59)</td>
<td>5(29)</td>
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<tr>
<td>Level of income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$15000</td>
<td>40(53)</td>
<td>24(32)</td>
</tr>
<tr>
<td>$15,000≤$30,000</td>
<td>21(84)</td>
<td>2(8)</td>
</tr>
<tr>
<td>$30,000≤$60,000</td>
<td>23(77)</td>
<td>2(7)</td>
</tr>
<tr>
<td>$60,000+</td>
<td>4(100)</td>
<td>0(0)</td>
</tr>
<tr>
<td>Community services card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>43(67)</td>
<td>16(25)</td>
</tr>
<tr>
<td>No</td>
<td>49(63)</td>
<td>14(18)</td>
</tr>
</tbody>
</table>

* The number of respondents for each characteristic may be less than 146 due to missing data; P-value from Fisher’s exact test.

Discussion

This study describes the use of health services by Pacific peoples who attended Pacific community and student events during the study period in Dunedin. It is not a randomly selected sample of the local community. Our sample was approximately one quarter of the total Dunedin Pacific population aged 15 years and over. The results from this study provide useful information about Pacific peoples access to health services in New Zealand, in particular those attending education institutions.

A large proportion of participants in our study did not have a doctor or health service they attended on a regular basis. Those who were younger, enrolled in education, had high school as their highest qualification, were on a student allowance or on a low income were less likely to have a regular GP or health service. The 2004 Pacific Health Chart book reported 97% of all Pacific peoples in New Zealand had a usual carer.
Most Pacific peoples (67%) in New Zealand live in the Auckland area, where Pacific-led health services are well developed. In areas whether there are fewer Pacific peoples such as Dunedin, there is a risk of increasing existing disparities because it is either not cost-effective to have Pacific-led health services or mainstream services do not address the needs of minority communities. It was surprising Pacific students were not accessing student health services, because costs were minimal. Previous research however indicated even minimal costs could still be a barrier to accessing health services.

Medical costs are subsidised in New Zealand for those who are eligible for a community services card. Most participants had an income less than $15,000 and were therefore eligible for this subsidy card. Approximately 15% of participants eligible for a community services card did not have one. Enabling those who are eligible to obtain a subsidy card may assist access. Education through local Pacific networks can ensure all who are eligible access available support services.

Recent changes in health services delivery with the establishment of Primary Health Organisations (PHOs) required patients to enrol with one health provider. Enrolling with a PHO entitles patients to a universal subsidy. Although there are no Pacific-led health services in Dunedin, there are specific targeted health initiatives for Pacific patients through mainstream services. Patients not enrolled with a PHO cannot access any of these services.

The age of participants was close to being significantly associated with the use of emergency services (ED). Older people were more likely to use ED because they felt their symptoms were an emergency, and younger people because their GP was unavailable. Just over half of those who used ED services did not feel at the time that their illness was an emergency.

The overcrowding of ED services is a world-wide concern. The high use of emergency services by Pacific peoples in New Zealand has previously been reported. Patients with non-urgent conditions in emergency departments are unlikely to see a health professional immediately. Health professionals and Pacific organisations can work together to improve health and the appropriate use of services through better community engagement and dissemination of information.

Participants’ age, qualifications, income source and level of income were associated with accessing the Urgent Doctors (UD) service. Those who were aged 30–44 years were more likely to attend the UD because their GP was unavailable. This may be due to their inability to access their GP during normal working hours because of work commitments. The older age group and those on a benefit were more likely to report they attended the UD because it was more convenient. The Urgent Doctors is a “walk-in” primary care service and patients usually present with acute illnesses. It is open during normal working hours, and also provides After Hours care. There have been discussions over the years whether this service was needed.

Patients are normally encouraged to see their own GPs first because costs associated with consultations are less. GPs however were not always available to see their patients when needed. A “walk-in” primary care facility provides a useful service when patients’ GPs are either fully booked or unavailable for other reasons.

There are systemic and structural issues minority groups (such as Pacific peoples) often struggle with, within the health and education sectors in New Zealand. These have contributed to poor health and education outcomes. Pacific peoples migrated to New Zealand.
Zealand in the hope of a better future for their families, but this has not been a reality for many. 1, 27

The government has responded to these needs by outlining plans and strategies to address the challenges. 10, 28 There are efforts within health and tertiary organisations to contribute to improving outcomes for Pacific peoples.11, 29-31 Some Pacific peoples have indicated they wished to be seen by a Pacific health professional when seeking healthcare.32 The challenge for health providers and education institutions in New Zealand is to ensure the services they provide cater for the needs of all New Zealanders including disadvantaged minority communities within society.

The motivation for this study was to learn more about access to, and the use of, health services by a particular group of Pacific peoples in Dunedin—those with links to Pacific networks and activities. Therefore participants were recruited at community events and through churches by members of the relevant communities. Community members who undertook the recruitment were instructed to invite all (rather than sample) Pacific peoples aged >15 years who attended particular events to complete the questionnaire.

The strength of this study was the participation of community members as researchers and facilitators of the research process. This resulted in a very good response rate of 85%. It also established good partnerships and pathways for future work and research. However the method of recruitment means that our results may not be generalisable to all Pacific peoples in Dunedin.

Although face-to-face recruitment at community events was an effective means to get a high response rate among those who attended those events, it meant the experiences of people without ties to Pacific networks were inevitably not captured. The needs of these people may be different and further research using different recruitment methods is required to explore their use of health services.

Conclusions

There is a significant proportion of Pacific peoples not enrolled with a primary care service provider in some areas of New Zealand. This can contribute to increasing disparities particularly in small settlement areas. A “walk-in” health facility plays an important role in the delivery of primary healthcare. Pacific community organisations can work together with primary care providers to encourage Pacific peoples’ access to, and the appropriate use of health services in New Zealand.

Competing interests: None known.

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References:
Improved stroke care processes and outcomes following the institution of an acute stroke unit at a New Zealand district general hospital

Nicholas G Burgess, Ritva Vyas, Jennifer Hudson, Olivia Browne, Yun Lee, Sisira Jayathissa, Tom Thomson

Abstract

Aims To examine whether stroke care processes and outcomes are improved following the institution of an acute stroke unit (ASU) at a medium-sized New Zealand hospital.

Methods Two retrospective audits over 12-month periods were carried out at Hutt Valley Hospital before and after the institution of a 6-bed ASU. Data was collected on demographics, length of stay, stroke type, investigations, processes of care and outcomes.

Results 139 strokes pre ASU and 155 strokes post ASU were studied. 86.8% of strokes received stroke unit care in the 2009 audit. There were more intracerebral haemorrhages in 2006 (17.2% vs. 9.0%). Significant improvements were seen between 2006 and 2009 in time to aspirin administration (52.7 versus 14.5 hours), swallow assessment within 24 hours (88.5% versus 96.1%), lag time to carotid Doppler studies (21 days versus 4.5 days), pressure risk assessments (19.6%, versus 87.2%) and urinary infection rates (10.8% versus 2.0%). Total length of stay (TLOS) and mortality were reduced but the difference was not statistically significant. (20.5 days versus 18.3 days p=0.34, Inpatient mortality 16.2% versus 10% p=0.12)

Conclusions The introduction of an ASU has resulted in improvements in several key processes of stroke care. Overall mortality and total length of stay showed a trend to improvement after the establishment of an ASU.

Stroke is a leading cause of death and disability in New Zealand. Over 7000 people suffer from stroke each year and less than half are alive and independent at 1 year.¹ A Cochrane review in 2006 showed that co-ordinated stroke care in dedicated stroke units reduced mortality and dependency.² Current New Zealand guidelines for stroke management advocate for the establishment of stroke units in all hospitals.³

In 2007 15% of New Zealand hospitals had an acute stroke unit (ASU). These provided service for 48% of the New Zealand population. Others had some form of organised stroke service.⁴

Research into discrete interventions has shown that prescription of aspirin,⁵ intravenous thrombolysis for selected patients⁶ and decompressive craniectomy⁷ are important in reducing mortality and dependency in acute stroke. The components of stroke unit care that influence outcome are still unknown and some researchers have labelled it a “Black Box”.⁸ There is some evidence that process of care in stroke units is important in improving outcomes.⁹,¹⁰
There have been three previous New Zealand studies looking at stroke unit care. Hanger et al\textsuperscript{11} used the Royal College of Physicians (London) stroke audit tool to examine cohorts of 119 patients admitted before and 72 patients admitted after the institution of a 15 bed ASU at Christchurch Hospital. Improvements were noted in process of care. Total length of stay (Pre 12.0 days, Post 15.7 days, \textit{p}=0.14) and 30 day mortality (Pre 24\% vs Post 25\% \textit{p}=0.94) were not different.

Di Matteo et al\textsuperscript{12} audited outcomes following the creation of a 12 bed ASU at Middlemore Hospital by retrospectively reviewing the case notes of a random sample of patients admitted pre (1999 \textit{n}=100) and post (2001 \textit{n}=100) ASU implementation. Significant improvements in process were noted, particularly in the case of swallow assessments and allied health input. Mortality decreased from 14.0 to 8.8\%, but only 33\% of patients were cared for in the ASU, and stroke unit subgroup mortality was worse probably due to the admission of more unwell patients. Both these studies suggested significant improvement in process but no clear improvement in outcomes.

Gommans et al\textsuperscript{13} audited a random selection of 50 patients admitted with stroke to Hawke’s Bay Hospital’s Stroke Unit. 94\% of patients with stroke were cared for on the Stroke Unit, and guideline adherence was generally high. In hospital mortality was 16\%. This was not a before and after study.

Stroke care has previously been studied at Hutt Valley Hospital. McNaughton\textsuperscript{14} audited 50 consecutive discharges with a diagnosis of stroke using the Royal College of Physicians Stroke Audit tool. He found serious deficiencies in stroke clinical assessment and process of care. Only 2\% of patients had a swallow assessment documented in the first 24 hours of admission. He suggested a clinical pathway to improve stroke care and ideally an ASU, but felt that implementing an ASU in a smaller hospital may not be practical. Taylor et al\textsuperscript{15} subsequently found that the introduction of a clinical care pathway for stroke had no impact on outcomes.

Hutt Valley Hospital is a 260-bed hospital located in the lower North Island servicing a population of 140,000. Stroke care at Hutt Valley Hospital was provided by general physicians in undifferentiated medical beds until an ASU was created in October 2008.

This study is a comparison of audits, the first undertaken prior to ASU implementation and the follow up performed during its first year of operation to see if improvements had been made to processes and outcomes of stroke care. We were also interested to examine the effectiveness of a stroke unit in a medium-sized New Zealand hospital as previous studies were undertaken in larger hospitals.

**Methods**

The initial audit was a retrospective case note based study of all strokes presenting to Hutt Valley Hospital between January 1 and December 31 2006 (2006 audit) when there was no organised stroke care at the hospital. Patients were cared for by one of six general physicians. Multidisciplinary input was provided by one of 3 teams involving medical, physiotherapy, speech language therapy, social work and nursing staff.

The 2006 audit focused on key processes which were thought to be problematic at the time such as aspirin administration, multidisciplinary team involvement in stroke patient care and inpatient waiting times before transfer to a rehabilitation service.

A follow-up audit was undertaken following ASU implementation over the period 1 October 2008 to 30 September 2009 (2009 audit). Key changes were made and are summarised in Box 1. The unit is a
ward bay with the capacity for 6 patients in a geographically defined clinical area on the medical floor. There was no increase in the number of medical beds overall. Two physicians with an interest in stroke, 0.4 + 0.2 Full Time Equivalents (FTE), and a stroke clinical nurse specialist (CNS), 1.0 FTE, were employed. Patients with suspected or confirmed stroke were admitted to the ASU under the care of the on-call general physician, and then transferred to the care of the stroke physician on the following morning during weekdays and Monday morning after the weekend.

All stroke nurses underwent an education programme and gained skills in level one swallow assessment and principles of stroke care. A health care assistant was employed to work specifically in the ASU to help with the additional care burden for stroke nurses. The stroke CNS has an intensive role in the delivery of nursing care coordination of multidisciplinary input, staff education and quality assurance activities.

A specialist multidisciplinary team (MDT) was created involving speech language therapy, occupational therapy, physiotherapy, social work and nursing. Team members attended an 8 hour training day focused on multidisciplinary aspects of stroke care. The MDT group met 3 times per week. There was no increase in the bedside nursing, junior doctor or allied health FTE for this initiative. Communication links to the Emergency Department (ED), Older Persons Rehabilitation Service (OPRS) and the Radiology Department were strengthened. Thrombolysis was not offered as part of the initial set up.

The 2009 audit had a wider scope and expanded on demographic data as well as acute care process variables. It collected information in line with New Zealand national guidelines and similar to that collected in United Kingdom national stroke audits with the intention of serial audits over time to monitor stroke unit performance.

Box 1. Key changes associated with the Hutt Valley Hospital Stroke Unit

- Geographically defined area in the Medical Ward (6 beds)
- Two Physicians with an interest in stroke (0.4 + 0.2 FTE) and a Stroke CNS 1.0 FTE employed
- Identified and trained a group of medical nurses interested in stroke
- Stroke Unit Health Care Assistant dedicated to the stroke unit patients to assist with workload of stroke nurses
- Defined and trained a specialist MDT. This team met 3 times per week
- Strengthened links to the Emergency Department, Older Persons Rehabilitation Service and Radiology

 Patients were identified by ICD codes on discharge (intracerebral haemorrhage, cerebral infarction or Stroke NOS) and admission details kept by the stroke CNS. Patients with a diagnosis of transient ischaemic attack, subdural haemorrhage, subarachnoid haemorrhage, traumatic brain injury and brain tumour were excluded. Data was collected retrospectively from the case-notes and computer records of confirmed stroke patients and transferred into a database.

Categories for data collection included in both audits were: demographics, estimated admission and discharge Barthel Index, stroke subtype, allied health professional involvement (Speech and Language Therapy (SLT), Physiotherapy (PT), Occupational Therapy (OT)), Nursing assessments, Rehabilitation referral lag times, inpatient antiplatelet administration, inpatient complications and investigations (Carotid Doppler studies, Echocardiograms), length of stay on medical and rehabilitation services, discharge disposition and mortality (inpatient, 30 day and 6 months). Mortality data was collected by searching national and local health databases for certified deaths according to National Health Index number.

In 2009 additional data was collected on: comorbidities and medications on admission, estimated pre-admission Modified Rankin Scale (MRS), CT Brain scan timings and admission investigations (blood tests, electrocardiogram) physiological variables and management within the first 24 hours (IV fluids,
hypoxia, fever, hyperglycemia, hypertension). Some of this data is outlined below. Other data is available from the authors upon request.

Comparisons of categorical variables between the two audits were made using the Chi-squared test. Comparisons of means were made using the student’s t-test. Information was compiled in a Microsoft Excel spreadsheet and analysed using Microsoft Excel and OpenEpi (Version 2.3.1. www.OpenEpi.com) software.

According to national health and disability ethics committee guidelines, this study is considered an audit primarily carried out for quality improvement by the employees of HVDHB and hence did not require formal ethical approval.

**Results**

There were 151 stroke events identified in the 2006 audit, and 174 in the 2009 audit. Case notes were available for 139 (92.1%) in 2006 and 155 (89.1%) in 2009. Key demographic features are included in table 1. Age, sex, ethnicity and pre-admission residence were not statistically significantly different. Comparison of estimated Barthel scores indicated stroke tended to be less severe in the second study period.

**Table 1. Baseline patient characteristics**

<table>
<thead>
<tr>
<th>Variables</th>
<th>2006</th>
<th>2009</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>71.7 (69.7-73.9)</td>
<td>73.4 (71.4-75.4)</td>
<td>0.28</td>
</tr>
<tr>
<td>Male</td>
<td>76 (54.7%)</td>
<td>77 (49.7%)</td>
<td>0.39</td>
</tr>
<tr>
<td><strong>Pre Admission Residence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>106 (76.3%)</td>
<td>114 (74.5%)</td>
<td>0.73</td>
</tr>
<tr>
<td>Home with Support</td>
<td>19 (13.7%)</td>
<td>33 (21.6%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Rest Home</td>
<td>11 (7.9%)</td>
<td>5 (3.3%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Hospital Level Care</td>
<td>2 (1.4%)</td>
<td>1 (0.7%)</td>
<td>0.51</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.7%)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Antiplatelet administration was compared in acute ischaemic strokes (Table 2). Aspirin was not administered in any patient with a diagnosis of ICH in 2006 or 2009. Data on timing of administration was only available on 75 of 95 patients in 2006 and 107 of 120 patients in 2009.

In 2009 95.5% of patients had a CT Brain scan. The average time to scan was 6 hours 31 minutes from medical admission (95% CI 5:21-7:42). 100% of CT scans were performed within 24 hours. 92.4% of patients had an ECG performed at admission, and 23.3% were found to be in atrial fibrillation. Data on investigations was not collected in 2006. Table 3 shows a similar rate of carotid Doppler studies between the two audits but the studies were performed much quicker in 2009. Significantly fewer echocardiograms were performed in 2009. Significant improvements to SLT, OT, PT and nursing assessments were seen in 2009 compared to 2006.

76.8% of patients were admitted directly to the ASU in 2009, and 86.8% had the majority of their acute care on the ASU. A statistically similar minority of patients were admitted to ICU or CCU in both cohorts. Significantly fewer patients were admitted to a non-medical ward in 2009 (5.8% vs 1.3% p=0.03). Length of stay in medical and rehabilitation wards (OPRS) is shown in Table 3.
<table>
<thead>
<tr>
<th>Variables</th>
<th>2006</th>
<th>2009</th>
<th>P values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stroke Subtype</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischaemic Stroke</td>
<td>111 (82.8%)</td>
<td>141 (91.0%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Intracerebral Haemorrhage</td>
<td>23 (17.2%)</td>
<td>14 (9.0%)</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Function and Dependency Assessment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Estimated Barthel Score at Admission</td>
<td>9.2 (7.7-10.6)</td>
<td>11.6 (10.4-12.7)</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Antiplatelet for ischaemic stroke</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin administered?</td>
<td>95/105 (90.5%)</td>
<td>120/140 (85.1%)</td>
<td>0.26</td>
</tr>
<tr>
<td>Aspirin within 48 hours</td>
<td>52/75 (69.3%)</td>
<td>105/107 (98.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Carotid Artery Assessment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotid Doppler Studies</td>
<td>50/138 (36.2%)</td>
<td>58/153 (38.6%)</td>
<td>0.77</td>
</tr>
<tr>
<td>Lag time to Carotid Assessment (days from admission)</td>
<td>21.0 (16.2-25.8)</td>
<td>4.53 (2.79-6.26)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Echocardiogram</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>34/125 (27.2%)</td>
<td>12/155 (7.7%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Swallow Assessment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performed by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>88/139 (63.3%)</td>
<td>129/152 (84.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>- Doctor</td>
<td>44/88 (50.0%)</td>
<td>1/129 (0.8%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>- Nurse</td>
<td>0/88 (0%)</td>
<td>123/129 (96.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>- Speech Therapist</td>
<td>44/88 (50.0%)</td>
<td>4/129 (3.1%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Performed within 24 hours:</td>
<td>77/88 (88.5%)</td>
<td>124/129 (96.1%)</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Allied Health Professionals</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physiotherapy (PT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lag time until first review</td>
<td>1.99 days (1.6-2.3)</td>
<td>1.45 days (1.1-1.7)</td>
<td>0.12</td>
</tr>
<tr>
<td>- Time to first mobilisation</td>
<td>2.2 days (1.3–3.1)</td>
<td>1.40 days (1.2-1.6)</td>
<td>0.09</td>
</tr>
<tr>
<td>Occupational Therapy (OT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lag time until first review</td>
<td>4.9 days (2.7-7.1)</td>
<td>2.8 days (2.1-3.4)</td>
<td>0.08</td>
</tr>
<tr>
<td>Speech Therapy (SLT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lag time until first review</td>
<td>1.6 days (1.3-1.9)</td>
<td>2.6 days (0.6-4.5)</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>Nursing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Risk Assessment</td>
<td>27/138 (19.6%)</td>
<td>130/149 (87.2%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Indwelling Catheter Rate</td>
<td>NA</td>
<td>27/155 (17.4%)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3. Outcomes

<table>
<thead>
<tr>
<th>Variables</th>
<th>2006</th>
<th>2009</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rehabilitation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPRS Admission</td>
<td>58/139 (41.7%)</td>
<td>58/155 (37.4%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Lag time from referral to transfer to OPRS</td>
<td>5.8 days (4.9-6.8)</td>
<td>1.9 days (1.6-2.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Length of Stay</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Length of Stay</td>
<td>20.5 days (16.5-25.1)</td>
<td>18.3 days (15.4-21.1)</td>
<td>0.34</td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia/LRTI</td>
<td>21/139 (15.1%)</td>
<td>16/155 (10.3%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Stroke Extension</td>
<td>15/139 (10.8%)</td>
<td>7/155 (4.5%)</td>
<td>0.93</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>4/139 (2.9%)</td>
<td>8/155 (5.2%)</td>
<td>0.32</td>
</tr>
<tr>
<td>Depression</td>
<td>6/139 (4.3%)</td>
<td>3/155 (2.0%)</td>
<td>0.93</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>2/139 (1.4%)</td>
<td>4/155 (2.6%)</td>
<td>0.48</td>
</tr>
<tr>
<td>Pulmonary Embolus</td>
<td>1/139 (0.72%)</td>
<td>4/155 (2.6%)</td>
<td>0.21</td>
</tr>
<tr>
<td>Deep Venous Thrombosis</td>
<td>0/139 (0%)</td>
<td>1/155 (0.7%)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Discharge Destination</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>48/139 (34.5%)</td>
<td>65/155 (41.9%)</td>
<td>0.19</td>
</tr>
<tr>
<td>Home with Supports</td>
<td>41/139 (29.5%)</td>
<td>49/155 (31.6%)</td>
<td>0.69</td>
</tr>
<tr>
<td>Rest Home</td>
<td>6/139 (4.3%)</td>
<td>9/155 (5.8%)</td>
<td>0.56</td>
</tr>
<tr>
<td>Hospital Level Care</td>
<td>20/139 (14.4%)</td>
<td>13/155 (8.4%)</td>
<td>0.10</td>
</tr>
<tr>
<td>Deceased</td>
<td>22/139 (15.8%)</td>
<td>15/155 (9.7%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Other Hospital</td>
<td>2/139 (1.4%)</td>
<td>4/155 (2.6%)</td>
<td>0.57</td>
</tr>
<tr>
<td><strong>Functional Outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Estimated Barthel Score On Discharge</td>
<td>14.4 (12.9-15.9)</td>
<td>16.2 (15.1-17.3)</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>Mortality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient</td>
<td>22/136 (16.2%)</td>
<td>15/150 (10%)</td>
<td>0.12</td>
</tr>
<tr>
<td>6 months</td>
<td>29/136 (21.3%)</td>
<td>27/150 (18%)</td>
<td>0.48</td>
</tr>
</tbody>
</table>
There was no statistically significant difference between the two groups in terms of discharge destination, however there did appear to be a trend towards fewer inpatient deaths, and fewer being discharged to hospital level care. Admission and discharge Barthel scores were higher in 2009.

Discussion

The establishment of an ASU at Hutt Valley Hospital has resulted in significant process improvements including time to aspirin administration, level one swallow assessment in the first 24 hours, lag time to carotid doppler studies, nursing pressure risk assessments, and OT reviews. Referral and transfer to the rehabilitation service has improved. There was improvement in the incidence of urinary tract infections, and a trend towards reduced institutional care and inpatient mortality. But what is it about a stroke unit that has brought about these changes?

The previous audit of stroke at Hutt Valley Hospital by Taylor et al in 2003/4 highlighted the fact that a stroke care pathway delivered by a general medical service without dedicated stroke beds, trained nursing staff and stroke physicians was ineffective in improving process. Aspirin administration within the first 48 hours in this 2003/4 audit was 46% pre pathway and 61% post pathway. Our audit showed rates of 69% pre ASU and 98% post ASU, a significant improvement, and an incremental improvement over the pathway audit. Similarly, echocardiograms were performed in 42% of patients audited in 2006 pre pathway and 26% post pathway and our audit showed rates of 27% pre ASU, and 7.7% post ASU. These two improvements show that aspirin is more likely to be given in a timely manner and echocardiogram use is restricted to patients who will benefit most from this investigation. We believe the presence of stroke team leaders to educate and drive clinical change is the difference between a pathway and a stroke unit.

Tight multidisciplinary teamwork and skills transference between the MDT especially to the bedside nurses may explain some of the other results (e.g. improved rate and timing of swallow assessments which were largely conducted by nurses). This may have contributed to a trend to fewer chest infections. We believe easy identification of stroke patients, increased patient ownership by the team and enthusiasm for effective stroke care were factors in achieving improved time to review by OT.

Stroke units improve links with other departments. This is illustrated by the reduction in delay to carotid ultrasound and in transfer to the rehabilitation service. The latter indicates an enhanced trust in the assessments of the acute team so the patient could be transferred without needing further rehabilitation team review.

Urinary tract infection rates were significantly lower in 2009. This may be due to reduced urinary catheterisation rates, although there is no catheterisation comparison data from 2006. Studies on prevalence of urinary catheterisation in acute stroke inpatients are few, but the UK National Sentinel Stroke Audit revealed a catheterisation rate of 29% in the first week of admission in 2006 and 26% in 2009. Our 2009 audit reveals a rate of 17.4%, reflecting an active discouragement of catheterisation.

Total length of stay reduced from 20.5 days in 2006 to 18.3 days in 2009. These results are comparable to other New Zealand stroke audits: (Christchurch Hospital...
Stroke Unit Audit 2004–5, 15.7 days\(^{11}\); Hawkes Bay Audit 2003, 20.9 days\(^{13}\). A lot of this may be attributable to reduction in the lag time from referral to transfer to our rehabilitation wards. This reduced from 5.8 to 1.9 days and was a statistically significant result.

The difference in ICH (17.2% 2006 vs 9.0% 2009) was unexpected and may represent year to year variation. Data from a large New Zealand audit of 7686 stroke events in 2007 revealed a rate of ICH of 10%\(^{20}\) and the previous pathway audit in 2003/4 at Hutt Valley Hospital showed a rate of 10.5%.

Inpatient and early mortality after ASU admission was lower but not statistically significantly so, possibly reflecting lack of power due to sample size. The disparity in ICH rates had an impact on overall mortality. ICH is associated with higher inpatient death (respective rates in 2006 and 2009 were 30.4% and 28.6%) and this exaggerated overall mortality differences. Higher Barthel scores on admission in 2009 may be part of the reason for more patients leaving with greater functional independence than in 2006. There were no significant differences in numbers in each discharge destination category between audits.

The limitations of this study include its retrospective design, and differences in the collection of data between 2006 and 2009. The differences in methodology were largely due to the need of a broader audit in 2009 as a baseline for future stroke unit assessments. Functional assessments at discharge and follow up were not audited in 2006 or 2009 so comparison of the combined endpoints of death or disability to international audits was not possible. In addition, due to the patient numbers involved, it was likely that differences in outcomes would not reach statistical significance. No study conducted in New Zealand has shown improvement in key outcomes despite several reporting significant improvements in process after ASU and it may be appropriate to consider conducting a meta-analysis of all published New Zealand data.

Our study has several strengths. It is the largest ‘pre and post’ audit conducted in a New Zealand hospital, the first to examine mortality beyond 30 days and the first such study for a medium sized hospital. All strokes admitted during the two study periods were studied. The data set is fairly robust with little missing data.

Unlike the Auckland study the majority of stroke patients were treated in the ASU after its implementation. Access to stroke unit beds is a key issue to address in planning a new unit. We follow the policy of our Coronary Care Unit in stating that “there should always be a bed in the stroke unit” and if the ASU is full our nurses are trained to step down the less acute patients to receive new admissions.

The investment required for our service was a 0.4 FTE physician and a 1.0 FTE stroke CNS to lead the service. A second physician adjusted his workplan to focus 0.2 FTE on acute stroke. With the rising incidence of stroke, the long length of stay of patients with stroke and the clear evidence that stroke units reduce institutionalisation, this upfront investment will be more than compensated for with cost savings in the future.

The establishment of a stroke unit at a medium-sized New Zealand hospital has resulted in significant improvements in stroke care processes. Subsequent audits may show incremental improvement in outcomes as organised stroke care with associated ongoing quality improvement becomes the norm.
We feel the main ingredient of success in our unit is having dedicated staff focused on evidence based acute and rehabilitative stroke care, multidisciplinary ownership and ongoing educational and quality improvement activities. Organised care is a key component of the “Black Box”, but the structure of that care may be different in hospitals of different sizes.

This audit demonstrates the usefulness of establishing a stroke unit in a medium-sized New Zealand hospital and should act as a catalyst for the establishment of such units in similar hospitals in other parts of Australasia.

Competing interests: None known.

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References:


Young ischaemic stroke in South Auckland: a hospital-based study
Teddy Y Wu, Ajay Kumar, Edward H Wong

Abstract

Background and Purpose: To analyse the risk factors, trends in incidence and aetiology of stroke in young adults in a hospital-based population in South Auckland, New Zealand.

Method: A retrospective review of patients aged 15 years to 45 years with a discharge diagnosis of ischaemic stroke (ICD 10 Codes I63 - I65, G46, I672, I675-I679, I694-I694) from June 1 2004 to December 31, 2009. Vascular risk factors, demographic factors, stroke severity, stroke subtype, results of investigations and stroke outcome were determined from review of the hospital record (paper copy and electronic record).

Results: A total of 131 patients were identified, representing 4.6% of all stroke discharges. Over one-half of the patients were of “underdetermined cause” (Trial of Org 10172 in Acute Stroke Treatment [TOAST] criteria), (1) mainly due to incomplete investigation. Cardioembolism (16%) was the second most common cause of stroke, followed by small vessel disease and stroke of other determined aetiology (both 12.2%). Confirmed large vessel atherosclerosis (6.1%) was the least common cause of stroke in this study population.

The most common risk factors were hyperlipidaemia (45.8%), hypertension (42.7%), current tobacco smoking (42.7%) and obesity (36.6%). The indigenous Māori and Pacific Island people had a higher rate of stroke, at least double of other ethnicities. The in-hospital fatality rate was 3.1%. All surviving patients were discharged home.

Eighty-six percent of the survivors were independent.

Conclusions: Our study demonstrates strokes of undetermined aetiology and cardioembolism were the most common cause of stroke in young people in South Auckland, and that Māori and Pacific Island people have a higher rate of stroke.

Cerebrovascular disease is uncommon in young people, but up to 10% of stroke victims are younger than 45 years.2,3 The incidence of stroke in young people has been reported to be between 6.8 to 11.3 per 100,000 per year in community-based and hospital-based studies.2,4-7 Young stroke patients often have traditional vascular risk factors but between 16.8 to 44% of patients do not have a clear cause despite extensive investigations.2,4-7

Although younger stroke patients have a lower mortality than older patients, there is potentially a greater personal cost to the stroke victims and their families, as well as a significant economic cost to society. The average lifetime cost per stroke has been estimated to be up to US$140,048,8 but likely to be greater for younger stroke patients who may survive longer and potentially have many years of lost ‘productivity’.
The objective of this study is to provide the first description of a case series of young stroke patients in New Zealand. Middlemore Hospital is located 20km south of central Auckland City. It is a tertiary hospital with a catchment of nearly 500,000 people, with a diverse ethnic mix, including a relatively high proportion of Māori and other Polynesians (Pacific Island people; in New Zealand mostly of Samoan, Tongan, Niuean, or Cook Islands origin).

**Methods**

All patients discharged from Middlemore Hospital from June 1 2004 to December 31 2009 with a discharge diagnosis of ischaemic stroke (ICD 10 Codes I63 - I65, G46, I67, I675-I679, I694-I694) were identified. Patients with transient ischaemic attacks and intracranial haemorrhage were excluded. Those that were aged between 15 and 45 years at the time of admission formed the cohort of this study. Electronic and paper hospital records were reviewed retrospectively by one investigator. Demographic factors were collected, including (self-reported) ethnicity, and employment status. Vascular risk factors, such as, arterial hypertension, hyperlipidaemia, diabetes mellitus, smoking status, alcohol use, recreational drug use, oral contraceptive use, family history of stroke and presence of structural heart disease or arrhythmia were recorded.

Hypertension was diagnosed when there was a pre-admission diagnosis of hypertension or the blood pressure was documented to be greater than 140/90 mmHg two weeks after stroke. Diabetes mellitus was present when there was a pre-existing diagnosis or newly diagnosed when a patient had a fasting glucose >7 mmol/L, symptoms of hyperglycaemia and a random glucose >11.1 mmol/L, or an abnormal 2 hour oral glucose tolerance test. Hyperlipidaemia was present if the patient had a pre-existing diagnosis, was on treatment with a lipid-lowering drug, or had a fasting total cholesterol level >5.0 mmol/L.

Obesity was diagnosed if the body mass index (BMI) was >30 kg/m². Excessive alcohol intake was considered present if >210 g of ethanol was consumed per week for a male or >140 g/week for a female.

The results of diagnostic investigations including Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) of the brain, echocardiography (mainly transthoracic), and carotid ultrasound, as well as laboratory investigations were reviewed. Electrocardiogram (ECG) was routinely performed and the presence of embolic rhythm such as atrial fibrillation or flutter was recorded.

Strokes were classified according to the TOAST criteria and Oxford Stroke Classification (OSC). The TOAST criteria are:

- Large artery atherosclerosis requires imaging to determine >50% stenosis or occlusion of a major cervical or intracranial vessel and an infarction should exceed 15mm in diameter;
- Small artery atherosclerosis is diagnosed in patients with a clinical lacunar syndrome and no stenosis of a large vessel of >50%. Imaging is either normal or shows an infarction diameter of less than 15 mm;
- Cardioembolism is diagnosed when a high risk source of embolus is present such as mechanical heart valve, atrial fibrillation or left ventricular thrombus. Possible cardioembolism is diagnosed when a medium risk sources such as patent foramen ovale, mitral stenosis without atrial fibrillation are present;
- Stroke of other determined aetiology includes patients with stroke from arterial dissection, hypercoagulable states and vasculitis; and
- Stroke of undetermined aetiology describes patients without identifiable cause despite extensive investigation, with two or more potential causes (atrial fibrillation and carotid stenosis) or patients with incomplete evaluation (e.g no carotid imaging).

The OSC subtypes are:

- Total anterior circulation infarct (TACI);
- Partial anterior circulation infarct (PACI),
- Posterior circulation infarct (POCI) and
- Lacunar infarct (LACI).
The severity of the stroke was determined using available information by calculating the National Institute of Health Stroke Scale (NIHSS) and functional capacity using the modified Rankin Scale (mRS).

At Middlemore Hospital neurovascular imaging was not routinely performed for patients with a high risk source of cardioembolism. These patients would be classified as "undetermined" under the TOAST classification. In keeping with local practice we have reclassified patients from the "undetermined" group into cardioembolism when a high risk cardiac source is identified.

Then from hospital census information, we calculated the stroke incidence for this age group, including by ethnicity.

The study received approval from the Northern X Regional Ethics Committee.

We performed statistics using the online software OpenEpi (http://www.openepi.com/Menu/OpenEpiMenu.htm). We used the Chi-squared test or Fisher’s exact test when appropriate.

Results

A total of 2838 patients were discharged from Middlemore Hospital from June 1 2004 and December 31 2009 with a diagnosis of ischaemic stroke. Of these 131 (4.6%) were aged between 15 and 45 years. There were an almost equal number of men and women (Table 1).

The mean age was 36.6 (± 7.5) years: the youngest patient was 15 years. The largest number (41.2%) of young stroke patients were of Pacific Island origin. One in 10 young stroke patients had had a previous cerebral ischaemic event, and they were all either Māori or of Pacific Island origin. Over 1 in 3 was unemployed.

The most common risk factor was hyperlipidaemia (45.8%) followed by hypertension (42.7%), current tobacco smoking (42.7%) and obesity (36.6%). Diabetes mellitus was present in 21.4%.

There were four (3.1%) deaths, all of whom had suffered TACIs. One patient developed malignant middle cerebral artery syndrome and was treated with decompressive hemicraniectomy and discharged home. The median NIHSS score for the cohort was 4.

At admission, over three-quarters of all patients had a mRS ≥2. At discharge, only 17.6% of those patients who had had TACIs had a mRS <2. Over three-quarters of the patients with PACIs, POCIs and LACIs achieved a favourable functional outcome at discharge (Table 2).
<table>
<thead>
<tr>
<th>Variables</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>All n (%)</td>
<td>Male n (%)</td>
<td>Female n (%)</td>
<td>P</td>
<td>Pacific Islands n (%)</td>
<td>NZ Maori n (%)</td>
<td>European n (%)</td>
<td>Other Ethnicity n (%)</td>
<td>P</td>
<td></td>
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<tr>
<td><strong>Total Patients</strong></td>
<td>131(100)</td>
<td>65(49.6)</td>
<td>66(50.4)</td>
<td></td>
<td>54(41.2)</td>
<td>40(30.5)</td>
<td>31(23.7)</td>
<td>6(4.6)</td>
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<td><strong>Non-modifiable risk factors</strong></td>
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<tr>
<td>Age</td>
<td>36.4±7.5</td>
<td>36.3±7.6</td>
<td>36.6±7.2</td>
<td>0.53</td>
<td>36.2±8.2</td>
<td>36.9±6.9</td>
<td>36.8±6.7</td>
<td>33.5±9.6</td>
<td>0.052</td>
<td></td>
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<td>Gender</td>
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<td>Past Event</td>
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<td>8(12.3)</td>
<td>6(9.1)</td>
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<td>7(13)</td>
<td>7(17.5)</td>
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<td>0</td>
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<td>Family History</td>
<td>9(6.9)</td>
<td>2(3.1)</td>
<td>7(10.6)</td>
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<td>5(9.3)</td>
<td>3(7.5)</td>
<td>1(3.2)</td>
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<tr>
<td>Hypertension</td>
<td>56(42.7)</td>
<td>26(40)</td>
<td>30(45.4)</td>
<td>0.53</td>
<td>28(51.8)</td>
<td>18(45)</td>
<td>9(29)</td>
<td>1(16.7)</td>
<td>0.12</td>
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<td>Hyperlipidaemia</td>
<td>60(45.8)</td>
<td>31(47.7)</td>
<td>29(44)</td>
<td>0.67</td>
<td>24(44.4)</td>
<td>20(50)</td>
<td>12(38.7)</td>
<td>4(66.7)</td>
<td>0.63</td>
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<td>Obesity</td>
<td>48(36.6)</td>
<td>23(35.4)</td>
<td>25(37.9)</td>
<td>0.77</td>
<td>23(42.6)</td>
<td>14(35)</td>
<td>9(29)</td>
<td>2(33.3)</td>
<td>0.44</td>
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<tr>
<td>Smoking</td>
<td>56(42.7)</td>
<td>24(36.9)</td>
<td>32(48.4)</td>
<td>0.18</td>
<td>20(37)</td>
<td>25(62.5)</td>
<td>9(29)</td>
<td>2(33.3)</td>
<td>&lt;0.001</td>
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<td>Diabetes Mellitus</td>
<td>28(21.4)</td>
<td>13(20)</td>
<td>15(22.7)</td>
<td>0.7</td>
<td>18(33.3)</td>
<td>6(15)</td>
<td>4(12.9)</td>
<td>0</td>
<td>0.04</td>
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<td>Alcohol abuse</td>
<td>7(5.3)</td>
<td>6(9.2)</td>
<td>1(1.5)</td>
<td>0.06**</td>
<td>5(9.3)</td>
<td>1(2.5)</td>
<td>1(2.5)</td>
<td>0</td>
<td>0.39**</td>
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<td>OCP</td>
<td>7(5.3)</td>
<td>0</td>
<td>6(9.1)</td>
<td>0.12**</td>
<td>1(1.9)</td>
<td>1(2.5)</td>
<td>5(16.1)</td>
<td>0</td>
<td>0.02**</td>
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<tr>
<td>Drugs</td>
<td>8(6.1)</td>
<td>5(7.7)</td>
<td>3(4.5)</td>
<td>0.56</td>
<td>1(1.9)</td>
<td>4(10)</td>
<td>3(9.7)</td>
<td>0</td>
<td>0.16**</td>
<td></td>
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<tr>
<td>Migraines</td>
<td>9(6.9)</td>
<td>1(1.5)</td>
<td>8(12.1)</td>
<td>0.03**</td>
<td>1(1.9)</td>
<td>3(7.5)</td>
<td>4(12.9)</td>
<td>1(16.7)</td>
<td>0.12**</td>
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<tr>
<td><strong>Cardiac disease</strong></td>
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<tr>
<td>IHD</td>
<td>10(7.6)</td>
<td>4(6.2)</td>
<td>6(9.1)</td>
<td>0.74**</td>
<td>4(7.4)</td>
<td>3(7.5)</td>
<td>3(9.7)</td>
<td>0</td>
<td>0.92**</td>
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<td>AF</td>
<td>15(11)</td>
<td>9(13.8)</td>
<td>6(9.1)</td>
<td>0.39</td>
<td>6(11.1)</td>
<td>7(17.6)</td>
<td>1(2.5)</td>
<td>1(16.7)</td>
<td>0.17**</td>
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<tr>
<td>Patent Foramen Ovale+</td>
<td>16(15.4)</td>
<td>8(15.1)</td>
<td>8(15.7)</td>
<td>0.47</td>
<td>4(7.4)</td>
<td>4(10)</td>
<td>8(25.8)</td>
<td>0</td>
<td>0.05**</td>
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<tr>
<td>Mechanical heart valves</td>
<td>17(13)</td>
<td>9(13.8)</td>
<td>8(12.1)</td>
<td>0.77</td>
<td>9(16.7)</td>
<td>6(15)</td>
<td>0</td>
<td>2(33.3)</td>
<td>0.04**</td>
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<td><strong>Employment status</strong></td>
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<tr>
<td>Unemployed</td>
<td>47(35.9)</td>
<td>13(20)</td>
<td>34(51.2)</td>
<td>&lt;0.001</td>
<td>23(42.6)</td>
<td>15(37.5)</td>
<td>8(25.8)</td>
<td>2(33.3)</td>
<td>0.3</td>
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</tr>
</tbody>
</table>

Data are expressed as mean ± SD or n (%)
* Male/Female ratio
** Fisher Exact test
+ Percentages derived using the number of patients who had echocardiography as the denominator
Table 2. Initial stroke severity and discharge outcome for 131 young ischaemic stroke patients

<table>
<thead>
<tr>
<th></th>
<th>Total patients n(%)</th>
<th>Median NIHSS</th>
<th>Admission* mRS ≥2</th>
<th>Discharge mRS**</th>
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</thead>
<tbody>
<tr>
<td>TACI</td>
<td>17(13)</td>
<td>23</td>
<td>17(100)</td>
<td>0-1</td>
</tr>
<tr>
<td>PACI</td>
<td>56(42.7)</td>
<td>4</td>
<td>42(75)</td>
<td>2-5</td>
</tr>
<tr>
<td>LACI</td>
<td>27(20.6)</td>
<td>3</td>
<td>15(55.6)</td>
<td>6 (death)</td>
</tr>
<tr>
<td>POCI</td>
<td>31(23.7)</td>
<td>3</td>
<td>26(83.9)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>4</td>
<td>100(76.3)</td>
<td></td>
</tr>
</tbody>
</table>

Data expressed in n (%)  
*p= 0.0057  ** p = <0.000001  
LACI (Lacunar infarct), mRS (modified Rankin Scale), NIHSS (National Institute of Health Stroke Scale score), PACI (Partial anterior circulation infarct), POCI (Posterior circulation infarct), TACI (Total anterior circulation infarct)

Table 3. Stroke aetiology using TOAST criteria

<table>
<thead>
<tr>
<th>Aetiology</th>
<th>n (%)</th>
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</thead>
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<tr>
<td>Large Vessel Atherosclerosis</td>
<td>8(6.1)</td>
</tr>
<tr>
<td>Small Vessel Disease</td>
<td>16(12.2)</td>
</tr>
<tr>
<td>Cardioembolism</td>
<td>2(16)</td>
</tr>
<tr>
<td>Other Determined Aetiology</td>
<td>16(12.2)</td>
</tr>
<tr>
<td>Cervical Artery Dissection</td>
<td>6(4.6)</td>
</tr>
<tr>
<td>Oral Contraceptive Pill</td>
<td>3(2.3)</td>
</tr>
<tr>
<td>Systemic Lupus Erythematosus</td>
<td>2(1.5)</td>
</tr>
<tr>
<td>Migrainous Infarction</td>
<td>1(0.76)</td>
</tr>
<tr>
<td>Wegener’s vasculitis</td>
<td>1(0.76)</td>
</tr>
<tr>
<td>Reversible Cerebral Vasoconstriction Syndrome</td>
<td>1(0.76)</td>
</tr>
<tr>
<td>Fibromuscular dysplasia</td>
<td>1(0.76)</td>
</tr>
<tr>
<td>Sturge-Weber Syndrome</td>
<td>1(0.76)</td>
</tr>
<tr>
<td>Undetermined Aetiology</td>
<td>70(53.4)</td>
</tr>
</tbody>
</table>
All patients had neuroimaging with CT scan and 79 (60.3%) also had a MRI. Sixty five (49.6%) patients had imaging of cervical vessels with either duplex ultrasound or Magnetic Resonance Angiogram. Fifty six (86%) with imaging of the cervical vessels had anterior circulation strokes, 44 (68%) of whom were considered non-cardioembolic (TOAST criteria). None of the patients imaged had >50% non-occlusive stenosis of the Internal Carotid Artery. Transthoracic echocardiography was performed in 96 (73.2%) patients, transoesophageal echocardiography in 16 (12.2%) patients and eight (6.1%) patients had both.

There was no gender bias in the performance of echocardiography (80.3% men versus 78.5% women) while European patients had the least number (48%) of echocardiography performed compared to patients of other ethnicities (Pacific Islands 83%, Maori 77%, Other 83%). A patent foramen ovale (PFO) was found in 16 (15.4%), four of whom went on to have percutaneous closure of the PFO. An additional two patients were referred for closure but did not attend cardiology follow-up.

Screening for pro-thrombotic states was performed in 81 (61.8%); there was a small gender difference in screening for pro-thrombotic states (63.6% women versus 58.5% men). Pro-thrombotic screening was performed in majority of European patients (80.6%) while less tests were done in patients from other ethnicities (Pacific Islands 63%, Maori 42.5%, Other 66.7%). There were four abnormal results, two patients had Protein S deficiency, one had an activated Protein C resistance, and one was positive for lupus anticoagulant. Six of the women were taking hormonal oral contraceptive pills at the time of their stroke.

Stroke of undetermined aetiology was the most common TOAST subtype (53.4%, Table 3). When a cause was identified cardioembolism was the most common (16%). Large artery atherosclerosis was infrequently (6.1%) cause of stroke.

In 2005, there were 195,600 people aged between 15 and 45 years in our hospital catchment area, European was the predominant ethnicity (42.6%), followed by the Pacific Island people (22%), Asians (17.8%) and New Zealand Maori (17.6%). The population in this age group grew by 6% to 207,720 in 2009 while the relative ethnic proportions remained static. The annual incidence of stroke in young people in 2005 was 8.7 per 100,000 and in 2009 was 13.0 per 100,000 (Figure 1).

The New Zealand indigenous Māori people had the highest average incidence (22.7 per 100,000) followed closely by the Pacific Island people (20.9 per 100,000). Young European New Zealanders and Asian New Zealanders had comparatively low incidence of stroke (6 and 2.6 per 100,000, respectively). The numbers are too small to make any meaningful comments about temporal trends overall or in each subgroup.
Figure 1. Trends in young strokes

Discussion

This study is the first analysis of young stroke patients in New Zealand. In the Auckland Regional Community Stroke (ARCOS) studies young stroke patients were incorporated within the under 65 years old cohort.\textsuperscript{10,11} The overall annual incidence in our study of 13 per 100,000 is comparable to published reports.\textsuperscript{2,12,13}

The Māori and Pacific Island people have the highest rates, over 20 per 100,000, more than twice that of other groups. The ARCOS studies found a lower average age of stroke in Māori and Pacific peoples with an increase in stroke rate in these groups from 1981 to 2002.\textsuperscript{11} In contrast to other studies\textsuperscript{5,6,11} that showed a male predominance, in our cohort there was no difference in the rates of strokes between females and males.

Epidemiological studies have shown an increased risk of vascular disease and stroke in unemployed women.\textsuperscript{14–16} In this study half of the women were unemployed, compared to only 20\% of the men. However, many of these “unemployed” women were “home-makers”. Women in this age group are of child-bearing age and possibly have dependent children; this information was not collected. We cannot rule-out a significant interplay between unemployment status and risk of vascular events.

Our study found much higher rates of some of the traditional vascular risk factors than in other studies of young stroke patients, even those from developing countries.\textsuperscript{4–7,17–20} An exception was smoking which was similar to other studies.
most recent New Zealand deprivation index calculation (Census 2006), 34% of our catchment population lives in areas with the highest index of deprivation (deciles 9 and 10).

While unproven, this could contribute to unhealthy lifestyle practices, reduced access to health care services and reduced medication compliance. This may contribute to the disparity between the stroke rates in Europeans and that of Māori and Pacific Island people, who are over-represented in the lower socioeconomic groups.

Despite the high rates of vascular risk factors, strokes due to large artery atherosclerosis was not common and lower than recent published young stroke series. Over half of our series had strokes of undetermined aetiology, considerably higher than reported by others. This may be due to incomplete diagnostic work-up.

At our facility, those patients with a potential cardioembolic cause of stroke, e.g. atrial fibrillation or valvular heart disease, do not usually have a carotid ultrasound scan performed. With strict application of the TOAST classification this would be considered incomplete diagnostic work-up and hence classified as stroke of undetermined aetiology. If we reclassified them as cardioembolic, then this becomes the most common cause of stroke in our series (34.3%).

Cardioembolism has been reported to cause 6% to 33.7% of strokes in young patients, our finding may reflect the high prevalence of rheumatic heart disease in New Zealand, especially in South Auckland, which has one of the highest incidence rates of paediatric acute rheumatic fever in the developed world (up to 10 per 100,000 per year).

Mechanical heart valve (13%) and atrial arrhythmia (11%) were the most common high risk cardiac factors. A PFO was found in 15.4% of patients who had an echocardiogram.

Of the other determined aetiology group, cervical artery dissection was the most common cause of stroke, consistent with other series.

The in-hospital case-fatality rate of 3.1% is considerably lower than in older patients, but similar to that reported by others. No patients were institutionalised. Eighty-three percent had a discharge mRS of less than 2, indicating a favourable outcome. This is within the (wide) range that has been reported (10.8% to 84%).

There are several limitations to our study. The main source of bias relates to the retrospective nature of the study. Patients were identified by hospital discharge diagnosis, therefore those stroke patients that are incorrectly coded will not be identified. More importantly, as we reviewed hospital records we were dependent upon the information that was recorded therefore some variables were not recorded in every patient. Prospective documentation of functional capacity using the mRS is not routine and retrospective estimation of mRS may not provide the most accurate assessment.

The absence of a standardised diagnostic work-up also leads to incomplete datasets. The population in South Auckland is a unique mix of different ethnicities. Therefore our findings may not be generalizable to other populations. Finally, we do not have
follow-up information available for all the patients particularly with respect to long term prospects of returning to work or recurrent events.

**Conclusion**

We have demonstrated in a hospital based study in South Auckland, New Zealand, that strokes of undetermined aetiology and cardioembolism are the most common causes of cerebrovascular disease in patients under the age of 45. Patients from Maori and Pacific ethnicities have higher incidence of young strokes indicating an ethnic disparity of health outcomes. Further research is needed in the implementation of effective ethnicity-appropriate health initiatives in New Zealand.

**Competing interests:** None known.

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**Acknowledgement:** We thank Ms Irene Zeng, biostatistician for her assistance with the statistics in this paper.

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**References:**

An assessment of the Hua Oranga outcome instrument and comparison to other outcome measures in an intervention study with Maori and Pacific people following stroke

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Abstract

Aim Health outcomes research for Maori has been hampered by the lack of adequately validated instruments that directly address outcomes of importance to Maori, framed by a Maori perspective of health. Hua Oranga is an outcome instrument developed for Maori with mental illness that uses a holistic view of Maori health to determine improvements in physical, mental, spiritual and family domains of health. Basic psychometric work for Hua Oranga is lacking. We sought to explore the psychometric properties of the instrument and compare its responsiveness alongside other, more established tools in an intervention study involving Maori and Pacific people following acute stroke.

Methods Randomised 2×2 controlled trial of Maori and Pacific people following acute stroke with two interventions aimed at facilitating self-directed rehabilitation, and with follow-up at 12 months after randomisation. Primary outcome measures were the Physical Component Summary (PCS) and Mental Component Summary (MCS) of the Short Form 36 (SF36) at 12 months. Hua Oranga was used as a secondary outcome measure for participants at 12 months and for carers and whanau (extended family). Psychometric properties of Hua Oranga were explored using plots and correlation coefficients, principal factors analysis and scree plots.

Results 172 participants were randomised, of whom 139 (80.8%) completed follow-up. Of these, 135 (97%) completed the Hua Oranga and 117 (84.2%) completed the PCS and MCS of the SF36. Eighty-nine carers completed the Hua Oranga. Total Hua Oranga scores and PCS improved significantly for one intervention group but not the other. Total Hua Oranga scores for carers improved significantly for both interventions. Total Hua Oranga score correlated moderately with the PCS (correlation coefficient 0.55, p<0.001). Factor analysis suggested that Hua Oranga measures two and not four factors; one 'physical-mental' and one 'spiritual-family'.

Conclusion The Hua Oranga instrument, developed for Maori people with mental illness, showed good responsiveness and adequate psychometric properties in Maori and Pacific people after stroke. Its simplicity, relative brevity, minimal cost and adequate psychometric properties should favour its use in future studies with both Maori and Pacific people. Suggestions are made for refinements to the measure. These should be tested in a new population before Hua Oranga is recommended for general use in a clinical setting.

New Zealand Maori have consistently been shown to have worse outcomes than European New Zealanders over a range of health conditions, including stroke, using various outcome measures which have generally been validated in European populations.1-3
Health outcomes research for Maori has been consistently hampered by the lack of outcome instruments that reflect issues important to Maori and conceived from a Maori perspective of health.

The Hua Oranga (translated literally as ‘the fruits of health’) outcome tool was developed as a means of assessing outcomes after interventions for Maori people with mental illness. It is based on a holistic Maori conception of well-being Te Whare Tapa Wha, and considers each of the four ‘pillars’ of well-being; taha wairua (‘spiritual’), taha hinengaro (‘mental’), taha tinana (‘physical’), taha whanau (‘family’).

Originally the tool was planned to be used by the patient/client, their whanau (family) and clinicians, with scores from each being accumulated into a single score for that person. There are few published studies using Hua Oranga as an outcome measure and all of these relate to Maori with mental illness. There is no particular reason why the tool, if psychometrically sound and valid, could not be used in other health conditions given the centrality of its four core components to health and well-being. Further, the tool might apply equally well to Pacific people. However, currently basic evaluation of the instrument’s psychometric properties is lacking.

We completed an intervention study designed to facilitate self-directed rehabilitation after stroke in Maori and Pacific people. Hua Oranga was used as one of the secondary outcome measures for participants and their whanau. This allowed a comparison of the performance of this instrument against other measures, and also to explore some of the psychometric properties of the instrument in a sizeable cohort of Maori and Pacific people.

The study interventions were based on previous qualitative work, and we hypothesised that improvement for Maori and possibly Pacific people following stroke would involve a strengthening in taha wairua (~ spiritual health) and taha whanau (~ family health and connections), something hard to capture with conventional instruments such as the Mental Component Summary (MCS) and Physical Component Summary (PCS) scores of the Short Form 36 (SF36). Consultation with Pacific people with stroke, their carers and health providers prior to the study confirmed a sense that the instrument fitted well with a Pacific view of health and well-being as much as it did for Maori.

We hoped that use of Hua Oranga would enable the exploration of these less conventional aspects of improvement for the participants, otherwise inaccessible in a quantitative study.

We present the results for the Hua Oranga outcome tool by intervention, compare this tool with the primary outcome measures (PCS and MCS) and use factor analysis to explore psychometric properties of the instrument.

Method

The overall design and methodology are presented in full elsewhere. Briefly, this was a randomised controlled study of two different interventions aimed at promoting self-directed rehabilitation for Maori and Pacific people, 15 years and older, within three months of stroke and living in the community. Participants were randomised in a 2x2 factorial design to receive one, both or neither of two interventions.

1. ‘Inspirational’ DVD—80 minute professionally produced DVD about stroke and stroke recovery using the inspirational stories told by four Maori and Pacific people and their families. The dominant messages were the potential for good outcomes, overcoming adversity, personal and family roles and their contribution to recovery, encouraging meaningful activity and participation for the person with stroke, and where to access resources for people following stroke. The DVD was left with the person and they were encouraged to view it as many times as they wished.
2. ‘Take charge’ session (TCS)—an 80 minute individualised assessment with a structured risk factor and activities of daily living assessment designed to engage the patient and their family in the process of recovery, facilitating a process where they identified for themselves areas where they could make progress and set personal goals i.e. self-directed rehabilitation. No direct therapy or formal goal-setting occurred.

Both interventions were delivered by research assistants of the same ethnicity as the participant. All research assistants had a minimum of 5 days training prior to starting the study and ongoing training days during the study. The control group received written material about stroke for people and their families delivered in person by a trained research assistant of the same ethnic group as the stroke person.

Primary outcome was self-rated health related quality of life (QoL) at 12 months following randomisation measured using the PCS and MCS on the SF36. Secondary outcomes were the Hua Oranga score for participants and carers measured at 12 months, activities of daily living (ADL) measured by the Barthel Index (BI), instrumental activities of daily living (IADL) measured by Frenchay Activities Index (FAI), Carer Strain Index (CSI), dependence (modified Rankin score [mRS]>2), and use of rehabilitation services.

Hua Oranga scores were not presented in the primary study report as it is a novel measure of uncertain validity in this context. To compute a score with the Hua Oranga instrument, the participant answers four questions from each of the four domains (taha wairua, taha hinengaro, taha tinana, taha whanau; respectively spiritual, mental, physical and family dimensions) with a general format of:

'As a result of the intervention do you feel _____ (eg 'healthier from a spiritual point of view')?'

The possible answers are scored 'much worse' (-2), 'worse' (-1), no change (0), better (+1), much better (+2), giving a summed score range for the 16 questions of -32 to +32. The questions for the carer have the general format:

'Has the intervention resulted in an improved _____ (eg spiritual health) for your relative?'

Scoring is the same with a range of -32 to +32. Modification to the wording was made for Pacific people, such as substituting 'Pacific person' for 'Maori'. Subsequent to the present study, a four question version of Hua Oranga has also been studied (see 'Discussion' section).

Analysis of variance was used to compare the effects of the two treatments, DVD and TCS for continuous outcome variables. Plots and correlation coefficients were used to explore the association between the total Hua Oranga score and the MCS and PCS of the SF-36. Simple linear regression was used to estimate the change in Hua Oranga total score corresponding to a 10 unit change on the MCS and PCS.

Plots and correlation coefficients were used to explore the associations between the pre-nominated dimensions of Hua Oranga score, and between these dimensions and the eight dimensions of the SF-36. Principal components analysis with a scree plot was used to explore the structure of the four dimensional construct of the Hua Oranga tool and the 16 questions of the instrument.

To determine a possible number of underlying factors for the Hua Oranga tool, a scree plot of the eigenvalues of the principal components analysis was used. The number of factors is
suggested by where the scree plot undergoes an abrupt change in slope, but also by the number of eigenvalues greater than one. If an eigenvalue is less than one this suggests that the particular linear combination of Hua Oranga instrument dimensions or questions explains less of the variance than one single dimension or question.

Results

172 participants, 94 Maori and 78 Pacific people, were randomised. The baseline characteristics of the participants are presented in the primary publication from the study8. 139 participants (80.8%) completed follow-up at 12 months after randomisation. Of these, 135 (97%) completed the Hua Oranga and 117 (84.2%) completed the SF36. Eighty-nine carers completed the Hua Oranga. See Table 1.

The Hua Oranga instrument was sensitive to change: Hua Oranga total scores were higher for the TCS (main effect 5.3 (95% CI 1.7 to 8.8), p=0.004) but not for the DVD (main effect 3.0 (95% CI -0.6 to 6.5), p=0.10). The TCS but not the DVD was associated with significant change in both PCS on the SF36 and dependence on the mRS. The Hua Oranga scores for carers were higher in both the TCS (main effect 5.1 (95% CI 1.3 to 9.0), p=0.01) and DVD (main effect 6.4 (95% CI 2.5 to 10.2), p=0.005) groups.

There was a moderate relationship between the total score of the Hua Oranga instrument and the PCS of the SF-36 (correlation coefficient 0.55, p<0.001; see Figure 1 for scatter plot), but only a weak relationship with the MCS (correlation coefficient 0.31, p<0.001). A 10 point change on the SF-36 PCS was associated with a 5.4 (95% CI 3.9 to 6.9) point change on the Hua Oranga total score.

Figure 1. Scree plot total Hua Oranga score vs physical component summary score (PCS) of the SF-36
Table 1. Main and secondary outcomes 12 months after randomisation

<table>
<thead>
<tr>
<th>Variable</th>
<th>DVD</th>
<th>TCS</th>
<th>DVD &amp; TCS</th>
<th>Control</th>
<th>Interaction DVD/TCS</th>
<th>Main Effect DVD</th>
<th>Main Effect TCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCS (n=117)</td>
<td>39.5 (12.0)</td>
<td>44.8 (10.4)</td>
<td>42.8 (10.4)</td>
<td>35.9 (10.1)</td>
<td>0.17 (-3.1 to 4.9)</td>
<td>0.9 0.67</td>
<td>6.0 0.004</td>
</tr>
<tr>
<td>MCS (n=117)</td>
<td>53.7 (5.7)</td>
<td>52.7 (9.3)</td>
<td>52.6 (9.2)</td>
<td>50.3 (10.1)</td>
<td>0.28 (-1.5 to 4.8)</td>
<td>1.6 0.31</td>
<td>0.6 0.720</td>
</tr>
<tr>
<td>FAI (n=132)</td>
<td>23.1 (12.7)</td>
<td>27.3 (12.8)</td>
<td>25.4 (9.8)</td>
<td>24.2 (10.2)</td>
<td>0.86 (-5.5 to 2.5)</td>
<td>-1.5 0.36</td>
<td>2.7 0.190</td>
</tr>
<tr>
<td>Hua Oranga (patient) n=135</td>
<td>13.5 (9.9)</td>
<td>15.8 (8.6)</td>
<td>15.9 (11.2)</td>
<td>7.6 (11.7)</td>
<td>0.11 (-0.6 to 6.5)</td>
<td>3.0 0.10</td>
<td>5.3 (1.7 to 8.8) 0.004</td>
</tr>
<tr>
<td>CSI (n=95)</td>
<td>4.5 (3.8)</td>
<td>2.8 (3.2)</td>
<td>3.1 (2.9)</td>
<td>4.4 (3.2)</td>
<td>0.89 (-1.2 to 1.5)</td>
<td>0.18 0.57</td>
<td>-1.5 0.030</td>
</tr>
<tr>
<td>Hua Oranga (carer) n=89</td>
<td>13.5 (8.2)</td>
<td>12.1 (9.4)</td>
<td>16.6 (7.4)</td>
<td>5.4 (10.4)</td>
<td>0.35 (2.5 to 10.2)</td>
<td>6.4 0.005</td>
<td>5.1 (1.3 to 9.0) 0.010</td>
</tr>
<tr>
<td>Systolic BP (n=71)</td>
<td>142.0 (17.7)</td>
<td>137.4 (17.8)</td>
<td>140.3 (17.3)</td>
<td>140.5 (18.6)</td>
<td>0.86 (-6.2 to 10.8)</td>
<td>2.3 0.59</td>
<td>-2.5 0.560</td>
</tr>
<tr>
<td>BI (n=132)</td>
<td>16.9 (4.8)</td>
<td>17.9 (4.3)</td>
<td>18.7 (3.1)</td>
<td>18.0 (3.3)</td>
<td>Kruskal-Wallis P=0.31 for difference between treatment arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mRS&gt;2 (n=139)</td>
<td>16/38 (42.1)</td>
<td>11/38 (29.0)</td>
<td>5/32 (15.6)</td>
<td>12/31 (38.7)</td>
<td>0.23 (0.38 to 1.64)</td>
<td>0.79 0.52</td>
<td>0.42 0.02</td>
</tr>
<tr>
<td>Current smoking (n=128)</td>
<td>7/34 (20.6)</td>
<td>7/35 (20.0)</td>
<td>3/31 (9.7)</td>
<td>4/28 (14.3)</td>
<td>0.20 (0.33 to 2.2)</td>
<td>0.85 0.73</td>
<td>0.82 0.67</td>
</tr>
<tr>
<td>Rehabilitation involvement (n=132)</td>
<td>9/35 (25.7)</td>
<td>6/37 (16.2)</td>
<td>1/30 (3.3)</td>
<td>7/30 (23.3)</td>
<td>0.14 (0.27 to 1.72)</td>
<td>0.68 0.41</td>
<td>0.34 0.03</td>
</tr>
</tbody>
</table>

DVD=DVD-based intervention; TCS=take charge session; PCS=Physical Component Summary of the Short Form 36 (SF-36); MCS=Mental Component Summary of the SF-36; FAI=Frenchay Activities Index; CSI=Caregiver Strain Index; BI=Barthel Index; mRS=modified Rankin Score.
Table 2. Association between individual question sections of Hua Oranga and individual dimensions of the SF-36 at 12 months

<table>
<thead>
<tr>
<th>SF-36 element</th>
<th>HO: Wairua (Spiritual)</th>
<th>HO: Hinengaro (Mental)</th>
<th>HO: Tinana (Physical)</th>
<th>HO: Whanau (Family)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>0.37 (133)</td>
<td>0.34 (136)</td>
<td>0.50 (135)</td>
<td>0.29 (136)</td>
</tr>
<tr>
<td>Role-physical</td>
<td>0.44 (129)</td>
<td>0.40 (132)</td>
<td>0.43 (131)</td>
<td>0.35 (132)</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>0.46 (132)</td>
<td>0.28 (135)</td>
<td>0.42 (134)</td>
<td>0.38 (135)</td>
</tr>
<tr>
<td>General health</td>
<td>0.57 (128)</td>
<td>0.54 (131)</td>
<td>0.67 (130)</td>
<td>0.57 (131)</td>
</tr>
<tr>
<td>Vitality</td>
<td>0.55 (128)</td>
<td>0.50 (131)</td>
<td>0.41 (130)</td>
<td>0.39 (131)</td>
</tr>
<tr>
<td>Social functioning</td>
<td>0.16 (131)</td>
<td>0.11 (134)</td>
<td>0.08 (0.36)</td>
<td>0.20 (134)</td>
</tr>
<tr>
<td>Role-emotional</td>
<td>0.40 (131)</td>
<td>0.38 (133)</td>
<td>0.36 (132)</td>
<td>0.33 (133)</td>
</tr>
<tr>
<td>Mental health</td>
<td>0.44 (130)</td>
<td>0.42 (133)</td>
<td>0.30 (132)</td>
<td>0.37 (133)</td>
</tr>
<tr>
<td>PCS</td>
<td>0.52 (114)</td>
<td>0.42 (116)</td>
<td>0.64 (115)</td>
<td>0.44 (116)</td>
</tr>
<tr>
<td>MCS</td>
<td>0.33 (114)</td>
<td>0.34 (116)</td>
<td>0.13 (115)</td>
<td>0.30 (116)</td>
</tr>
</tbody>
</table>

HO=Hua Oranga, SF36=Short Form 36, PCS=Physical Component Summary of the SF36, MCS=Mental Component Summary of the SF36.

Individual dimensions of the Hua Oranga were most strongly associated with the General Health and Vitality dimensions of the SF 36 (Table 2). PCS score correlated most strongly with the physical (correlation coefficient 0.62) and spiritual (correlation coefficient 0.52) dimensions of the Hua Oranga. Individual dimensions of the Hua Oranga were strongly associated with each other (Table 3, correlation coefficients between 0.74 and 0.82).

Table 3. Association of dimension totals for Hua Oranga instrument with each other at 12 months

<table>
<thead>
<tr>
<th>Variables</th>
<th>HO: Wairua (Spiritual)</th>
<th>HO: Hinengaro (Mental)</th>
<th>HO: Tinana (Physical)</th>
<th>HO: Whanau (Family)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO: Wairua (Spiritual)</td>
<td>1 (135)</td>
<td>0.79 (135)</td>
<td>0.75 (135)</td>
<td>0.82 (135)</td>
</tr>
<tr>
<td>HO: Hinengaro (Mental)</td>
<td>1 (138)</td>
<td>0.75 (137)</td>
<td>0.76 (138)</td>
<td></td>
</tr>
<tr>
<td>HO: Tinana (Physical)</td>
<td></td>
<td></td>
<td>1 (137)</td>
<td>0.74 (137)</td>
</tr>
<tr>
<td>HO: Whanau (Family)</td>
<td></td>
<td></td>
<td></td>
<td>1 (138)</td>
</tr>
</tbody>
</table>
Table 4 shows the principal components analysis of the four dimensions of the Hua Oranga. With only one of the eigenvalues greater than one, an underlying factor structure is not supported. However, Table 5 shows that a two factor structure is suggested by the factor analysis of the 16 component questions. These two factors have a physical-mental health component and a spiritual-family health component (Table 6). For this spiritual-family health component there was not a strong relationship with the equivalent SF-36 dimensions i.e. 'social functioning' and 'role-emotional' (Table 2). This suggests that the spiritual-family dimensions on the Hua Oranga instrument may be capturing quality of life issues not captured in the SF-36.

### Table 4. Principal components values and scree plots for 4 dimensions of Hua Oranga

<table>
<thead>
<tr>
<th>Eigenvalue number</th>
<th>Eigenvalue</th>
<th>Proportion of variance (%)</th>
<th>Cumulative proportion of variance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.3</td>
<td>82.6</td>
<td>82.6</td>
</tr>
<tr>
<td>2</td>
<td>0.28</td>
<td>7.0</td>
<td>89.6</td>
</tr>
<tr>
<td>3</td>
<td>0.24</td>
<td>6.1</td>
<td>95.7</td>
</tr>
<tr>
<td>4</td>
<td>0.17</td>
<td>4.3</td>
<td>100</td>
</tr>
</tbody>
</table>

![Scree plot of principal components analysis](image-url)
Table 5. Principal components values and scree plots for 16 questions of Hua Oranga

<table>
<thead>
<tr>
<th>Eigenvalue number (first four only)</th>
<th>Eigenvalue</th>
<th>Proportion of variance (%)</th>
<th>Cumulative proportion of variance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.3</td>
<td>64.2</td>
<td>64.2</td>
</tr>
<tr>
<td>2</td>
<td>1.2</td>
<td>7.6</td>
<td>71.8</td>
</tr>
<tr>
<td>3</td>
<td>0.9</td>
<td>5.6</td>
<td>77.4</td>
</tr>
<tr>
<td>4</td>
<td>0.7</td>
<td>4.4</td>
<td>81.8</td>
</tr>
</tbody>
</table>
Table 6. Factor loadings using maximum likelihood with varimax rotation with two factors specified

<table>
<thead>
<tr>
<th>Hua Oranga Question</th>
<th>Factor 1 loading</th>
<th>Factor 2 loading</th>
<th>Communality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wairua (Spiritual)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>0.65</td>
<td>0.51</td>
<td>0.69</td>
</tr>
<tr>
<td>Stronger</td>
<td>0.55</td>
<td>0.59</td>
<td>0.66</td>
</tr>
<tr>
<td>Spiritually healthier</td>
<td>0.44</td>
<td>0.71</td>
<td>0.69</td>
</tr>
<tr>
<td>Valued</td>
<td>0.58</td>
<td>0.57</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Hinengaro (Mental)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goals</td>
<td>0.77</td>
<td>0.17</td>
<td>0.62</td>
</tr>
<tr>
<td>Manage feelings</td>
<td>0.51</td>
<td>0.60</td>
<td>0.62</td>
</tr>
<tr>
<td>Positive</td>
<td>0.69</td>
<td>0.51</td>
<td>0.73</td>
</tr>
<tr>
<td>Understand Health</td>
<td>0.73</td>
<td>0.40</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>Tinana (Physical)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthier</td>
<td>0.71</td>
<td>0.44</td>
<td>0.69</td>
</tr>
<tr>
<td>Mental Wellbeing</td>
<td>0.68</td>
<td>0.32</td>
<td>0.57</td>
</tr>
<tr>
<td>Move</td>
<td>0.62</td>
<td>0.32</td>
<td>0.48</td>
</tr>
<tr>
<td>Physical Health</td>
<td>0.78</td>
<td>0.36</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Whanau (Family)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearer</td>
<td>0.20</td>
<td>0.89</td>
<td>0.83</td>
</tr>
<tr>
<td>Communicate</td>
<td>0.35</td>
<td>0.82</td>
<td>0.79</td>
</tr>
<tr>
<td>Community</td>
<td>0.65</td>
<td>0.44</td>
<td>0.61</td>
</tr>
<tr>
<td>Confident</td>
<td>0.52</td>
<td>0.69</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Discussion

This study provided an opportunity to study the psychometric properties of the Hua Oranga outcomes instrument in a novel, sizeable population of people following stroke. The nature of the questions and the framing in terms of the four dimensions of Te Whare Tapa Wha provide Hua Oranga with good face validity if one accepts this model as a valid representation of Maori (and Pacific people’s) health and well-being. Support was provided for its sensitivity to change, both for patients and carers. External validity was provided by correlation of total Hua Oranga scores with PCS scores and significant change occurring in Hua Oranga scores for the same intervention (TCS) that significant change in PCS and dependency scores were seen.

Factor analysis suggested that the Hua Oranga measures two rather than four separate factors, one physical-mental and one spiritual-family. However, this may have been influenced by the strong ‘physical’ nature of stroke recovery and may be different in a population with different health problems, such as mental health. There was some evidence that the spiritual-family factor was measuring something different to the equivalent dimensions of the SF-36. Utility of the measure was good with participants having little trouble completing the questions, generally in less than half the time it took to complete the SF-36 and with higher completion rates. Little cost is involved in use of the measure.

A significant issue with the measure relates to the wording of each question. The general question stem ‘As a result of the intervention do you feel …e.g. healthier from a spiritual point...
of view' asks the subject to both describe a change (choices of 'much more' to 'much less') and attribute this change to the intervention.

The measures against which we have compared Hua Oranga do not have this 'change' element and the validity of that comparison could be questioned. This has been addressed in a recent study15 which trialled the measure in 43 subjects with mental health problems as well as their clinicians and whanau. Two versions of the questionnaire were used with the first option being the one used in this study.

The second option reformulated the questions as statements to indicate how the person felt now and avoided mentioning an intervention, thus under the 'Wairua' category the options were from 'I feel that my spiritual health is extremely good at present' to 'I feel that my spiritual health is extremely bad at present'. This effectively condensed the instrument down to only four questions (one for each 'pillar') from the 16 questions used in the first option.

The second option was seen by participants as more acceptable and better correlations were seen between the responses of the subjects and their clinicians when the second option was used. It remains to be seen whether the 4-question version (option 2), although more acceptable, may be too limited to be useful.

Some caution is required in interpreting the results of our study. The study population comprised Maori and Pacific people with the instrument modified for Pacific participants. We chose not to analyse the Hua Oranga results separately in order to maximise the available information. Missing data mainly related to participants with communication difficulties who, if they had been able to respond, may have responded in a consistently different way to the questions than people with normal communication.

Overall, however, the Hua Oranga appears to have much to offer in Maori health outcomes research. Its simplicity, relative brevity, minimal cost, adequate psychometric properties should favour its use in future studies with both Maori and Pacific people. Its use in health conditions other than mental health and stroke could also be encouraged.

Our analysis suggests that results should be presented as total scores. If further subdivision is attempted, two scores - one summing physical and mental dimensions and one summing spiritual and family dimensions, but not each of the four pre-specified dimensions separately would be appropriate. It would be more conventional, and statistically more simple, to score each question 0–4 rather than -2 to +2 giving a total score between zero and 64.

A further study is required to test the instrument in a new population of subjects with items selected on the basis of the two-factor structure outlined here. Further work needs to be done on the questions themselves – perhaps transforming all 16 questions into statements and comparing this to the short version tested in option two of the McClintock study.15 In a further study, the 'spiritual-family' dimension of the Hua Oranga could be explored more fully, using complementary measures, to determine what is being measured by this part of the instrument.

**Competing interests:** None known.

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Associate Professor, Wellington School of Medicine and Health Sciences, Wellington; Kathryn McPherson, Professor, Health and Rehabilitation Research Institute Auckland University of Technology, Auckland; Harry McNaughton, Medical Research Institute of New Zealand, Wellington

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References:

Health-enhancing physical activity programme (HEPAP) for transient ischaemic attack and non-disabling stroke: recruitment and compliance

James Faulkner, Danielle Lambrick, Brandon Woolley, Lee Stoner, Lai-kin Wong, Gerard McGonigal

Abstract

Aim To assess the feasibility of recruiting and retaining patients newly diagnosed with a Transient Ischaemic Attack (TIA) into an 8-week exercise programme.

Methods: The study was a single-centre, randomised-controlled trial. TIA was confirmed by a specialist stroke physician within 7 days of symptom onset. Following baseline assessment, participants were randomised to either an 8-week exercise intervention or control group (usual care). Participants completed a further assessment 2 months after baseline.

Results Of the 285 individuals diagnosed with TIA, 97 patients were invited to participate in the trial, of which 60 were successfully recruited (62%). Of those invited, 89% were identified within outpatient care. Individuals were typically of European descent (87%) and lived within 20km of the study site (81%). Distance to travel was considered the primary barrier for non-participation (46%). Three participants (5%) did not attend the follow-up assessment.

Conclusion Individuals with TIA were successfully recruited and retained into a RCT. A different approach is required to study interventions in Māori, Pacific Islanders, Asian and Indian populations. If the exercise intervention improves vascular risk factors and reduces recurrent vascular events, it could be applied to a large number of people who suffer a TIA or non-disabling stroke.

Stroke is a common cause of death and is the leading cause of disability in New Zealand (NZ), with approximately 7000 people suffering an initial or recurrent stroke each year. Stroke has an enormous physical, psychological and financial impact on individuals’ lives. When symptoms of stroke resolve within 24 hours it is known as a transient ischaemic attack (TIA).

Individuals classified with a non-disabling stroke have minor residual symptoms which are managed by the same treatment paradigm as TIA. With the risk of stroke elevated soon after TIA and minor stroke, recurrent events are commonly fatal or disabling. There will be major public health benefits if interventions are developed to reduce the burden of recurrent stroke and disability following TIA.

Many individuals presenting with a TIA have predisposing risk factors such as hypertension, tobacco use, diabetes mellitus, hyperlipidaemia, obesity and physical inactivity. It has been suggested that 80% of recurrent vascular events could be prevented through a comprehensive multi-factorial strategy. Exercise-based cardiac rehabilitation (CR) has been shown to improve each of these risk factors, and reduce morbidity and mortality among coronary artery disease (CAD) patients.
Preliminary evidence suggests that TIA patients in the non-acute phase, within 12 weeks and
5 years of an event, can reduce vascular risk factors and improve their cardiovascular fitness
by following a CR-type programme.\textsuperscript{6,7} However, very little is known about when to engage
new TIA patients in exercise and education programmes and whether these may reduce
recurrent vascular events.

Participant recruitment is considered the most difficult aspect of the research process,\textsuperscript{8} with
trials typically unable to conclude on schedule due to low participant accrual and retention.\textsuperscript{9}
Evidence-based feasibility studies are conducted to ensure that difficulties associated with
study design are avoided when completing future randomised controlled trials (RCT).\textsuperscript{10}
Feasibility studies are needed to validate recruitment and consent procedures, confirm effect
sizes and power calculations for sample size, confirm study inclusion and exclusion criteria,
test the appropriateness of questionnaires, and monitor the operational process of the study.\textsuperscript{9}

Despite the integral role of recruitment in RCT, publication of data defining the recruitment
effort is not routine in rehabilitation initiatives.\textsuperscript{9,11} This information is vital in order to design
definitive exercise intervention trials.

The purpose of the present study was to assess the feasibility of recruiting and retaining
patients newly diagnosed with TIA or non-disabling stroke into an 8-week health enhancing
physical activity programme (HEPAP).

Methods

Study design—The study was a single-centre, randomised, parallel-group clinical trial. TIA was confirmed by
a specialist physician at Wellington Regional Hospital within 7 days of symptom onset, in accordance with the
NZ TIA guidelines.\textsuperscript{12} Following baseline assessment, participants were randomised to either an 8-week exercise
and education intervention (HEPAP) or control group (usual care). All participants completed a further
assessment 2 months after the baseline assessment (Table 1).

Sample size—To attain sufficient data to analyse the difference in treatment effect between HEPAP and
control (P<0.05; effect size [ES] 0.80), which would enable an appropriate sample size calculation for a full
RCT,\textsuperscript{19,20} the study intended to recruit 60 subjects. It was postulated that 9 months would be required to
complete participant recruitment, on the basis that one-to-two patients (out of the average 6-to-10 newly
diagnosed TIA patients) would volunteer each week.

The study has been powered to assess for a secondary rather than a primary outcome measure (i.e., blood
pressure) as insufficient data is currently available to estimate a potential treatment effect of exercise on
recurrent stroke and TIs.

Ethics approval—Ethical approval was ascertained from the Central Regional Health and Disabilities Ethics
Committee (NZ).

Participants—Individuals residing within New Zealand’s Capital and Coast District Health Board (CCDHB)
catchment area and who were diagnosed with new TIA or non-disabling stroke were eligible to participate.
Exclusion criteria included oxygen dependence, uncontrolled angina, unstable cardiac conditions, uncontrolled
diabetes mellitus, severe claudication, febrile illness, significant cognitive impairment and immobility. All
participants were required to comply with drug treatment and standardised therapy in accordance with
recommendations from the stroke physician as per the NZ TIA treatment guidelines.\textsuperscript{12}

Patient identification and recruitment—Following stroke physician approval, TIA patients were provided
written information and a verbal explanation of the purpose of the study, and were invited to participate.
Patients provided verbal consent to the clinical team to release their contact details to the study team at the local
academic institution (AI). Potential recruits were contacted by telephone to identify whether they were
interested in participating in the study. Non-respondents to the initial telephone call were phoned until contact
was achieved.\textsuperscript{21}

Patients who declined to participate were given the opportunity to provide a reason why. For those agreeable
for baseline assessment, a suitable date and time was arranged at the AI. Written consent was obtained at this
stage.
Table 1. Trial assessments and intervention

<table>
<thead>
<tr>
<th>Baseline assessment</th>
<th>0 week intervention</th>
<th>Follow-up assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HEPAP</td>
<td>Normal care</td>
</tr>
<tr>
<td>Health History Questionnaire</td>
<td>Exercise</td>
<td>Monthly telephone calls</td>
</tr>
<tr>
<td>Physical Activity Questionnaire</td>
<td>2 x 90 minute exercise sessions per week</td>
<td></td>
</tr>
<tr>
<td>Coronary Artery Disease (CAD) risk stratification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total lipid profile – Total cholesterol (TC), high-density lipoproteins (HDL); TC:HDL ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting blood glucose</td>
<td>15 min walking &amp; 15 min cycling</td>
<td></td>
</tr>
<tr>
<td>Seated/standing/supine systolic &amp; diastolic blood pressure</td>
<td>60 min of resistance training (alternate arm biceps curl &amp; shoulder press, pec-dec, dumbbell press), core/stability and postural exercises using bus and swiss balls, and flexibility exercises</td>
<td></td>
</tr>
<tr>
<td>Smoking history</td>
<td>Blood pressure, heart rate and ratings of perceived exertion (RPE) monitored throughout exercises</td>
<td></td>
</tr>
<tr>
<td>Family history of CAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist &amp; hip girth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height, weight, Body Mass Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak or symptom limited exercise ECG stress test on a treadmill</td>
<td>Education</td>
<td>1 x 30 min group discussion each week concerning the following issues: Stroke Facts, understanding stroke, risk of stroke after TIA, stroke prevention, dietary advice, blood pressure, physical activity participation, coping with stress, fatigue after stroke</td>
</tr>
<tr>
<td>Cycle ergometry test to provide submaximal estimates of oxygen consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 2min stages (90 &amp; 60 W)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psycho-social questionnaires</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-form 36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile of Mood States</td>
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<tr>
<td>Stanford Medical Centre Stroke Awareness Questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Anxiety and Depression Scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Physical Activity Questionnaire</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*CardioChek, Hannover, Germany; Optum, Abbott Diabetes Care, Victoria, Australia; Accuson Works, London, England; Schiller, Baar, Switzerland; Monark Ergometer, Sweden
Distance between patients’ residential address and the assessment site were calculated for each individual, whether recruited or not. The assessment and intervention site was at the AI, located within 1 km of the hospital.

**Randomisation**—Randomisation to the HEPAP or control group occurred after baseline assessment. Allocation to groups was by means of sealed envelopes drawn by the participants, designed for a 50:50 allocation between groups. Due to the nature of the intervention, it was not feasible to blind patients or researchers to group allocation.

**Statistical analysis**—Independent sample t-tests were used to assess the effect of residential locality on participant recruitment, and whether there were any differences in the demographic characteristics of randomised and non-randomised participants. Levene’s test for equality of variance was used to assess the variance in values between conditions. All data were analysed using the statistical package SPSS for Windows (version 18).

**Results**

Participant recruitment—97 TIA patients met study inclusion criteria and were invited to participate in the trial. Of these 62% (n=60) attended baseline assessment and were randomised (Figure 1).

**Figure 1. Patient recruitment to HEPAP study**
Table 2 describes participant characteristics between randomised and non-randomised participants. There were no significant differences between the age, gender, ethnicity or diagnosis category of randomised and non-randomised participants (all P>0.05).

Table 2. Demographic characteristics and diagnostic categories of randomised and non-randomised participants

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total</th>
<th>Randomised</th>
<th>Non-randomised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>68.5 ± 10.4</td>
<td>67.3 ± 10.5</td>
<td>70.8 ± 10.1</td>
</tr>
<tr>
<td>Gender (male; n)</td>
<td>51</td>
<td>31</td>
<td>20</td>
</tr>
<tr>
<td>Ethnicity (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European NZ</td>
<td>84</td>
<td>53</td>
<td>31</td>
</tr>
<tr>
<td>Māori</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pacific Islands</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Asian</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Indian</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Diagnostic category (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ant Cir*</td>
<td>49</td>
<td>32</td>
<td>17</td>
</tr>
<tr>
<td>Post Cir*</td>
<td>26</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Uncertain territory</td>
<td>22</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

*Ant Cir (Anterior Circulation); Post Cir (Posterior Circulation)

Residential location—Participant recruitment was more likely when residential addresses were within 20 km (n=38/47; 81%) of the study site and lowest for individuals living greater than 30 km from the study site (n=10/27; 37%; Table 3). Randomised participants lived closer to the study site than non-randomised participants (21.3 ± 20.3 cf. 36.6 ± 22.6 km, respectively; t<sub>95</sub> = -3.38, P <0.001; ES 0.37; Cohen d=0.67).

Table 3. Number of randomised and non-randomised participants and corresponding residential location from study site

<table>
<thead>
<tr>
<th>Distance (km)*</th>
<th>Total number of referred patients</th>
<th>Randomised participants (n)</th>
<th>Non-randomised participants (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>24</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>23</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>&lt; 30</td>
<td>23</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>≥ 30</td>
<td>27</td>
<td>10</td>
<td>17</td>
</tr>
</tbody>
</table>

*Distance of residential address from AI (assessment & HEPAP site)

Barriers to recruitment—Thirty-seven eligible patients were not randomised. Of these patients, nine were unable to be contacted. Twenty-eight patients declined to take part in the study. Distance of travel to the AI (46.2 ± 16.6 km) was cited by 13 patients as the primary reason for non-participation. Other reasons for non-randomisation included lack of time (n=5), patient perception of poor health (n=4), lack of interest in exercise participation (n=2), language difficulties (n=2) and patient migration out of study area (n=2).

Adverse events & participant adherence to HEPAP—There were three recurrent TIAs between the baseline and follow-up assessment (n=1, HEPAP; n=2 control). Participant retention was 95% at the follow-up assessment. Three participants (5%) were unable to be
re-assessed due to a clinical diagnosis of depression (n=1; HEPAP), lack of patient time (n=1; control) and overseas travel (n=1; control).

For individuals randomised to HEPAP, participants attended 94% of the available exercise sessions. Twenty-four (83%) participants attended all of the available exercise sessions.

**Discussion**

This study has demonstrated that it is possible to successfully recruit and retain newly diagnosed TIA patients to a health enhancing physical activity programme (HEPAP). This is important as participant accrual is the primary predisposing factor determining the feasibility of clinical rehabilitation trials.22

In the present study, 62% of eligible TIA patients (60 out of 97 patients) were recruited; far greater than the 6 to 17% that has previously been reported for acute stroke-focused research trials.9,23,24 It is of practical significance that the intended sample (60 participants) was obtained within the anticipated timeframe (9 months). These findings are of relevance to those considering designing and conducting larger, multi-site RCTs of this nature for newly diagnosed TIA patients.

Studies that have restrictive entry criteria may prohibit successful patient recruitment and minimise the number of individuals eligible for randomisation. A pragmatic research design was used to improve the generalisability of the trial. A large number of ineligible individuals was expected at hospital screening (inpatient & outpatient) due to the high proportion of diagnoses encountered within TIA services.25,26

Of the 285 individuals diagnosed with TIA or non-disabling stroke at WRH, 97 (34%) were invited to participate in the trial (Figure 1). Of these invited participants, 89% were identified within outpatient care, whereas only 11% were identified from inpatient care. This value was lower than anticipated and is likely attributed to the high in-patient staff workload. To increase participant recruitment, it may be important to ensure adequate staff resourcing within inpatient care so that a greater number of participants may be actively recruited.

Participant recruitment was superior when residential location was within 20 km of the assessment site, with 81% of eligible patients accepting the opportunity to participate in the study. This is intuitive as participants were required to travel to and from a centralised AI frequently. Nevertheless, 46% of all non-randomised participants cited ‘distance to travel’ as the most critical barrier to participation, as previously demonstrated9,21 due to living in outlying recruitment areas. For these individuals, an additional study site for this RCT, perhaps 20-30 km away from the AI, may have increased interest in trial participation. For those planning TIA focused research, this is a vital consideration.

For those randomised to the intervention group, participation in the first 8 weeks of the trial amounted to approximately 1680 minutes (28 hours) for each individual (Table 1). This is a considerable time commitment for participants. It is reassuring that once recruited the vast majority regularly attended the available exercise and education sessions.

Furthermore, participant retention was successful with 95% of randomised participants attending the 8-week post-intervention assessment. This is consistent with other research that shown approximately 90% participant retention following 2 weeks of physical therapy9 or a 12-week home-based exercise programme.27
Communication, support, symptom management and supervision are important characteristics that may influence patient retention. Retention of participants randomised to the exercise group was expected to be high due to the anticipated rapport that would develop between participants and project staff during the intervention. However, for a RCT to examine intervention efficacy it is vital for individuals randomised to the control condition to stay within the trial despite meeting project staff much less frequently. This study demonstrates that similarly high retention rates in the control group can be achieved.

We feel that the responsiveness, friendliness and approachability of the project staff within the baseline assessment was important to create a trusting and empathetic environment that would encourage control participants to return for their second assessment. Previous research also suggests that a clinician educated within the area of research may have a positive effect on recruitment and retention and this was a factor in the present study. This trial is ongoing and we will continue to examine retention in the further assessments planned 3 and 12 months following completion of the intervention.

In this study there were no differences in age, gender, ethnicity or TIA diagnosis classification between randomised and non-randomised participants. However, particular races and ethnicities were found to be disproportionately represented. Eighty-seven percent of all invited participants were NZ European, whereas only 13% in total were Māori, Pacific Islanders, Asian or Indian (Table 2). This is of particular interest as ~35% of the NZ population is of the above ‘minority groups’, and as previous research has demonstrated that Māori and Pacific peoples are at higher risk of stroke than NZ Europeans.

The disproportionate representation is likely due to differences in socioeconomic and environmental vascular risk factors between these groups. A longer recruitment period and consideration of additional, culturally sensitive recruitment methods may be necessary to achieve a more heterogenous and representative participant sample. It is also of interest to note that 22 of the 97 TIA or non-disabling stroke diagnoses were classified as being of uncertain territory. This is likely due to more than one vascular territory having been responsible for the TIA diagnosis, although there is the possibility that some of the participants may not have suffered a TIA or non-disabling stroke.

In conclusion it is possible to recruit and retain a large proportion of people into a RCT to examine the effects of exercise and education in TIA and non-disabling stroke. Recruitment from outpatient care was more successful than inpatient care. Distance to travel was the most frequently reported reason for non-participation.

Māori, Pacific Islanders, Asian and Indian patients were disproportionately underrepresented and a different approach may be required to study interventions in these groups. To date, management strategies post-TIA discharge are largely aligned with lifestyle advice and pharmacotherapy. If the present intervention is efficacious with regards to improving vascular risk factors and reducing recurrent vascular events, it could be applied to a large number of people who suffer a TIA or non-disabling stroke.

Competing interests: None known.

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Internal Medicine, Wellington Regional Hospital, Wellington; Gerard McGonigal, Stroke Physician, County Durham and Darlington Foundation Trust, Durham, UK

Acknowledgements: Funding for this study was provided by the Massey University Research Fund and the Wellington Medical Research Foundation.

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References:

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Carotid endarterectomy in octogenarians

Shaw-Hua Kueh, Vicki Livingstone, Ian A Thomson

Abstract

**Aim** This study compared the postoperative complication rate between patients age 80 or older to those younger than 80 to determine if older patients were associated with higher risk of complication following carotid endarterectomy.

**Method** Patients who received carotid endarterectomy between January 1997 and December 2005 were identified using the New Zealand Vascular Surgical Audit Registry. Patients were recruited into the two predetermined age groups. Baseline demographics and the complication rates between the two groups were analysed and compared using Chi-squared test. Confounding factors were adjusted using logistic regression.

**Results** 1682 patients were identified, of which 243 patients (14%) were age 80 or older. Younger patients were more likely to be male (P=0.002) and diabetics (P=0.047) and more patients in the older age group were symptomatic from the carotid stenosis (P=0.014). The overall complication rate was 17.2% and there was no significant difference between the two groups (P=0.268). The overall combined postoperative death, TIAs and stroke rate was 3.3%. The cardiac complication rate was low but higher in octogenarians at 4.5% compared to 2.2% (P=0.035).

**Conclusions** Older age does not appear to be associated with higher perioperative complications in carotid endarterectomy.

Carotid endarterectomy (CEA) was first described by Eastcott and colleagues in 1954 to treat carotid artery stenosis with the intention to reduce the risk of stroke and death.

The benefit of CEA in patients who are symptomatic with severe carotid stenosis has been well established in large multi-centred randomised trials. In the Northern American Symptomatic Carotid Endarterectomy Trial (NASCET) a 17% absolute risk reduction of stroke at 2 years was reported when comparing CEA to medical therapy in patients with severe symptomatic carotid stenosis of 70–99%. The European Carotid Surgery Trial (ECST) was also in agreement, demonstrating a 9.6% reduction in stroke risk at 3 years follow up.

CEA used to carry a significant perioperative risk of stroke and death of 6.5% to 7.5%. Octogenarians were thought to have an even higher complication rate and were therefore excluded from several major trials. However with an aging population seen worldwide and the argument that these are the patients most at risk of stroke and would therefore benefit most from CEA, there has been an increasing interest to evaluate if CEA can be performed safely on older patients.

Retrospective studies from tertiary hospitals in Europe and America have demonstrated no difference between the older and younger patients in terms of mortality and stroke rates. This was further supported by meta-analysis of 46 studies between 2000 and 2010 with 2963 octogenarian included. On the contrary, a recent multi-centred retrospective study...
involving 10 countries across Europe and Australasia reported a higher rate of mortality among those older than 75.  

We evaluated the complication rates of carotid endarterectomy in New Zealand to determine if CEA was performed safely on octogenarians.

**Method**

Carotid endarterectomies (CEAs) were performed by 17 experienced vascular surgeons who were members of the New Zealand Society of Vascular Surgery (NZSVS) in 6 mainly tertiary hospitals across New Zealand. These centres were Auckland, Wellington, Christchurch, Dunedin, Hamilton and Nelson. CEAs performed were registered in the New Zealand Vascular Surgical Audit Registry.

The Registry was developed by the Clinical Audit Research Unit at the Department of Surgery in Dunedin School of Medicine, University of Otago, New Zealand. The study was approved by the New Zealand Society of Vascular Surgery.

Patients were categorised into two predetermined age groups of ≥ 80 and those < 80 years old at the time of surgery. Baseline characteristics between the two groups were analysed using the Chi-squared ($\chi^2$) test.

Postoperative period was defined as within 30 days after surgery. Complications were further classified as follows:

- Neurological complications included Transient Ischaemic Attack (TIA), stroke and peripheral nerve injury related to either anaesthesia or surgery. TIA was defined as neurological deficit lasting less than 24 hours.
- Cardiac complications include cardiac ischaemia, arrhythmia and cardiac complications otherwise not specified.
- Wound complications include wound infection and wound haematoma.

The complication rates were compared between the two study groups. All statistical analyses were conducted using statistical Package for Social Sciences (SPSS) version 13.0 software (SPSS Inc., Chicago, IL, USA). Potential confounders were adjusted using logistic regression. A P-value of less than 0.05 was considered significant.

External validation of the data collection of the registry was analysed and over the period of 1997 to 2005 47% of CEAs performed in New Zealand were reported in the registry when compared with data from Ministry of Health, New Zealand. The proportion of octogenarians was comparable with 13.9% identified in the Ministry of Health data and 14.9% identified in the vascular registry.

**Results**

A total of 1682 CEAs were performed on 1682 patients between January 1997 and December 2005. The baseline demographics are summarised in Table 1. There was male predominance in both age groups and more symptomatic patients were found in the older age group.

American Society of Anesthesiologists (ASA) score was used as a measure of patients’ preoperative physical status to undergo surgery. These were missing in 14% (243) of the cases and majority of patients had ASA score of 2 or 3 (Table 3).

The ASA score and the proportion of those with missing data were not significantly different between the 2 age groups. The majority of the patients had elective CEA and there was no difference in the urgency of the surgery between the two age groups. Nearly half of all patients received patched closure (805 patients, 48%).

357 complications were documented in 290 patients. The overall postoperative complication rate in New Zealand was 17.2% (290/1682). Younger patients had a postoperative complication rate of 17.7% (255/1439) and older patients had 14.4% (35/243). This was not statistically significant, P=0.268. The odds of octogenarians developing perioperative
complication was 21% less than younger patients after adjusting for confounders; however
this did not reach statistical significance (Table 2).

Table 1. Baseline demographics

<table>
<thead>
<tr>
<th>Variables</th>
<th>&lt;80 years (n=1439)</th>
<th>≥80 years (n=243)</th>
<th>Chi-squared</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age</td>
<td>70 (70.0)</td>
<td>82 (83.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age range</td>
<td>41–79</td>
<td>80–99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>933 (64.8)</td>
<td>133 (54.7)</td>
<td>0.002*</td>
<td></td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>79 (5.5)</td>
<td>6 (2.5)</td>
<td>0.047*</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>246 (17.1)</td>
<td>30 (12.3)</td>
<td>0.064</td>
<td></td>
</tr>
<tr>
<td>Dyslipidaemia</td>
<td>181 (12.6)</td>
<td>21 (8.6)</td>
<td>0.081</td>
<td></td>
</tr>
<tr>
<td>Cardiac events</td>
<td>38 (2.6)</td>
<td>5 (2.1)</td>
<td>0.594</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>398 (27.7)</td>
<td>71 (29.2)</td>
<td>0.616</td>
<td></td>
</tr>
<tr>
<td>Urgency of operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>9 (0.6)</td>
<td>4 (1.6)</td>
<td>0.193</td>
<td></td>
</tr>
<tr>
<td>Urgent</td>
<td>249 (17.3)</td>
<td>46 (18.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>1181 (82.1)</td>
<td>193 (79.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptomatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIA</td>
<td>630 (43.7)</td>
<td>127 (52)</td>
<td>0.014 *</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>483 (33.6)</td>
<td>98 (40.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>40 (2.8%)</td>
<td>3 (1.2%)</td>
<td></td>
<td>0.429</td>
</tr>
<tr>
<td>2</td>
<td>644 (44.8%)</td>
<td>102 (42.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>496 (34.5%)</td>
<td>97 (39.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>46 (3.2%)</td>
<td>8 (3.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>210 (14.6%)</td>
<td>33 (13.6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistical significance. TIA=transient ischaemic attack.

Table 2. Logistic regression of odds ratio (OR) for the overall complication rate between the two age groups

<table>
<thead>
<tr>
<th>Age</th>
<th>Crude OR (95% CI)</th>
<th>OR adjusted for gender (95% CI)</th>
<th>OR adjusted for gender &amp; comorbidities (95% CI)</th>
<th>OR adjusted for gender &amp; comorbidities &amp; symptoms (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;80 years</td>
<td>1.0</td>
<td>0.08 (0.55–1.18)</td>
<td>0.08 (0.54–1.16)</td>
<td>0.79 (0.54–1.16)</td>
</tr>
<tr>
<td>≥80 years</td>
<td>0.81 (0.55–1.18)</td>
<td>0.82 (0.56–1.20)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The complication rates are shown in Table 3. Due to the infrequent rate of TIA, stroke and
death, statistical analyses were unable to be performed reliably. Four deaths (0.3%) were
reported during the perioperative period in the younger age group. Two patients died from
cardiac causes—one from myocardial infarction 5 days postoperatively and another from
unspecified cardiac death. One patient died from a major stroke 7 days after the operation
and one patient died of unspecified death. No deaths were reported in the older age group.
### Table 3. Complications by age group

<table>
<thead>
<tr>
<th>Variables</th>
<th>&lt;80 years (n=1439)</th>
<th>≥80 years (n=243)</th>
<th>Overall n (%)</th>
<th>Chi-squared</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>4 (0.3)</td>
<td>0</td>
<td>4 (0.2)</td>
<td>NA‡</td>
<td>NA‡</td>
</tr>
<tr>
<td>Stroke</td>
<td>23 (1.6)</td>
<td>4 (1.6)</td>
<td>27 (1.6)</td>
<td>NA‡</td>
<td>NA‡</td>
</tr>
<tr>
<td>TIA</td>
<td>21 (1.5)</td>
<td>4 (1.6)</td>
<td>25 (1.5)</td>
<td>NA‡</td>
<td>NA‡</td>
</tr>
<tr>
<td>Cardiac total</td>
<td>32 (2.2)</td>
<td>11 (4.5)</td>
<td>43 (2.6)</td>
<td>0.035*</td>
<td></td>
</tr>
<tr>
<td>Cardiac ischaemia</td>
<td>12 (0.8)</td>
<td>6 (2.5)</td>
<td>18 (1.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>4 (0.3)</td>
<td>4 (1.6)</td>
<td>8 (0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wound complications</td>
<td>67 (4.7)</td>
<td>9 (3.7)</td>
<td>76 (4.5)</td>
<td>0.508</td>
<td></td>
</tr>
<tr>
<td>Haematoma</td>
<td>61 (4.2)</td>
<td>8 (3.3)</td>
<td>69 (4.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>6 (0.4)</td>
<td>1 (0.4)</td>
<td>7 (0.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nerve injury</td>
<td>54 (3.8)</td>
<td>5 (2.1)</td>
<td>59 (3.5)</td>
<td>0.184</td>
<td></td>
</tr>
</tbody>
</table>

* Statistical significance. NA‡ Analysis not available due to insufficient numbers.

Cardiac complications were more frequently seen in older patients compared to their younger counterpart at 4.5% and 2.2% respectively (P=0.035) but were at a low level. Cardiac ischaemia more than doubled in the older age group at 2.5% compared to 0.9%, and cardiac arrhythmia more than four times higher at 1.6% compared 0.3%.

Postoperatively, the median duration of hospital stay was 4 days for both age groups, with an interquartile range (IQR) of 3 to 5 days amongst younger patients and 3 to 6 days amongst older patients. The median duration of operation was 90.0 minutes for both age groups with IQR of 74 to 120 in younger patients and 70 to 120 in older patients.

### Discussion

In this study the overall complication rate following CEA was 17.2% and no difference was found between those older than 80 years of age and those younger than 80.

Subanalysis revealed our combined rate of TIA, stroke and death was 3.3% and no difference was found between the 2 age groups. However octogenarians were more likely to suffer from cardiac complications compared to their younger counterparts.

The stroke and mortality complication rate was significantly lower than those previously reported in major trials. External validation of the registry showed that only 47% of CEA performed in New Zealand were registered which may subject our study to selection bias as it is possible that only those with good surgical outcomes were reported in our registry.

Although the data suggest significant under-reporting of the CEAs performed, we noted that octogenarians accounted for 13.9% of the data from Ministry of Health, New Zealand. This was comparable to those found in our registry at 14.4%.

Our registry can therefore be considered to be a representative sample of the New Zealand CEA population. There may also be an inherent selection bias in that younger patients are treated more aggressively despite significant comorbidities compared to older patients in whom surgery would only be considered if they have less comorbidities and were symptomatic. Baseline demographics did suggest this, with older patients being less likely to be diabetics and more likely to be symptomatic with carotid stenosis.

When adjusted for comorbidities, the odds of older patients developing perioperative complications was no different to younger patients (Table 2). Furthermore, we utilised ASA score in our study as a marker of patients’ preoperative physical state and no difference was
found between the 2 age groups with approximately 80% in both age groups having an ASA score of 2 or 3. Therefore it appears that comorbidities and preoperative physical state did not significantly impact on the overall complication rate in our study.

Internationally, there have been a number of reports supporting the role of CEA in the elderly population, contrary to the conventional idea that age is associated with increased risk of complication. O’Hara et al. reported a retrospective study conducted in Cleveland clinic of 182 CEA performed on 167 patients age 80 and older, were not associated with increased risk of complications.5

Eighty-five percent of patients had 80% to 99% stenosis. The postoperative stroke and mortality rates were 1.6% and 1.8% respectively. These were indistinguishable from that of younger patients of 2.2% and 1.1% respectively. The 5 years stroke-free survival rate was 42% (95% CI, 30%–53%).

In the University of North Carolina, 2398 CEA were performed on 1970 patients;218 CEAs were performed on 187 patients age 80 and older.12 Older patients were less likely to be male, diabetic, smoker or have a history of vascular surgery. These differences were considered by the author to be the result of selection bias, thereby favouring a better postoperative outcome for older patients. The mortality and stroke rates were similar between the two age groups.

In Italy, Ballotta et al reported a retrospective study of 1260 carotid endarterectomy, of which 115 were performed on 112 patients age 80 and older.9 Their data closely resembles ours with mortality of 0.3% in younger patients and none in older patients. Stroke rates were lower compared to ours at 0.8% in younger patients and none in older patients. Older patients were less likely to be diabetic and hypertensive. Cardiac complications were similar between the two study groups.

Most recently, an international, multi-centred study with combined analysis of 8 national and 2 regional databases across Europe and Australasia showed a 0.2% increased risk of stroke and death in those over 75 years of age.11 The database included 48035 carotid endarterectomy performed in 383 centres. The type of anaesthesia did not affect the mortality or stroke but CEAs without patch was associated with increased risk of non-fatal stroke. No comparisons were made of other characteristics between the 2 age groups.

In conclusion, our retrospective audit over a 9 year period demonstrated that octogenarians did not have a significantly increased risk of neurological events or deaths following carotid endarterectomy compared to their younger counterparts, however, non-fatal cardiac complications occurred more frequently amongst octogenarians. This is in agreement with a number of previous reports.

We acknowledge that in our database, there was significant under-reporting and possibly subjects our study to a significant selection bias. This study could be further improved with better compliance with data collection and further evaluation of perioperative complication rates based on symptom as well as age.
Competing interests: None known.

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References:

Investigating the pathways in primary practice leading to the diagnosis of central hypothyroidism

Veronique Gibbons, Ross Lawrenson, Phillipa Sleigh, Tania Yarndley, John V Conaglen

Abstract

Aim Clinical diagnosis of central hypothyroidism is not always obvious: patients may live for years with symptoms. Endocrinologists and biochemists have suggested that a first-line TSH strategy will lead to avoidable delays in diagnosis and treatment of patients with central hypothyroidism. In order to improve timely diagnosis, and thus decrease morbidity from a treatable disease, this study aimed to investigate the diagnostic journey of patients with central hypothyroidism in the Waikato region of New Zealand.

Method A retrospective convenience sample seeking note review and semi-structured interviews were carried out with 16 patients who had a diagnosis of central hypothyroidism that was not caused by pituitary surgery or radiotherapy to the pituitary or hypothalamus.

Results Seventy-five percent of participants had tests performed in general practice with results suggesting either pituitary disease or that further investigation would be required. In 38% (6/16) of participants diagnosis was made by the general practitioner. Time to diagnosis ranged from 3 months to more than 12 months. Seven participants identified having 3–6 visits to their general practitioner and five participants made 6 to 12 visits to their general practitioner prior to diagnosis. Lethargy was the most common symptom in 94% of participants. This was followed by changes in skin texture and body hair distribution and texture in 75% of participants and headaches in 63% of participants.

Conclusion Due to the era during which these patients were diagnosed, we did not find that a delay in diagnosis was due to an absence of FT4 requests; which a first-line TSH strategy would imply. It is important to recognise that a normal TSH does not exclude central hypothyroidism. By raising awareness with general practitioners of pituitary disease, with potential for deficiency of other anterior pituitary hormones, would focus more specific questioning on related symptoms.

Central hypothyroidism is rare and is associated with a varied and prolonged course of somewhat vague symptoms. Since October 2005, recommendations have been made to limit thyroid function testing to the use of thyroid stimulating hormone (TSH) as a first-line strategy for investigating thyroid function. This has been developed in response to economic pressures to reduce the overwhelming number of requests for tests.

The majority of thyroid function testing in adults are within the normal range, which supports the view that thyroid tests are requested in the absence of strong clinical suspicion of disease. Recommendations, therefore, would appear appropriate.
However, a normal TSH does not exclude central hypothyroidism and endocrinologists and biochemical pathologists have suggested that a TSH first-line strategy will lead to avoidable delays in diagnosis and treatment for patients with this condition.2,3,6

Central hypothyroidism, formerly known as secondary hypothyroidism, relates to anatomical or functional conditions of the pituitary or hypothalamus, or both.7 The term conveys quantitative and qualitative abnormalities of TSH secretion, irrespective of whether it is of hypothalamic or pituitary origin.7 Central hypothyroidism is rarely an isolated defect, usually part of a more complex condition, hypopituitarism, which also affects other pituitary hormone secretions such as growth hormone, gonadotropin, prolactin and adrenocorticotropic hormone.7

Current literature suggests that the incidence of hypopituitarism which includes central hypothyroidism is around 4-5 per 100,000 population per year.2,7,8 It is distributed equally between sexes and peaks between 30 and 60 years of age.7

The causes of central hypothyroidism vary, with the most common cause being pituitary adenomas, which account for over 50% of cases (see Table 1).7

### Table 1. Causes of acquired central hypothyroidism

<table>
<thead>
<tr>
<th>Cause</th>
<th>Classical causes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Space-occupying lesions (pituitary adenoma, craniopharygioma, etc)</td>
</tr>
<tr>
<td></td>
<td>Radiation to the pituitary/hypothalamus</td>
</tr>
<tr>
<td></td>
<td>Vascular disease (Sheehan syndrome, etc)</td>
</tr>
<tr>
<td>Non-classical causes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Traumatic brain injury or subarachnoid haemorrhage</td>
</tr>
<tr>
<td></td>
<td>Infection</td>
</tr>
<tr>
<td></td>
<td>Inflammation (lymphocytic hypophysitis)</td>
</tr>
<tr>
<td></td>
<td>Idiopathic</td>
</tr>
</tbody>
</table>

Modified from Yamada, 20089

The clinical presentation of central hypothyroidism can often be similar to that of primary thyroid disease.7,10,11 The investigations into the diagnosis of central hypothyroidism are hampered by the use of TSH alone as a first-line thyroid test.12

Current recommendations for investigating thyroid function are believed to be a barrier for general practitioners in diagnosing central hypothyroidism and may lead to under- or delayed diagnosis and treatment; it further potentially increasing morbidity and reducing the quality of life for these patients.2,6

Best Practice Advocacy Centre (BPACnz) guidelines suggest a first-line TSH policy based on symptomatic presentation – showing that unless the patient has a goitre or delayed reflexes in which hypothyroidism is suspected– the likelihood of thyroid dysfunction is low (below 3%).13 It is acknowledged that there are limitations in using this strategy when investigating central hypothyroidism.1
The majority of thyroid function tests are requested by primary care doctors who may have very little experience with pituitary disease and may not consider that a patient with symptoms but a normal TSH value may have central hypothyroidism.\textsuperscript{3,6,14}

In order to improve timely diagnosis and thus decrease morbidity from a treatable disease, this study aimed to investigate the diagnostic journey of patients with central hypothyroidism in the Waikato region.

**Research design and methods**

We used note review and semi-structured questionnaires to retrospectively review patients with a diagnosis of central hypothyroidism; following ethics approval from the Northern Y Regional Ethics Committee (NTY/08/09/091).

We sought a convenience sample of 20 patients from the 100 patients with a diagnosis of hypopituitarism (including those with panhypopituitarism and central hypothyroidism) whose details were held on the Waikato Hospital endocrine database.

Inclusion criteria were patients with confirmed central hypothyroidism as evidenced by patterns of thyroid function testing and consultant diagnosis from the Waikato endocrine database and patients with a diagnosis of central hypothyroidism who presented to the endocrinology department for a routine visit while the study was being carried out.

Exclusion criteria were patients who were diagnosed with central hypothyroidism before 1990 to reduce recall bias and patients whose diagnosis was as a result of pituitary surgery or radiotherapy to the pituitary or hypothalamus. The pathway for surgical patients is through secondary care and is outside the aims of this study.

A timeline of the diagnostic process was constructed for each patient as accurately as possible from the hospital files. Further information was supplemented through patient interviews.

The semi-structured questionnaires were conducted either face-to-face at the patient’s home or over the telephone depending on the patient’s place of residence (e.g. if >1 hour’s drive from Waikato Hospital). General questions for every participant included information about the symptoms leading to general practitioner visits and to their first endocrinology visit leading to diagnosis. These were supplemented with specific questions about the experience leading up to their diagnosis to attain a full picture of the process.

With the patients’ permission, their general practitioner and specialists who were involved with their care around the time of diagnosis, including those from outside of Waikato, were contacted for further information if needed.

This study was part of a 10-week summer studentship carried out over the summer of 2008/09 as part of a larger body of work on hypothyroidism in general practice.\textsuperscript{15}

Due to the time limitation of the study, a convenience sample was undertaken based on the first 20 people who met the criteria from the order in which they appeared in the database (by NHI number) or referred by the endocrinology team. While we set a minimum diagnosis date after 1990, those with an NHI number (a 3-letter, 4-number
health identifier) who are early in the numbering sequence, e.g. closer to AAA1111, are likely to be older.

We aimed to include 20 participants for detailed assessment, a number considered large enough yet manageable within the time constraints of the study.

**Results**

Of the 20 people selected, 16 agreed to take part in the study. Eight were male and 8 were female, ages ranged from 39–83 years (mean age 65, median age 67.5). The age range at diagnosis was 35-80 years (mean age 58, median age 57.5). Our sample included one Māori and 15 New Zealand European participants.

**Testing thyroid function**—Both TSH and T₄ tests were taken in 81% (13/16) participants prior to their first endocrine assessment, with 75% (12/16) having results suggesting either pituitary disease or that further investigation would be required. Of the 13 participants with prior testing, general practitioners requested 69% (9/13) of these.

In 38% (6/16) of participants diagnosis was made by the general practitioner. For two participants, their diagnosis was made when, independently of each other, they had moved to register with the same general practitioner. Another two participants had their diagnosis immediately identified by their general practitioner and in the remainder, a further two participants, central hypothyroidism was identified by their general practitioner after a period of more than six months.

For five participants (31%) a diagnosis of primary hypothyroidism had been made by the general practitioner prior to their correct central hypothyroidism diagnosis.

**Length of diagnostic process**—Time to diagnosis ranged from 3 months to more than 12 months. Seven participants identified having 3–6 visits to their general practitioner and five participants made 6–12 visits to their general practitioner prior to diagnosis. (Figure 1).

**Figure 1. Number of GP visits pre-diagnosis**

![Number of GP visits pre-diagnosis graph]

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Symptoms—One or more of the following symptoms were reported by the participants: headaches, lethargy, visual disturbances, weight change, joint or muscle pain, change in skin texture, change in body hair distribution or texture, mood changes, irritability, menstruation irregularities in women, loss of facial hair in men, erectile dysfunction and loss of sexual drive. Five participants had symptoms for less than three months, while seven participants had symptoms for greater than a year before seeing a general practitioner. Thirty-eight percent (6/16) of participants lived with symptoms for more than 2 years (Figure 2).

Figure 2: Duration of symptoms pre-diagnosis

![Bar chart showing duration of symptoms pre-diagnosis](chart.png)

Lethargy was the most common symptom in 15/16 participants. This was followed by changes in skin texture and body hair distribution and texture (12/16), and headaches (10/16). Of the 16 participants, nine were diagnosed upon acute admission to Waikato Hospital with symptoms severe enough to cause in-patient admission.

Discussion

Central hypothyroidism is rare: the incidence of central hypothyroidism is approximately 0.005% in the general population. The rarity of central hypothyroidism means the likelihood of having this condition is small, however, there is a suggestion that it may be more common than is reported. Symptoms are vague and there is low clinical suspicion for this condition. However, missing central hypothyroidism is potentially life-threatening as there may be coexistent ACTH/cortisol deficiency which could ultimately be fatal if missed.

Thyroid function test results are often used by general practitioners as a diagnostic tool. Because central hypothyroidism is rare, we identified known cases in order to
examine the journey of the participants to diagnosis. Three methods of information gathering were used to ensure accuracy of information; using each source to confirm or correct another.

Eighty-one percent (13/16) of participants had at least one abnormal thyroid function test result prior to being seen by an endocrine specialist. The majority of participants in this study were diagnosed prior to October 2005 when current BPACnz guidelines for investigating thyroid function were released. The use of TSH, FT₄ and FT₃ by general practitioners were not limited at this time.

Of participants who received thyroid function tests prior to their first endocrine specialist appointment, 12 had results that warranted further investigation. Contrary to what has been currently stated in the literature, that a first-line TSH policy will delay diagnosis, even with the full range of thyroid function tests, general practitioners were failing to investigate abnormal results.

Clinical suspicion of central hypothyroidism needs to be raised. Earlier identification of central hypothyroidism would avoid patients reaching a point where immediate action is required. Greater provision for reflective testing which implies additional testing at the discretion of the reporting biochemical pathologist given relevant clinical and biochemical information would provide timely input into the diagnostic process. This is in contrast to reflex testing, where additional tests are added automatically.

Several prevalent symptoms of central hypothyroidism are like those of primary hypothyroidism; causing difficulties in diagnosis. Thirty-one percent of participants (5/16) were misdiagnosed with primary hypothyroidism. When presented with vague symptoms of thyroid dysfunction, investigating central hypothyroid-specific symptoms associated with other hyposecretion of other pituitary hormones may help such as secondary amenorrhea, erectile dysfunction, nausea and anorexia.

Changes in skin texture and body hair distribution may be evident—the skin is pale and cool in central hypothyroidism compared with coarse and dry from primary hypothyroidism; loss of body hair and thinning of lateral eyebrows are usually more pronounced in central hypothyroidism. Body weight is likely to be reduced rather than increased in central hypothyroidism. In addition, periorbital and peripheral oedema and hoarseness of the voice are uncommon in central hypothyroidism.

The small number of participants interviewed is a limitation of this study, although it can be argued that the message they gave about their symptoms was consistent. Due to participants’ age or the length of time since diagnosis, this study is likely to have some recall bias. However the three methods used—hospital records, patient interview and general practice records were able to clarify where there may have been gaps.

Conclusion

A first-line TSH strategy works only if the hypothalamic-pituitary-axis is normal. This strategy may also work as long as limitations are appreciated. While it can be argued that symptoms such as tiredness and lethargy are common in the general population, these findings are also common in patients with a diagnosis of central hypothyroidism. The diagnosis of central hypothyroidism in the Waikato area was delayed for the majority of participants until they had received specialist involvement due to a lack of recognition by general practitioners. Due to the era during
which participants were diagnosed, i.e. no recommendations for restriction on thyroid function testing, we did not find that a delay in diagnosis was due to an absence of FT4 requests which a first-line TSH strategy would imply.

Raising awareness with general practitioners of pituitary disease with potential for deficiency of other anterior pituitary hormones would focus more specific questioning on related symptoms. Missing the diagnosis of central hypothyroidism could miss or delay the opportunity to diagnose a significant pituitary tumour with potential for visual loss.

Central hypothyroidism is rare, but if general practitioners suspect abnormalities in thyroid function, it is essential that they accurately interpret thyroid function tests, seek advice from endocrinologists and biochemical pathologists, recognise that TSH may be unreliable, and thoroughly pursue relevant symptoms.

Bullet point summary

- Clinical diagnosis of central hypothyroidism is not always obvious
- A normal TSH does not always equate with normal thyroid function
- Central hypothyroidism is rare at around 4-5 cases per 100,000 population per year
- Enquiring about symptoms related to other pituitary hormone deficiencies may be helpful.

Competing interests: None known.

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References:
Smoking cessation is a prolonged journey rather than a single trip

K Marie Ditchburn, Brent Caldwell, Julian Crane

Abstract

Smoking is the biggest cause of preventable death and ill health in the developed world, and of all health interventions, those that can reduce the prevalence of smoking will have the biggest impact on health. However, smoking is highly addictive and more effective ways to help people quit are urgently required if New Zealand is going to achieve its smokefree vision by 2025. While there is strong evidence that specialist smoking cessation clinics overseas substantially reduce smoking prevalence, similar treatment clinics is not a key feature of the healthcare system in New Zealand. This viewpoint outlines the reasons why New Zealand can ill afford not to have nationwide specialist smoking-cessation clinics.

Smoking is the biggest cause of preventable death and disability in New Zealand and other developed countries. Despite many decades of public health interventions, one-fifth of the adult New Zealand population remains addicted to smoking. Clearly a new and more intensive approach needs to be taken if New Zealand is to achieve its goal of being tobacco-free by 2025. While we are seeing a number of potential ‘new’ treatments such as electronic cigarettes, we should not lose sight of the fact that addiction to tobacco is highly individual and for many, successful quitting requires a personal approach.

Addiction to smoking needs to be considered as a chronic disease, requiring specialist care delivered by specialists, just like other chronic diseases such as chronic obstructive pulmonary disease, ischaemic heart disease, and diabetes. Although existing cessation initiatives in New Zealand do go some way to address this, they are more inclined towards a broader reach rather than individual tailored care.

The latest version of the New Zealand Smoking Cessation Guidelines published in 2007 provides a guide for health professionals on how to treat smokers. The Health Target, Better help for smokers to quit, introduced into the health system in 2007/2008 is based on the ABC model, designed to prompt providers to routinely Ask about smoking status as a clinical ‘vital sign’, then provide Brief advice and Cessation support to current smokers. Many District Health Boards (DHBs) and primary care providers deliver smoking cessation services, and there is a range of privately provided services. Additionally smokers have access to specialised services such as the freephone Quitline and Aukati Kai Paipa (Māori smoking cessation services). However, despite this suite of measures, only 18% of smokers remain quit 1 year after using current treatments in New Zealand.

Although there is strong evidence that specialist smoking cessation clinics substantially reduce smoking prevalence with long-term quit rates of 40% or more evident in overseas clinics, smoking treatment clinics are not a key feature of the healthcare system in New Zealand. Clinic-based treatment is a key component of the United Kingdom’s (UK’s) National Health Service (NHS) Guidelines, and smokers who use these services are four times more likely to quit than those who quit without such assistance.
If this country is going to achieve its Smokefree New Zealand vision by 2025 and prevent morbidity and mortality, successive governments will need to consider more intensive and effective treatment services including clinics, for its at-risk smoking populations. These populations include Māori, heavily nicotine-dependent smokers, treatment resistant smokers, particularly those with early smoking related cardiovascular or lung disease, and those with mental health issues.

**Smoking addiction requires specialist clinics just like other chronic diseases**

Smoking addiction is a chronic relapsing disease of brain reward, motivation, memory and related neuro-circuitry. Until we stop treating smoking as a lifestyle choice and start treating it as a chronic disease, we are unlikely to see much improvement in quit rates or the morbidity and mortality associated with smoking. Els and Kunyk make an analogy between the evidence for treating hypertension as a chronic disease to prevent serious health problems, and the evidence for treating tobacco use as a chronic disease, and point out the unjustifiable differences in the way these two chronic diseases are treated.

Specialist clinics are in keeping with the philosophy of treating smoking as a chronic relapsing disease with people cycling in and out of abstinence. Like other chronic diseases, specialist knowledge is required to identify appropriate individually tailored interventions including the long-term (possibly lifelong) use of nicotine replacement therapy (NRT) as well as other multi-modal therapies for people who have relapsed after multiple attempts using conventional therapy.

**Clinics are very effective**

Clinics provide an ideal setting in which to deliver the latest evidence-based multi-modal treatment (psychotherapy and combination pharmacotherapy), enabling clinics to achieve long-term smoking cessation in almost half of all participants.

A recent Cochrane Review concluded that multi-component smoking cessation interventions for hospitalised in-patients which continue for one month post-discharge, are highly effective, with an odds ratio for long-term smoking cessation of 1.65, 95% confidence interval (CI) 1.44 to 1.90.

In a specialist clinic in the United States of America (USA) that provided combination pharmacotherapy along with counselling, 6 month quit rates of up to 57% were achieved.

Similarly when Brose and colleagues reviewed the United Kingdom’s (UK’s) National Health Service Stop Smoking Service (NHS SSS), they found smokers who used a combination of NRT, varenicline, and group sessions in specialist clinics were more likely to succeed than those who used primary care and single NRT.

Patients are much more likely to receive smoking cessation treatment in hospitals that have a dedicated smoking cessation program than hospitals that do not. In Christchurch, New Zealand, a pilot smoking cessation programme which provided face-to-face psychological and behavioural therapy, achieved a 15-month quit rate of 52% among those who completed the programme (none of these were biologically verified). This is a high success rate considering NRT was not used. Interestingly, of the 24 smokers who dropped out of their initial programme, all took up the opportunity to re-engage in subsequent courses. Another New Zealand study of a clinic in Wellington Hospital used behavioural interventions with...
nicotine gum, which resulted in a biochemically verified 12-month quit rate of 32%. This clinic ended in the 1980s when its funding by a pharmaceutical company stopped.

Treatment clinics are also ideal for at-risk populations, such as pregnant smokers and those who require medical care for co-morbidities as part of the treatment for their smoking addiction. To illustrate, the NHS SSS targets pregnant smokers and during a national evaluation, 37.2% were biochemically verified as quit at their 4-week follow-up. In an American study, pregnant smokers who received smoking cessation therapy at antenatal clinics were twice as likely to be abstinent than those who received usual care. Even if pregnant smokers in these cessation programmes only quit for the period of their pregnancy, this will significantly reduce poor pregnancy outcomes such as low birth weight or preterm deliveries.

Similarly, smoking treatment clinics (as part of inpatient care) have proven to be effective in reducing the morbidity and the cost of inpatient care. Smokers who attended weekly counselling with optional NRT before their elective surgery had a significantly lower complication rate of 18% compared to 52% of smokers not attending a clinic, and the median length of stay was 11 days compared to 13 days.

**Smoking cessation treatment services are a priority**

Using simulation modelling to examine the effects of tobacco control and cessation treatment policies, Levy and colleagues found that treatment services to promote cessation among smokers will have the biggest impact on reducing the prevalence of smoking and smoking-related disease, compared to other policy options.

Treatment policies have an even greater impact (78.8%) on smoking rates than increased tobacco taxes (65.9%), smokefree environments (31.8%), and mass media educational campaigns. These authors concluded that combining public health and cessation treatment policies produce optimal quit outcomes but stronger policies to promote cessation treatments can have strong effects and “individually tailored/stepped care approaches merit further attention”.

A smoking cessation clinic can be an easy and effective way to treat tobacco use and dependence. It provides intensive treatments to smokers motivated to quit, ensuring a higher success rate, and it also treats "difficult" patients, such as those who have relapsed despite multiple treatments, or those with psychological co-morbidities.

Clinic-based treatment services are particularly effective among socioeconomically disadvantaged groups, and help to reduce health inequalities. UK services were more successful in attracting smokers from deprived areas than those from more affluent locations. “This is a remarkable finding which goes against previous research on health care and deprivation…”.

**Clinics are ideal for delivering psychological therapy – a vital missing link**

High quality face-to-face psychological counselling increases the efficacy of smoking cessation interventions. Individual and group counselling are equally effective, and both are more effective than self-help programmes (RR = 1.98), with clinics especially suited to the delivery of both individual and group therapy.
Clinics are ideal for delivery of experimental and novel treatment

Clinics are an ideal setting for research into novel treatments, which can inspire disillusioned smokers (smokers who failed to quit after using current treatments, and have lost self-efficacy); to try and make future quit attempts. The opportunity to conduct research at hospital-based clinics led to the establishment of 103 clinics in Iowa, USA. The UK’s NHS specialist smoking-cessation clinics have provided the setting for considerable research into the effectiveness of new treatment approaches.

A unique medical student-run smoking treatment clinic was established by volunteers at the Mayo Medical School in the USA. Not only did this clinic develop and implement a comprehensive intervention for treating smokers of lower socio-economic status (with quit rates comparable to other treatment programmes), but the medical students thought that this service-based learning programme broadened their knowledge and counselling skills around smoking cessation.

Clinics are cost-effective

Treating smokers is one of the most cost-effective interventions a health system can deliver and it has been argued that these treatment services will eventually free up resources that are no longer needed to treat smoking related disease such as lung cancer. Even the most expensive smoking cessation programs are more cost-effective than most medical care interventions. In the UK, the cost per quality-adjusted life years (QALY) from a very intensive group-based smoking cessation treatment was 80% below the National Institute of Clinical Excellence’s willingness to pay threshold.

Outpatient smoking cessation services are cost-effective, even for seriously depressed patients whose mental illness might be expected to worsen as a consequence of quitting smoking. A New Zealand model of the number of lives that would be saved by increased smoking cessation services led to increased government funding of these services.

Barriers to promoting cessation treatment

While smoking treatment services are a priority, a number of barriers to promoting cessation treatment among health professionals have been identified, with these difficulties having their roots in both a historical and cultural context. Until very recently healthcare professionals have not included smoking cessation treatment or promoted NRT use in their routine practice, often citing time constraints, their perception that smokers were unreceptive to cessation advice, lack or poor training about smoking cessation and that they are smokers themselves.

To illustrate, despite the strong evidence that NRT is a safe and effective method of helping smokers to quit, the greatest barriers cited by health professionals not recommending this treatment is their lack of training and their own lack of confidence. As a result, it is vital to educate and update staff on smoking cessation as well as providing special smoking cessation programmes directed at the staff themselves, with the clinic environment providing an ideal setting for these activities to take place.

What makes a successful clinic?

The internationally renowned UK’s NHS network of stop smoking services is amongst the best value for money, life-preserving clinical interventions in the NHS. Modelled on the
Maudsley Hospital Smokers Clinic, this treatment model has evolved since its 1969 inception into a service that delivers a model of treatment for smokers motivated to quit. These smoking services focus on the use of NRT to ease the discomfort of withdrawal symptoms, other pharmacotherapy (varenicline and bupropion) to assist in quitting and behavioural interventions delivered at both an individual and group setting. Since its establishment in 1999, the service has supported over 2 million people to quit smoking in the short term, 500,000 in the long term and has been responsible for saving 70,000 lives.

Evidence-based NHS stop smoking support is effective both in cost and clinical terms and these services remain a key part of tobacco control and health inequalities polices both at local and national levels in the UK.17

What could a New Zealand clinic look like?

Funded by DHBs, via PHOs, these community-based specialty clinics would be housed in outpatient medical practices and staffed by multidisciplinary quit coaches with specialist knowledge. Fundamental to achieving long term cessation is the ability of these clinics to provide on-going evidence based pharmacological and psychological interventions delivered in both an individual and group setting.

A major feature of these specialised clinics will be the tailored pharmacological therapy provided to individual smokers who have had a long and complicated history of unsuccessfully using many of the commonly prescribed NRTs. This individual approach could for example include using pre-cessation NRT, long duration NRT as well as combinations of NRT with other interventions such as the electronic cigarette and would include therapies such as bupropion and varenicline. While cessation is always the most desired outcome, a further role of these clinics would be to offer options needed to reduce harm for smokers not yet ready or able to quit.

Conclusion

The establishment of specialist smoking cessation clinics across New Zealand, to complement the service provided by Quitline, is likely to greatly reduce the prevalence of smoking, particularly among treatment-resistant smokers, groups with very high levels of smoking (50% of Māori woman smoke), and vulnerable population groups such as smokers with co-morbid psychiatric conditions. It is important that such clinics take on smokers for the long term rather than for a quick treatment ‘fix’ and that for some, who are unable to quit, to consider managing their addiction with long term nicotine replacement in whatever form best suits them.

At present such strategies and long term individual help are unavailable in New Zealand. Appropriately designed treatment clinics may help to increase the relatively low access of treatment services by minority groups, and ensure they get intensive multi-modal therapy, face-to-face counselling, and individually tailored pharmacotherapy (including prescription medicines such as varenicline as required). Smoking cessation clinics have been shown to be cost-effective overseas. In the current economic climate, the most appropriate question is not “can we afford to have nation-wide specialist smoking-cessation clinics?” the most appropriate question is “can we afford not to have specialist smoking-cessation clinics?”
Competing interests: None known.

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New Zealand’s first two-pair kidney transplant chain

Karina Voitov, Ian Dittmer, Jo Burton, Carl Muthu

Abstract

Kidney transplantation is the treatment of choice for end-stage renal disease, providing better quality and quantity of life compared with dialysis. Living donor transplantation is being increasingly utilised to match the demand, however it is limited by HLA antigens or ABO blood group incompatibility between the donor and recipient.

Organising a kidney transplant chain can overcome such incompatibilities through recipients ‘exchanging’ incompatible for compatible donors. We have reported New Zealand’s first two-pair kidney transplant chain, outlining the reasons for this new technique, its benefits and some of its limitations.

Kidney transplantation is the treatment of choice for end stage renal disease. In most patients it provides superior quality and quantity of life compared to dialysis and in addition is more cost effective for society. Due to an imbalance between the number of potential kidney transplant recipients and number of deceased donors, living donor transplantation is being increasingly utilised.

In 2009, 55% of all kidney transplants in New Zealand (i.e. 67 of 121) originated from a living donor.3 There are many potential obstacles to a patient receiving a living donor transplant. One such obstacle is a “positive cross-match” to HLA antigens or ABO blood group incompatibility between the donor and recipient.

Under normal circumstances performing such a transplant would result in acute antibody mediated rejection of the kidney due to pre-formed anti-HLA or anti-ABO antibodies. Recipients “exchanging” or “swapping” incompatible for compatible donors is one way to overcome these immunological barriers to transplantation.

Case report

Mr XX is a 62-year-old man who had end-stage renal failure (ESRF) secondary to hypertensive nephrosclerosis. He underwent the usual transplant work-up and was accepted for kidney transplantation. His wife, Mrs ZZ, volunteered to be his donor. She also underwent the usual work-up and was found to be healthy enough to donate her kidney. Unfortunately they were ABO incompatible (his blood type O was and hers was A). They entered into our ABO incompatible kidney transplant programme.

Mr XX underwent a course of plasma exchange in an attempt to reduce his anti-A blood group antibodies to a sufficiently low level to allow transplantation to occur. Unfortunately the plasma exchange was unsuccessful. Mr XX therefore continued to wait for a deceased donor transplant.

Mr YY, a 45-year-old male, then presented himself as a “non-directed kidney donor”, i.e. he simply wished to donate a kidney to anyone as a selfless act of altruism.
Kidneys from non-directed donors have previously been allocated to the next patient on the deceased donor list, in this case Mr GG.

Mr GG is a 61-year-old male with ESRF due to IgA nephropathy. He has been on dialysis since 2005 after the failure of his first kidney transplant from 1996. However, in this instance a ‘two-pair transplant chain’ was proposed (Figure 1). Mr YY would donate his kidney to Mr XX. In exchange for this, Mr XX’s donor, Mrs ZZ would donate her kidney to Mr GG. In effect Mr YY’s altruistic act would now facilitate two transplants being performed rather than the usual one.

**Figure 1. Two-pair transplant chain**

On 13 April 2011 Mr YY and Mrs ZZ underwent simultaneous hand-assisted laparoscopic donor nephrectomies. Mr XX and Mr GG then underwent their respective kidney transplants. Both donors and both recipients made uncomplicated recoveries from their surgeries. At 6 months post transplant both Mr YY and Mr GG are well with stable graft function (creatinine of Mr XX and Mr GG were 87 and 102, respectively).

**Discussion**

Two-pair transplant chain is a relatively new technique that has the potential to increase living donor kidney transplantation. This has an important effect of decreasing the number of patients on the ever growing deceased donor kidney transplant waiting list. Kidneys from a living donor also have the advantage of having a longer survival time compared to those from a deceased donor. It is possible to perform ABO incompatible or cross-match positive kidney transplantation using advanced immunosuppressive techniques (e.g. plasmapheresis, bortezomib, anti C5 monoclonal antibodies) with reasonable results. However these techniques are expensive, place the recipient at increased risk of complications from the stronger immunosuppression and the long-term outcomes, especially with positive cross-match kidney transplants, are probably inferior to a compatible kidney transplant.
However, paired exchanges and transplant chains do have other non-immunologic barriers that need to be overcome to enable a successful transplant to be performed. Most of these barriers are logistical. Performing two living donor operations and two living donor kidney transplants simultaneously was moderately difficult to organize but performing three or more would present significant logistical challenges, for example in organizing the necessary theatres and surgeons.

One solution to this is to perform the donor surgeries and transplants at different hospitals. However this would mean either splitting up the donor/recipient pairs (such as husband and wife, parent and child). Another solution is to transport the kidney between hospitals in a similar way to which deceased donor organs are currently transported. Successful transport and transplantation of living donor kidneys over long distances (e.g. west coast to east coast of USA) with immediate graft function has been reported. 7

As well as a two-pair transplant chain a non-directed donor can also be used to construct longer chains (see figure 2). In 2009 a chain of 10 transplants initiated by a single non-directed donor was reported. 8 This strategy can allow transplants to be performed non-simultaneously which reduces logistical challenges.

A “bridge donor” at the end of a cluster of transplants may wait many months before donating their kidney and re-starting the chain. Although the delay may provide the bridge donor with an opportunity to “renege” which would break the chain, as long as the chain started with a non-directed donor, no recipient would have actually “lost” their donor. It would still also be possible to re-start the chain with another non-directed donor in this circumstance.

**Figure 2. 10-pair transplant chain**


A limitation to these techniques increasing the number of kidney transplants being performed in New Zealand is our small population. The larger the pool of donors the more likely a successful match will be made. A potential solution to this problem is combining our pool of potential donors with Australia along with trans-Tasman transportation of kidneys. Another possibility is asking donor recipient pairs who are actually compatible whether they would consider participating in exchange schemes.

Potential advantages for the compatible pair in participating in these schemes include an increased sense of altruism from helping patients who would otherwise be unable to receive a kidney transplant and the possibility of receiving higher quality organs (e.g. from a younger donor).
In conclusion, we have reported New Zealand’s first two-pair kidney transplant chain. We have outlined the reasons for this new technique, its benefits and some of its limitations. All healthcare professionals involved in the care of patients with renal failure should encourage their patients to investigate the possibility of receiving a living donor kidney transplant and be aware that the blood group and HLA incompatibility is not the absolute barrier to transplantation that it once was.

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Thigh pain—an unusual presentation of ruptured appendicitis

John English, Jean-Claude Theis

Abstract

We present a case in a 56-year-old female with a perforated retrocaecal appendicitis presenting as a large right thigh abscess. We discuss the diagnosis and treatment and the importance to refer early to a general surgeon if suspected.

Acute appendicitis is the most frequently encountered surgical condition of the abdomen, with a lifetime risk of 7%. A perforated appendix is a major complication, with an incidence of approximately 16%. There is usually a delay in diagnosis, and perforation can form an appendicular mass or retroperitoneal abscess. 1,2

Retroperitoneal abscesses often present with very subtle symptoms and signs, making early diagnosis difficult and consequently have high morbidity and mortality rates. The presenting complaint can be thigh pain and swelling with little in the way of abdominal manifestations. 3

The following case presented to the orthopaedic service with a large right thigh abscess as a result of perforated retrocaecal appendicitis.

Case report

A 56-year-old female presented with a 3-day history of increasing right anterior thigh pain, swelling and inability to weight bear, on a background of 4 weeks of fevers, sweats and intermittent diarrhoea. She denied any abdominal pain, urinary symptoms or recent weight loss.

She had seen her GP 2 weeks prior regarding her fevers, however no source was identified. At that time she was prescribed a 10-day course of roxithromycin.

On examination, she looked flushed with a temperature of 37.9°C. Her other observations were within normal range. Her right thigh was noticeably larger than the left, with no skin erythema. Hip movements were uncomfortable. The anterior thigh was tender to touch with no palpable masses or subcutaneous emphysema. There was no lumbar spinal or flank tenderness. Her abdomen was soft and non-tender. Her PR examination was normal.

She had elevated C-reactive protein (C-RP) – 400, white blood cell count (WCC) – 16 mm$^3$ and neutrophils – 15. Plain films of her chest, abdomen, hips and right femur were unremarkable.

An MRI of the thigh showed multiple fluid collections tracking along the intermuscular fascial planes of the quadriceps down to the level of the femoral condyles and no abnormal bone signal to suggest osteomyelitis. (See Figure 1)

A CT of the abdomen was also performed to look for a psoas abscess and findings were in keeping with an inflamed perforated appendix with a peri-appendicular abscess (see Figures 2 & 3).
Figure 1. T2 weighted MRI of right thigh showing multiple abscesses within the intermuscular fascial planes of quadriceps femoris muscle

Figure 2. Coronal CT of abdomen showing large retroperitoneal collection in measuring 8.2×8.3×7.4 cm with areas of rim enhancement in the right iliac fossa, which was in continuity with a thickened appendix. The abnormal signal extended inferiorly from the RIF collection over the right iliacus muscle into the right groin
After consultation with the general surgeons, a CT guided percutaneous drainage of the periappendicular abscess was performed. A large amount of feculent material was aspirated and the drain left in situ.

Following this, an open drainage and debridement of the right thigh was carried out. Significant amounts of purulent material were encountered between the intermuscular planes of the quadriceps muscle. This was followed by five repeat washouts and application of negative pressure dressings. The thigh wound was closed after 2 weeks.

Swabs grew *Bacteroides fragilis* group and mixed anaerobic organisms. An antibiotic therapy consisted of a combination of IV metronidazole and imipenem. The patient was discharged from hospital 28 days after admission.

A colonoscopy was attempted one month later, but aborted due being too uncomfortable. She went on to have a CT colonography, which was unremarkable. Risks of recurrence of abscess were explained to her (10–15%) and given that she was asymptomatic, interval appendicectomy was not performed. Unfortunately a couple of months later, she developed right flank pain, fevers and sweats. Recurrence of an appendiceal mass was suspected, so she had an acute laparscopic appendicectomy. A small appendiceal abscess was found. She made a full recovery following this.

**Discussion**

The diagnosis of appendicitis is not always straight forward and can be missed, particularly when peritoneal or retroperitoneal signs of a ruptured appendicitis are not present.3

Our case presented to the orthopaedic department with a primary diagnosis of thigh abscess and the retroperitoneal appendicular abscess was only discovered later. A deep thigh collection is often secondary to pyomyositis, osteomyelitis, infected haematoma, or
thrombophlebitis. When presented with a deep thigh collection, it is important to consider an intra-abdominal cause as the underlying origin of the abscess. Referral to a general surgeon is recommended.

A retroperitoneal collection can spread to the buttocks and thigh, via the fascial investments and insertions of muscles and vessels that escape from the pelvis. These include, the Iliopsoas passing under the inguinal ligament, Piriformis and Obturator internus through the greater and lesser sciatic notches, and the Superior gluteal artery piercing the pelvic fascia in order to reach the buttocks. Other reported routes include the obturator or femoral canal.

A CT scan is the gold standard for diagnosing a retroperitoneal collection, with a sensitivity close to 100%. Conventional radiology has a much lower sensitivity in showing signs of retroperitoneal process.

CT guided percutaneous drainage of abscesses will confirm the diagnosis and allow for minimally invasive external drainage, which in addition to antibiotics will avoid open surgery in some cases. As far as imaging of the thigh is concerned, an MRI is the procedure of choice as it will show any intra muscular collection and confirm whether there is osteomyelitis or not. In case of a painful hip an MRI will be able to differentiate between an intra-articular pathology and a psoas abscess, which has tracked down through the inguinal canal.

With regards to the thigh abscess, Rostein recommends open drainage as it allows assessment of the viability of muscle and fascia and debridement of any necrotic tissue.

The role of interval appendicectomy is controversial. The majority of studies looking at this have been small and retrospective. A recent review by Corfield, found the recurrence rate of appendiceal mass following conservative treatment varies between 3% and 25%. They found that at least 75–90% of routine interval appendicectomies in adults to be unnecessary. Corfield recommends a safe approach to management would be adequate follow up of symptoms coupled with investigations such colonoscopy or CT colonography (to look for signs of malignancy), and performing appendicectomy only if symptoms recur or persist.

In conclusion, perforated retrocaecal appendicitis presenting as a thigh abscess is a rare and life-threatening condition. For its diagnosis and treatment, it requires a high index of suspicion and a good understanding of the pathogenesis and anatomy of the retroperitoneal spaces. It can be effectively treated with percutaneous drainage of the retroperitoneal abscess and open debridement of the thigh.

General practitioners, musculoskeletal physicians, emergency physicians and orthopaedic surgeons should be aware of the potential intra-abdominal origin of a deep local infection in the groin, buttock or thigh. Moreover, abdominal examination and referral to a general surgeon should be part of the initial assessment.

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Tarantula hair keratitis

Simran Singh Mangat, Bill Newman

Abstract

We describe a 12-year-old boy in England with keratitis secondary to tarantula hairs embedded within the stroma of his cornea. Every attempt must be made to isolate these hairs at the first visit as they have a barbed nature and have a propensity to propagate through ocular tissues. A chronic keratitis requiring long-term steroid use may result if hairs persist in the cornea. Children who keep tarantulas as pets should be instructed on safe handling to prevent the tarantula from adopting defence mechanisms and shedding their hairs.

We describe a case of keratitis secondary to corneal tarantula hairs with resulting inflammation.

Case report

A 12-year-old boy in England presented to the local casualty with a red itchy right eye. He recently acquired a pet tarantula spider named Stevie after the late wildlife celebrity and conservationist Steve Irwin.

Without gloves or eye protection he quickly scooped his tarantula with one hand. The tarantula adopted a defence mechanism spraying its hairs into the boy’s eyes and biting his left wrist.

On examination visual acuity was 6/6 OD 6/4 OS. There was right conjunctival injection. A hair was removed from the right cornea. It was thought there were no visible hairs in the inferior fornix or on upper lid eversion. A puncture bite was visible on the palmar aspect of his wrist.

Two days later, visual acuity was 6/9 OU. No visible hairs were seen. The eyes were still itchy with mild conjunctival injection only. Four days later, four intrastromal corneal hairs were visible on slitlamp biomicroscopy. The anterior chamber and vitreous were quiet. Intraocular pressure was normal. He remained on G Pred Forte (prednisone) and G chloramphenicol qid for 4 and 1 weeks respectively until further notice.
Discussion

Ophthalmia nodosa was first described in 1906 by secondary to caterpillar hairs and it is now used to describe ocular inflammation secondary to urticating hairs such as those of a tarantula.

The tarantula hairs are type III urticating hairs with a barbed appearance under electron microscopy. This barbed feature allows them to migrate relentlessly within ocular tissue. Hence they can penetrate corneal epithelium into the stroma causing a chronic keratoconjunctivitis. They can also penetrate descemets membrane and enter the anterior chamber to cause chronic anterior uveitis.
Sanboe et al describe a persisting keratouveitis 10 months after first exposure to the tarantula hair in a 15-year-old boy. Watts et al describe a 16-year-old male with chronic keratouveitis following exposure to tarantula hair. Topical steroid therapy made him asymptomatic, however at 4 months there remained a persistent uveitis and keratitis.

The morbidity of long-term topical steroid use is well described including raised intraocular pressure and cataract causation. They may yet migrate further posteriorly to cause a vitritis, retinitis, choroiditis and even involve the optic nerve. This may cause chronic intraocular inflammation requiring multiple hospital visits over a prolonged period of time. Thus vigilant identification of corneal tarantula hairs, including examining under the upper eyelid must be performed at presentation to prevent long-term sequelae.

At the time of writing the hairs were present in the corneal stroma. Surgically removing the hairs by making linear cuts in the cornea over the hairs wasn’t performed because of the barbed nature of these fine microscopic would make excision extremely difficult with the risk of the hairs snapping during attempted removal. His symptoms have been controlled with topical steroids.

Chilean Rose Tarantulas (*Phrixotrichus cala*) are becoming an increasingly popular pet in England and some other countries that allow their importation for use as pets. Their popularity is due to their long lifespan (typically around 16 years) and their friendly nature when handled properly. This appears to be the key and is the biggest issue with an excitable child who may overlook this.

Taking extra precautions such as wearing gloves and using eye protection is valuable during the early period while the owner is inexperienced.

A telephone survey of local pet stores was conducted to ascertain handling advice given to future tarantula owners. Twenty local pet stores were contacted, out of which five stocked tarantulas. All advised about handling the tarantula with care and avoiding sudden movements. Only one specifically advised to let the tarantula crawl onto the owner’s hand. One mentioned to wear gloves while handling the tarantula as the minute urticating hairs can be left on the hands and can be introduced to other parts of the body such as the eyes. None advised on post handling hand washing. No stores advised on wearing eye protection.

We recommend demonstration of safe handling to children and wearing of hand and eye protection in the early period after acquiring the tarantula.

In the emergency department every attempt must be made to locate and remove these hairs at the initial presentation as it is likely this will be the only opportunity in which this procedure can be performed.

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References:

Another stroke with chest infection?

Philip M C Choi, Danielle H J Oh

A 64-year-old previously healthy man was brought to the emergency department after being found by neighbour in a confused state around 9am in the morning. He was well when last seen the night before. On arrival his temperature was 38°C, pulse 94 and blood pressure 130/80 mmHg. He was agitated, dysphasic and combative. There were some crackles in the right lung base. Neurological exam was difficult however he was moving four limbs possibly less so on the left.

Figure 1. Axial CT shows hypodensity in the right insula cortex

What is the diagnosis?
Answer

Computed tomography (CT) head was reported as showing a subacute right insular cortex infarct (Figure 1). The patient was treated with antibiotics and aspirin. The diagnosis was revised to HSV (*Herpes simplex* virus) encephalitis after review by the medical team. Viral polymerase chain reaction on cerebrospinal fluid confirmed HSV-1 infection.

MRI 3 days later showed diffusion restriction changes consistent with the diagnosis of HSV encephalitis (Figure 2). Timely diagnosis and treatment of HSV encephalitis is essential given the generally poor prognosis in untreated cases. Loss of the insular ribbon is an early CT sign of middle cerebral artery infarction. However, in a delirious patient with fever, HSV encephalitis must be considered.

Figure 2. Axial Diffusion Weighted MRI (DW-MRI) showed signal changes in the bilateral insular cortex

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Synthetic cannabinoid use in New Zealand: a recent rebound

Synthetic cannabinoid analogues had, until August 2011, been readily available in various retail outlets within New Zealand and were openly promoted and sold as legal substitutes for cannabis. These analogues describe a range of disparate chemicals that bind to CB1 and CB2 cannabinoid receptors, mimicking the effects of delta-9-tetrahydrocannabinol, though with greater efficacy.

Published case reports and case series, and information based on calls received at the National Poisons Centre (NPC) suggest the adverse signs and symptoms displayed by users of these analogues are different from those found in cannabis users. The predominant effects displayed, in rank order are tachycardia, vomiting, agitation, drowsiness, psychosis, hallucinations, anxiety, headache, seizures and tremors.

Recent calls to the NPC additionally suggest an increase in the severity of the neuropsychiatric effects, particularly psychosis, hallucinations and seizures. Additionally, staff at some Emergency Departments have noticed an increasing number of presenting patients who are aggressive and violent. Little is known of the chronic effects; however, there is an emerging concern with patients suffering adverse withdrawal effects following cessation of long-term use.

Recently, the NPC published a letter describing a dramatic fall in calls to the Centre following the prohibition of identified analogues present in New Zealand in August 2011. Within a month of the ban, calls dropped from 10 in August 2011 to 1 in September 2011. Calls to the NPC in months subsequent to this were low and varied between zero and four calls until July 2012 (figure one).

In the last two months there has, however, been a dramatic rise in calls; calls per month increased from three in July, nine in August to thirteen in September. Products reported in these three months were overwhelmingly identified as ‘K2’. Analogues identified in new products introduced to the market since August 2011 have been regularly added to the Gazette, but there have not been any further inclusions since July 2012 (as of October 07, 2012), which may, in part, explain this increase.

Once these analogues have been added, there should be a subsequent decrease in use in the community, which will be reflected in calls to the NPC. In the meantime, we wish to draw the attention of healthcare professionals to this trend, which is resulting in patient presentations to Emergency Departments with the additional burden on ED staff and resources.
Figure 1. Calls received by the National Poisons Centre on synthetic cannabinoids (October 2010 to September 2012)

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References:


Admission to Medicine at the University of Auckland

Why were there no less than three articles in the 7 September 2012 issue of the NZMJ about the selection process for the admission of candidates to Auckland Medical School?

As outlined in these articles in the NZMJ,1-3 entry to our medical schools is judged on a number of criteria.

There are ‘affirmative’ pathways. These attract their specific critics. Most would support the entry of ‘culturally fluent’ applicants. For some, an applicant’s heritage or place of upbringing becomes a useful tool to gain entry through the affirmative pathway. The rural pathway has a wide inclusion base, “in the hope” that students will return to their rural communities, as stated on the Auckland University website earlier this year. For this process there is no bonding, and no undertaking of commitment to return back to that rural community. Yet the applicant may be accepted with lesser grades than those required on average.

For the rest, the major criterion for admission to medical school is the GPA (Grade Point Average). Undergraduate entry is based on a prescribed course at both Auckland and Otago Universities. The GPA is finely dissected out using a 9-point scale. At least each school is comparing students who have done the same courses, comparing like with like. It is an equal process.

Poole3 talks about a GPA above 6 as a basic requirement. In reality, it is more like 8 for current applicants. Most of my colleagues are firmly of the opinion that they would not have a chance of getting in to our medical schools if they were to apply today. It seems the bar has been lifted considerably.

At postgraduate level, the GPA remains the major weighting factor. But how does one realistically compare different degrees from different universities and apply the same fine 9-point weighting system for grades obtained? An A+ weighting from one university might equate to an A or even an A- from another. Surely this is comparing apples with oranges and perhaps lemons as well.

Crampton1 states that the GPA is the most reliable tool for predicting future academic performance. Postgraduate students have already proven their academic ability. Should they still be subject to a 9-point rating system when their grades are not comparable?

UMAT speaks for itself; it is not popular with students. There are ways and means of getting around this hurdle, introducing further inequality to the selection process. Do we see the universities informing prospective students where they can get ‘coaching’ to improve their scores, or providing advice as to how they do this, or financial advice for this?

Then there is the interview, the major point of difference between the two New Zealand medical schools, with Otago opting not to employ an interview, except for the few students gaining entry through the ‘other’ category. Is there a significant difference in the outcomes of the graduates from the two schools at the end of the day?

For a very few it serves a useful purpose,2 but for the majority it is a lottery. As stated, the interview process has variable reliability. There is no standardisation of the questions asked.
Some of the questions are ridiculously hard. Ethics is never an easy topic, and to have a candidate quizzed at length on difficult ethical issues is hardly relevant at a time when they are young, inexperienced and nervous.

But not every interviewer probes such challenging issues. The personality and perspective of any individual interviewer appears to play a significant role in the conduct of the interview. Subjects and topics appear to be discussed at random, both in content, and with respect to the interaction and responses of the interviewer.

Poole\(^3\) talks about measures to enhance reliability. The evidence for interview reliability is hard to find. If the interview is retained then why not modify this to a process proven to have greater reliability and validity. Multiple Mini Interviews (MMIs) or similar processes have more reliability and better predictive powers. This offers the chance to standardise the interview process. Other universities employ this interview process.

These selection processes have been criticised both in the popular press, and by politicians. *North and South*, July 2011 edition, had a large focus on the changing ethnicity of medical students. While Auckland defends its selection process, stating the ethnicity of admissions reflects the ethnicity of its secondary schools and the Auckland population, one must remind them they are supplying graduates for all of New Zealand, not just the Auckland region.

Perhaps the good old lottery is a fairer process. We all understand a true lottery. Biases in the current system are considerable, with first-year GPA being the only consistent validated assessment tool. So given all this, the present process remains just that, a lottery.

Brigid Loughnan
General Practitioner
Christchurch

References:
Multiple nutrient insufficiencies—hypovitaminosis D and C in young adult New Zealand males

Vitamins D and C are essential micronutrients with a number of important functions in the body.\(^1,2\) Vitamin D deficiency is particularly common in New Zealand, especially during the winter months.\(^3,4\)

We recently carried out a study in >50 young adult males (aged 18–35) measuring both their vitamins D and C status. Their mean serum 25-hydroxy vitamin D\(_3\) concentration was 47±21 nmol/l.

Overall, 62% of the young males had suboptimal vitamin D levels (<50 nmol/l), and 13% were moderately to severely deficient (<25 nmol/l). Of note, nearly 20% of the males had suboptimal levels of both vitamins D and C (<28 µmol/l vitamin C). This latter observation could indicate either an \textit{in vivo} association between vitamins D and C status or independent multiple nutrient insufficiencies.

The active form of vitamin D is synthesised from vitamin D\(_3\) via two hydroxylation steps to sequentially produce 25-hydroxy vitamin D\(_3\) and the bioactive 1,25-dihydroxy vitamin D\(_3\).\(^5\) Although vitamin C is a cofactor for a number of biosynthetic and regulatory enzymes which form hydroxyl groups on specific amino acids and proteins,\(^6\) it does not appear to act as a cofactor for the cytochrome P450 hydroxylases involved in vitamin D synthesis. However, it is possible that vitamin C may affect the level of cytochrome P450 gene expression,\(^7\) thus a positive association between vitamins D and C status may be expected.

In our study we observed only a very weak positive correlation between the subjects’ plasma vitamin C and serum 25-hydroxy vitamin D\(_3\) levels (\(R=0.116, \ P=0.246, n=101\)). Furthermore, only small (~5 nmol/l) non-significant increases in vitamin D levels were observed in the subjects following 6 weeks supplementation with 50 or 200 mg/d vitamin C (supplied as tablet or kiwifruit).

Another clinical trial supplementing ~30 critically ill patients with 1 g/d vitamin C also found no effect on their plasma 25-hydroxy vitamin D levels, i.e. they remained at ~50 nmol/l.\(^8\) In addition, a recent observational study carried out in ~1000 men and women found no association between circulating 25-hydroxy vitamin D and tertials of vitamin C.\(^9\)

Thus, there appears to be no discernible \textit{in vivo} association between vitamins D and C. It should be noted, however, that it is unknown whether the measurement of 25-hydroxy vitamin D\(_3\) levels is an accurate estimate of the levels of the bioactive 1,25-dihydroxy vitamin D\(_3\).

Overall, the hypovitaminosis D and C observed in our study participants is likely due to dietary and sunlight insufficiency. The implications of having both hypovitaminosis D and C are unknown, but it is likely to potentiate conditions which have deficiencies of both these vitamins in common.\(^1,2\)

As such, it is critical that young people are appropriately educated with regard to adequate dietary intakes of high vitamin C containing fruit and vegetables and, since most adults are
unlikely to obtain more than 5–10% of their vitamin D requirement from dietary sources, appropriate exposure to sunshine.

Appropriate nutrition in the younger population will likely prevent much onset of chronic diseases in later life.

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References:

Cholesterol levels have negligible correlations with cardiovascular incidents

For some years I have been working on databases trying to find a way of reducing the error in estimates of cardiovascular risk. One of the results that puzzled me is the very low correlations between individual predictors used for this purpose and cardiovascular incidents (CVIs).

My first order correlations of date of birth and the blood pressures are about only 0.1 with CVIs while total cholesterol and high density lipoprotein (HDL) both yield correlations of less than 0.08. I had detected similar values in a much larger sample some years ago but I was still interested to see what discriminant analysis could do with them.

My result of 94% of CVIs correctly predicted was much greater than the most popular existing methods, but the ratio of false positive predictions to true positives of almost 3 to 1 overall was a concern.¹ That is, although I could identify most of the likely cases, the accuracy was not much better than chance! Which shows that we do not yet have a satisfactory way for calculating cardiovascular risk.

Since then, further inspection of the data has shown that neither cholesterols had a significant relationship with strokes but were significant for heart attacks. But this significance is obtained only because the sample is big enough to detect the very small effect.

Mean differences in cholesterol levels between those having CVIs and those who had none show that the relationships between the predictors and CVIs are tiny at best. One can only speculate as to why this has been overlooked, but the mechanics of what occurred can be explained thus. The sample size required to just detect the significant relationship between total cholesterol and heart attacks was about 1000. This is because a $z$ value around 4 with a sample of 2000 requires an effect size of less than 1% for significance.

The relationship in the population between the cholesterols and CVIs can be obtained by calculating the estimate of omega-squared ($\Omega^2$).¹ This confirmed that the effect size (strength of association or amount of variance accounted for) in the population of the total cholesterol/heart attack–myocardial infarction (MI) relationship is less than 1%.

If a relationship between two variables is so small that it takes a sample of 1000 cases to detect it then its practical usefulness is highly questionable.

The results of contrast tests, using the cholesterol data, between those who have had or have not had CVIs are shown in Table 1.
Table 1. Those who have had strokes or heart attacks compared with those who have not (* p < 0.001)

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Status</th>
<th>Number of cases</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Critical ratio Z</th>
<th>Omega-squared (percent)</th>
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<tbody>
<tr>
<td></td>
<td>Stroke</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total cholesterol</td>
<td>Yes</td>
<td>252</td>
<td>5.59</td>
<td>1.02</td>
<td>0.65</td>
<td>0.0</td>
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<tr>
<td></td>
<td>No</td>
<td>2050</td>
<td>5.63</td>
<td>1.02</td>
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<td></td>
</tr>
<tr>
<td>HDL cholesterol</td>
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<td>252</td>
<td>1.00</td>
<td>0.23</td>
<td>1.41</td>
<td>0.0</td>
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<tr>
<td></td>
<td>No</td>
<td>2050</td>
<td>1.03</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heart attack</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>Yes</td>
<td>369</td>
<td>5.87</td>
<td>1.02</td>
<td>4.82*</td>
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<tr>
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<td>No</td>
<td>1933</td>
<td>5.59</td>
<td>1.01</td>
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<tr>
<td>HDL cholesterol</td>
<td>Yes</td>
<td>369</td>
<td>0.97</td>
<td>0.23</td>
<td>4.70*</td>
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<td>1933</td>
<td>1.03</td>
<td>0.29</td>
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</tr>
</tbody>
</table>

From the results for this sample, any predictions or estimates of cardiovascular risk based on cholesterol levels will be highly inaccurate as will be correlations between them and other variables.

A corollary of this is that there seems little point in lowering cholesterol levels for people who have not had a cardiovascular incident. The number of people who are treated for high cholesterol levels is in the 20 to 30 millions worldwide, with high usage in Australasia. Apart from the costs and inconvenience, there are also the side effects that can arise.

To test this result, people with similar data could repeat the simple exercise reflected in Table 1 and report their results. I used data from the British Caerphilly study.¹

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Take it from me

Most general practitioners are now captive to at least four bureaucracies; the District Health Boards, the Primary Health Organisations funded by the District Health Boards, The Royal College of General Practitioners, and the Medical Council. There are other bodies. They keep budding off. There’s General Practice New Zealand, ‘an energetic, future oriented organisation with excellent government and health system relationships.’ An optional extra? Do your own work on that one.

A lot of primary medical care is supplied by the Casualty Departments of the public hospitals, where the expenses are without fuss transferred to the taxpayer. Out on Main Street, the costs have never been greater, and I do not see any of the listed bureaucracies having the will or desire to bring them down. Take the Medical Council. The fee to be paid to the Council for registration is $733.82c. Doctors with a pathetic “general registration” are currently being billed for recertification as well. Hospital doctors have managed to avoid the direct impost.

The extra fee demanded for recertification, an entirely new proposal in the hands of a “non-profit” thing called BPAC, is $1,200.00 plus GST $180.00 = $1,380.00. The total of those two demands is $2113.82 per annum. That burdens the hapless generalist with a fixed overhead expense of $40.65 per week, but in fact it will come to much more than that if the doctor is to conform to the stringent new proposals. Since he has to pay in advance for something he knows little about, one might have thought that there was a fair trading side to this. No one has said anything so far.

Now to the Royal College of General Practitioners, claiming about 90% of general practitioners as members. It would like to have them all. A doctor arriving here recently from the UK with provisional registration found that she had to work initially in a practice certified by Cornerstone, a monster under College control.

For those earning $60,000 or less, the levy is $729.00 per annum. If you are a Fellow, a Distinguished Fellow, or you have vocational registration, you will pay $972.00. Recent graduates pay $486.00. Does anyone ask the authorities what they do with the money? What are the rules for an annual report and balance sheet? Yes, you will have to meet the requirements of CME, that is to say, Continuing Medical Education. The College has a messy website, but if you persevere, you can pick up a few of the signals.

I asked a GP with generalist registration why he was willing to put up with BPAC. He tersely replied, “The alternative is worse.”

Things must be grim out there, but don’t tell the Minister. Just raise the fees. Take it from me. There is no other way.

Roger M Ridley-Smith
Retired GP
Wellington
Presidential Address: ‘A State service will eventually evolve’


Ours is a philanthropic profession; at least we consider it such, and the public take us at our own estimate, and sometimes a little over. We attend public hospitals and clubs, educate nurses, found associations for the purpose of relieving distress at less than cost price, and so arrange it that all our methods devised to benefit the poorer public are turned against ourselves and taken advantage of by unscrupulous persons for whom they were never intended. Is it not time that the medical profession took some steps to check the abuses, that are all too frequent and which, if allowed to run riot, are as injurious to the public as they are ruinous to the profession; and which if continued, will lead to inferior men entering it. Our profession is no doubt passing through a transitional stage.

The ultimate goal I cannot be sure of, but possibly something of the nature of a State service will eventually evolve, in which medical men will receive a fixed salary and a pension. This would no doubt have its disadvantages, but I fancy would have the effect of abolishing many of the disadvantages which seem to be inseparable from present day practice of which I could give many illustrations. It would certainly be more logical from the standpoint of preventive medicine, which is without doubt a prominent feature of the present and the future, but might tend to diminish individual effort.

Some one has said that destructive criticism is easy. This is no doubt true, and if in the attempt I have made to expose what I consider fallacies, I must ask your indulgence on that ground, as I told you earlier, that it was difficult to select a subject and more difficult to deal with it. I have been at some trouble to point out evils. Now if you will kindly afford me a few more minutes I will attempt to offer a few suggestions as regards prevention. I am quite aware that it is not the same to give advice to the poor as it is to the well to-do, but I shall give it nevertheless, the principle being the same in both cases. The means are a matter of detail, which must be found.

First. It is the duty of every grown person to be medically overhauled once a year at least, and this applies to the teeth also. Every child should be submitted to the same medical and dental examination once a year.

Second. The mentally unfit must be controlled, and the same applies to the feeble-minded and criminal. The details of this must be thoroughly worked out and radically applied. All schools, public and private, should be placed under thorough medical supervision and frequently and thoroughly cleansed. I think it would be a good plan to conduct open-air teaching when weather permits.

Third. No alcohol in any form should be used by people under 21. By that time no habit will be formed and the moral resisting power of the individual will come into play. I think the existing laws, if properly enforced, are quite sufficient to control the use of alcohol.
Dynamics of myogenic progenitors in the rat hindlimb – a role for innervation. B Hurren, M Duxson. Department of Anatomy, Otago School of Medical Sciences, University of Otago, Dunedin.

Development of a functional relationship between nerve and muscle is important both embryonically and throughout postnatal life. A breakdown of this relationship can lead to diseases such as motor neuron disease and muscular dystrophies. In order to better understand the relationship between developing muscle and nerve, we used the rat as an animal model to investigate the effect of a chemical denervation in utero on the development of muscle progenitor cells expressing the paired homeobox genes Pax3 and Pax7 - which are early markers of the limb myogenic lineage.

In normal embryos, immunohistochemical examination showed that Pax3+ve progenitors were first seen in the hindlimb at embryonic day (E) 12.5, followed by Pax7+ve progenitors one full day later at E13.5. The nerve entered the limb at the same time and in close proximity to the first Pax7+ve progenitors. Denervation in utero by injection of beta-bungarotoxin (BTX) into the embryonic peritoneum at either E15.5 or E16.5, followed by immunohistochemical examination of extensor digitorum longus (EDL) and tibialis anterior (TA) muscles either 24 h or 48 h later, revealed a decrease in the number of Pax7+ve progenitors compared to controls (e.g. at 48 h: control TA / EDL: 248.8 ± 5.3 / 123.7 ± 3.6, BTX TA / EDL: 218.5 ± 3.4 / 85.1 ± 2.2, P < 0.0001, n = 6, Student’s t-test). Concurrently, after denervation we saw an increase in the number of cells expressing myogenin (a marker of muscle differentiation) and increased apoptosis of Pax7+ve progenitors (assessed by active caspase-3 labeling). Quantitative PCR analysis corroborated these findings, with many genes associated with differentiation and apoptosis being upregulated, and genes associated with proliferation and cell cycle regulation being downregulated after denervation.

From these results, we conclude that differentiation and survival of Pax7+ve myogenic progenitors is critically dependent on developmental interactions with the muscle nerve.
Immunisation using a sustained release vaccine generates CD8 T cell memory population in the gut. A Highton\textsuperscript{1}, A Girardin\textsuperscript{1}, S Hook\textsuperscript{2}, R Kemp\textsuperscript{1}. \textsuperscript{1}Department of Microbiology and Immunology, Otago School of Medical Sciences, \textsuperscript{2}School of Pharmacy, University of Otago, Dunedin.

Understanding how to generate an effective memory population of quantity, quality and in the correct biological location is key in having a good vaccination method. Further, it is apparent that, although humoral immune responses conferred through current vaccination methods are effective, in many cases there is still a need for vaccination that will confer a cytotoxic CD8 T cell response. We investigated the generation of murine CD8 memory T cells using a sustained antigen release vaccine vehicle (chitosan gel) and conventional dendritic cell (DC) vaccination. The aims of this work were to evaluate the efficacy of sustained release vaccines and to compare their ability to generate peripheral versus gut associated CD8 T cell memory.

Mice were vaccinated subcutaneously with chitosan gel ± ovalbumin or DCs pulsed with ovalbumin. After 30 or 60 days mice were euthanised and cells harvested from peripheral or gut associated lymphoid tissues were phenotyped using flow cytometry and assessed for functional cytotoxicity. We found higher numbers of CD8 memory T cells specific for ovalbumin in both peripheral and gut associated lymphoid tissues after vaccination with chitosan gel compared to DC vaccination (mean ± SEM, 38827 ± 6260 and 10416 ± 2178 cells, respectively, n = 3). Vaccination with chitosan gel, but not DCs, showed a cytotoxic response \textit{in vivo} up to 60 days. Interleukin-7 receptor expression, important for memory cell survival, differed between peripheral and gut associated memory T cells after chitosan gel vaccination (median fluorescence intensity ± SEM, 172 ± 8 and 221± 33 respectively, n = 3).

These results indicate that subcutaneous vaccination using chitosan gel can generate a population of functional CD8 memory T cells in gut associated lymphoid. This form of vaccination could be an easier way to induce immunity in sites that are not easily accessible such as the gut.

Understanding the mechanisms behind levodopa-induced dyskinesias. L Smith\textsuperscript{1}, E Duncan\textsuperscript{2}, L Parr-Brownlie\textsuperscript{1}, M Black\textsuperscript{2}, P Dearden\textsuperscript{2}, J Reynolds\textsuperscript{1}. \textsuperscript{1}Department of Anatomy and the Brain Health Research Centre, \textsuperscript{2}Department of Biochemistry, University of Otago, Dunedin.

Levodopa is the gold standard pharmacotherapy for Parkinson's disease. However with prolonged use abnormal involuntary movements known as levodopa-induced dyskinesias (LIDs) develop in up to 80% of patients. The mechanism underlying LIDs and why some patients do not develop them is unknown. The aim of this project was to determine the gene expression profile associated with the presence of LIDs using a rodent model of Parkinson's disease.

Adult male Wistar rats received an intracerebral injection of the neurotoxin 6-hydroxydopamine to lesion the dopamine system unilaterally. Successful lesioning was verified using behavioural tests, and confirmed post-mortem using immunohistochemistry. Two weeks post-surgery, rats received treatment with levodopa (L-DOPA methyl ester; 3-4 mg/kg s.c.) and benserazide (7.5 mg/kg s.c.) or benserazide only (control) twice daily for three weeks. This regimen induced dyskinesias in half the levodopa treated rats, determined by a rodent scale of abnormal involuntary movements. Following levodopa dosing, tissue
was sampled from the lesioned striatum and RNA extracted for next-generation sequencing. To minimise biological variation, RNA was examined in two pools of three rats per condition (dyskinetic, non-dyskinetic, control; n = 6 per condition). Gene expression in these samples was measured using RNA-seq on the Illumina HiSeq 2000. Sequences were mapped to the rat genome with annotation RGSCv3.4.65. Differential expression analysis was performed using Baggerly’s test, with a false discovery rate threshold of 0.05 used to determine significance.

One hundred and fifty-nine genes were significantly differentially expressed between dyskinetic and non-dyskinetic rats; ninety-seven genes between dyskinetic and control rats. Gene Ontology analysis using Ingenuity Pathway Analysis software revealed changes related to GABA receptor signalling and calcium signalling. Overall, these results show that LIDs alter many aspects of neuronal signalling and function, which may underlie motor effects observed in Parkinson’s patients.

Orthopaedic biomaterials: Does magnesium have a promising future? S Shadanbaz1, J Walker1, M Staiger2, T Woodfield3, G Dias1. 1Department of Anatomy, University of Otago, Dunedin. 2Department of Mechanical Engineering, University of Canterbury, Christchurch. 3Department of Orthopaedic Surgery and Musculoskeletal Medicine, University of Otago, Christchurch.

Magnesium (Mg) is a lightweight metal with degradable properties that has been suggested as a revolutionary replacement of current inert metallic materials. Advantages include osteogenic properties, biocompatibility and an elastic modulus comparable to human bone. However, if the corrosive nature of Mg is not controlled, premature mechanical failure and/or excess hydrogen production with resultant tissue damage and retardation of healing. This study investigates the application of brushite and monetite calcium phosphate coatings to improve the corrosion behaviour and biocompatibility of Mg substrates.

In vitro immersion tests were carried out in Earle’s balanced salt solution (EBSS), minimum essential media (MEM) or MEM with protein (MEMP) for 7, 21 or 28 days. In vivo assessment involved the subcutaneous implantation of samples on the dorsal region of Lewis rats for 3, 6, 9 and 12 weeks. Further in vivo investigations included intraosseous implantation in both cortical and cancellous bone of Romney Cross sheep. Corrosion was assessed via gravimetric analysis or volume loss and biocompatibility was assessed histologically using a haematoxylin and eosin (H&E) stain.

In vitro immersion tests showed a maximum weight loss of 10% for naked magnesium, 6% for brushite, and 4% for monetite at 28 days. Monetite coatings improved corrosion resistance in EBSS (P < 0.05, n = 3) and MEMP (P < 0.01, n=3) compared to naked controls. A protective trend was also observed in MEM. Similarly, brushite provided significant corrosion protection (P < 0.05, n=3) in MEMP with a protective trend seen in other solutions. Subcutaneous investigations demonstrated monetite provided significant corrosion protection over 3 months (P < 0.05, n=6) with a trend towards improved resistance with brushite (all statistics performed were ANOVA with Bonferroni post-hocs). Preliminary analysis of subcutaneous and intraosseous histology illustrated that both coatings reduce corrosion and improve biocompatibility.

Our findings indicate that calcium phosphate coatings may be an effective way of improving Mg properties for future clinical application of biomaterials of this nature.
Induction of hypertension blunts baroreflex inhibition of vasopressin neuron activity in Cyp1a1-Ren2 (inducible hypertensive) rats. S Han¹², D Schwenke¹, C Brown¹².
¹Department of Physiology and the ²Centre for Neuroendocrinology, Otago School of Medical Sciences, University of Otago, Dunedin.

When blood pressure acutely increases, vasopressin secretion decreases as part of the corrective baroreflex response. However, in some hypertensive individuals, vasopressin level is paradoxically increased, despite chronically-elevated blood pressure. Here, we investigated the mechanisms that underpin the paradoxically-increased vasopressin level using transgenic Cyp1a1-Ren2 rats, which develop moderate angiotensin II (ANGII)-dependent hypertension when fed 0.225% indole-3-carbinol (I3C) over seven days.

Extracellular single-unit recordings of vasopressin neuron firing rate were made from urethane-anaesthetised Cyp1a1-Ren2 rats fed ordinary diet (CYP) or 0.225% I3C for seven days (HD7). The vasopressin neuron firing rate was higher in HD7 rats (8.8 ± 0.8 spikes s⁻¹; mean ± SEM, n = 22) than in CYP rats (6.1 ± 0.5 spikes s⁻¹; n = 30; P = 0.004, unpaired t-test). Intravenous injection of the α₁-adrenoreceptor agonist, phenylephrine (PE, 2.5 µg kg⁻¹), inhibited vasopressin neurons in CYP rats (by 61.9 ± 8.2%, n = 15) but not in HD7 rats (15.4 ± 15.5%, n = 13; P = 0.01), despite a similar increase in blood pressure. Intra-subfornical organ (SFO) infusion of the ANGII-receptor antagonist, losartan (5 µg hr⁻¹), during the induction of hypertension did not affect the development of hypertension or the increased vasopressin neuron firing rate (8.8 ± 1.4 and 9.7 ± 1.3 spikes s⁻¹, n = 17 and 36 in vehicle- and losartan-treated HD7 rats, respectively; P = 0.66, unpaired t-test). Similarly, intra-SFO losartan infusion did not affect phenylephrine-induced vasopressin neuron inhibition (36.7 ± 9.1 and 28.7 ± 9.2%, n = 15 and 27 in vehicle- and losartan-treated HD7 rats, respectively; P = 0.57, unpaired t-test).

Hence, induction of ANGII-dependent hypertension likely increases vasopressin neuron activity via reduced baroreflex inhibition, rather than by activation of ANGII-sensitive afferent inputs. Therefore, reduced baroreflex gain might exacerbate hypertension, in part, by increasing vasopressin-induced vasoconstriction and water retention.

Association of non-specific low back pain with physical activity, smoking and food choices in New Zealand adolescent females. N Mehta¹, G M Johnson¹, P Skidmore², M Skinner¹, S Milosavljevic¹. ¹School of Physiotherapy, ²Department of Human Nutrition, University of Otago, Dunedin.

The emerging literature indicates the trio of low PA, smoking and poor diet is associated with the most common musculoskeletal disorder, low back pain (LBP). Our aim is to investigate whether a combination of more than one can significantly increase the risk of developing non-specific low back pain (LBP) in adolescent females, which was investigated in this study.

An online cross-sectional survey was completed by 307 girls (mean age 14.8 ± 1.2 years) from six Otago schools. Data were collected on prevalence of LBP (current, within past month, 6 mth, 1 y, 3 y); smoking history (current, lifetime), PA and food choice. Participants reporting LBP on three or more distinct occasions were further classified as having recurrent LBP. PA was classified by participants meeting national recommendations for moderate to
vigorous PA (MVPA) or not. Usual frequencies of food consumption using indices for fruit and vegetables (FV), fibre foods, calcium foods, treat foods and an overall dietary variety index were calculated.

The results showed that the recurrent, past month and point prevalence of LBP were 37.6%, 25.6% and 15.2% respectively. The prevalence of lifetime smoking was 19.8%; 4.5% were current smokers. Less than one-third of the participants met the MVPA recommendations; 46% met daily FV consumption guidelines and 24.4% consumed treat foods on at least five days/week. Multiple logistic regression showed a significant association for PA, odds ratio (OR) = 1.80 [confidence interval (CI), 1.03 - 3.16, \( P = 0.03 \)] and lifetime smoking OR = 1.94 [CI, 1.03 - 3.64, \( P = 0.03 \)] with LBP in the past month, whereas their association with recurrent LBP was not significant. No significant associations were found with any food variables.

In conclusion, adolescent females who meet the MVPA criteria and are lifetime smokers have a higher risk of developing LBP irrespective of their dietary habits.
Proceedings of the Waikato Clinical School Biannual Research Seminar, September 2012

Fetal anaemia impairs heart growth and increases indices of cardiovascular risk in adult survivors of intrauterine transfusion. Alexandra Wallace, Liggins Institute, University of Auckland; Stuart Dalziel, Starship Children’s Hospital, Auckland; Kent Thornburg, Heart Research Center, Oregon Health and Sciences University, Portland, Oregon; Jane Harding, Liggins Institute, University of Auckland

Background: In sheep, fetal anaemia alters coronary conductance, flow and architecture in adulthood. It is not known whether similar changes occur in humans.

Objectives: To compare cardiovascular function of adults who received intrauterine blood transfusion for treatment of fetal anaemia with that of their unaffected siblings.

Method: Participants were individuals who received intrauterine transfusion at National Women’s Hospital from 1963-1992, and their unaffected sibling(s). Assessments included anthropometry, blood pressure, complete blood count, lipids, oral glucose tolerance test, heart rate variability analysis and cardiac MRI. Data were analysed using multiple regression adjusted for age, sex and birth weight z-score.

Results: Results are available from 187 participants in 88 sibling groups. Affected participants were younger than unaffected, born at lower gestation and of lower birth weight. Compared to unaffected siblings, affected participants had decreased end diastolic, end systolic and stroke volumes and a trend to decreased left ventricular mass index. They also had reduced high density lipoprotein concentration and augmented sympathovagal tone with increased low frequency to high frequency (LF/HF) ratio on assessment of heart rate variability.

Discussion: These findings suggest that heart growth is impaired by fetal anaemia with reduced cardiac chamber size in adulthood. A relatively smaller heart implies reduced cardiomyocyte number and greater work per unit of myocardium. In addition, reduced high density lipoprotein and augmented sympathovagal tone in affected participants suggest increased cardiovascular risk. These findings provide the first evidence in humans that fetal anaemia may have deleterious consequences for cardiovascular health in adulthood.

Use of Change in EEG Photo-Paroxysmal Response to Rapidly Predict Chronic Anti-Epileptic Drug Efficacy: A Double-blind Placebo Controlled Study of Lamotrigine vs. Sodium Valproate in Juvenile Myoclonic Epilepsy. Paul L. Timmings, Waikato Clinical School, University of Auckland School of Medicine, Hamilton, New Zealand

Rationale: Juvenile Myoclonic Epilepsy (JME) is a common IGE but therapy is fraught with problems because optimal treatment involves sodium valproate (VPA). Particular difficulties arise in selecting appropriate therapy for women of child bearing age because of risks of spina-bifida, other malformations and reduced IQ in their children.
For many of these patients prolonged trials of therapy to prove efficacy are not a viable option. Methods to rapidly assess likely effectiveness of alternative therapies are needed.

We propose that change (and suppression) of the EEG Photo-Paroxysmal-Response (PPR) would provide an early indicator of efficacy.

**Methods:** We designed a 20 wk 1:1 randomised double blind 1-way cross-over parallel group study to compare VPA and LTG monotherapy in JME patients. At 4 weekly visits; trough AED concentrations, seizure frequencies & types, PPR during IPS and adverse effects were recorded. Only “Waltz” grade 3 or 4 PPR’s were included. Standardisation of the IPS responses was carried out by use of a standardised IPS protocol to define lower and upper photoparoxysmal response frequencies, which were then converted to a “SPR” by calculating the number of standard stimulation frequencies at which a PPR was elicited (Kasteleijn-Nolst Trenite et al., 2012).

**Results:** 74 JME patients were identified. All gave informed consent. Ethics approval was obtained prospectively. 40 were taking VPA monotherapy. 17 VPA treated patients agreed to enter the study (M:F=13:4), nine of whom had PPR on previous EEG. At study entry 4 exhibited a persistent PPR.

At study end 2 VPA treated patients still had PPR’s and 4 LTG treated patients had PPR’s. All the LTG PPR’s were higher than baseline. In the LTG group the PPR had risen and trended down again as dose was increased (Figure 1). In the LTG group myoclonic seizures had increased markedly but returned to baseline levels by study end associated with progressive LTG dose increases (Figure 2).

**Conclusions:** LTG initially suppressed PPR less effectively than VPA but a dose-response effect of LTG on PPR was identified. Efficacy of LTG for all types of JME seizures was demonstrated, also with a dose-response relationship. Increased LTG doses appeared to overcome transient worsening of myoclonus.

Change in PPR did correlate with LTG effect and may be utilised as an early indicator of efficacy.

**Figure 1**

![Figure 1](attachment:figure1.png)

New Zealand (NZ) has 9th highest age standardised breast cancer incidence and mortality in the world. Maori women fare even worse with a 30% higher incidence and 60% higher mortality compared to NZ European women. The Waikato Breast Cancer Register (WBCR) is a comprehensive population based database of breast cancers diagnosed in the Waikato since 2005.

From 2005-2011, 95.7% (1478) women with newly diagnosed primary breast cancers consented to entry in to WBCR. Invasive cancers were diagnosed in 1279 (86.5%) and in-situ cancers in 199 (13.5%) women. Majority of patients (~80%) were of European origin with Maori women making up just over 15%. Of the women diagnosed with breast cancer who were within the screening age (45-69 years, n=975), 60% were screen-detected cancers. Maori women were less likely to present with a screen-detected cancer compared to NZ European women (50% vs 63.5%, p<0.01). Maori women were of younger mean age at diagnosis (55.3 vs 61.3 years, p<0.01), presented with more advanced cancers and underwent less breast conserving surgeries (56.7% vs. 45%) compared to NZ European women.

Out of the women undergoing primary surgery with a curative intention (n=1282), Maori women had a longer delay between histological diagnosis and first surgical intervention compared to NZ European women (44.7 vs 36.9 days, p<0.01). Significantly lower proportion of Maori women (69.9% vs 61.1%, p=0.03) underwent primary surgery within a period of 6 weeks compared with NZ European women. No significant difference was observed in time gap between BreastScreen Aotearoa (BSA) and patients diagnosed outside BSA. Multivariate analysis showed increasing age (p=0.02, OR= 1.47) and Maori ethnicity (p=0.03, OR=1.63) to be predictors of a delay of more than 6 weeks. It also showed a significant reduction in delay across all ethnicities over the period 2005 -2011.

Maori women with breast cancer were found to have a significantly lower mean age, lower chance of being diagnosed through screening and longer mean delay from diagnosis to surgery compared to NZ European women. Maori women and women of older age had a
higher risk of a delay of >6 weeks. Overall, a significant reduction in treatment delay was observed over the study period. These delays in surgical treatment possibly combined with other accumulated delays along cancer care pathway could contribute towards poorer outcome from breast cancer among Maori women.


Introduction: Approximately 5% of all CT and MRI scans, which include the adrenals, will demonstrate an incidental adrenal lesion. Whilst most of these are likely to be benign, non-functioning adenomas some lesions may be malignant or have excess hormone production.

Aim: To determine whether the investigation of incidentally identified adrenal lesions at a large New Zealand teaching hospital is consistent with current international guidelines.

Methods: A retrospective study was performed using a key phrase search of all CT and MRI reports from 1st December 2009 to 1st January 2012 to identify all patients identified as having an incidental adrenal lesion.

Results: A total of 125 patients with incidentally found adrenal lesions were identified. Patients with known metastatic disease were excluded from further assessment, leaving 74 patients in whom further workup was likely to be appropriate. Of this group 19 (26%) were referred for further investigation to endocrine service of whom only 17 patients attended for further assessment. In total 17 (23%) patients had complete biochemical work-up and 21 (28%) had appropriate imaging follow up during the time period. The reporting radiologist provided advice for follow up in 31/74 (42%) of cases. When advice for biochemical evaluation or endocrine follow up was given this resulted in further investigations in 8/11 (72%) cases; however advice for imaging follow up was adhered to in only 9/20 (45%) of cases. Of the 15 patients who were referred and assessed at an endocrinology clinic 2/15 (13%) were found to have clinically significant lesions (1 Cushing’s syndrome and 1 plasmacytoma).

Conclusions: This study suggests that in clinical practice, work up of adrenal incidentalomas is poor and the majority of patients are not being investigated according to current international guidelines. The reporting radiologist’s recommendation appeared to strongly influence further investigations and management of these patients. Despite the low number of patients that underwent further assessment, significant pathology was identified in two suggesting that it is important to investigate these lesions.

Development of a Risk Assessment Tool to evaluation the risk of experimental Monoclonal Antibodies to Healthcare Staff. Ragupathy R1, Eaden A1, Young M1
1Pharmacy Services, Waikato District Health Board

Introduction: Many clinical trials use experimental monoclonal antibodies (MABs), for indications ranging from cancer and neurological disease to psoriasis. The toxicity and antigenicity of experimental MABs are not always fully understood.

Relatively little attention has been paid to the risk posed to healthcare staff by occupational exposure to such compounds. The antigenic nature of MABs means that risk is not
necessarily dose related, and nor can risk be extrapolated from experience with related compounds. Furthermore, adverse effects may only become apparent after prolonged exposure.

**Aims:** 1) To identify tools for evaluating the occupational risks posed by MABs in common use. 2) To adapt these tools to enable evaluation of the risk of experimental MABs.  

**Methods:** A systematic literature search was performed in June 2012 (MEDLINE, PUBMED, E-JOURNALS and Google). Risk assessment tools developed by other authors [1,2] were adapted for use with experimental MABs.

Each experimental MAB received two risk scores: 1) **Health and Safety Risk Assessment** (composed of toxicity and antigenicity, weighted by clinical trial phase and the disease the compound is intended to treat). 2) **National Patient Safety Agency Risk Assessment** [3] (risks in aseptic reconstitution and administration, using information from clinical trial documents).

These risk scores were combined to create an over-all risk category for each experimental MAB.

**Results:** Using this methodology, experimental MABs can be separated into three categories. 1) Compounds which should be prepared in an aseptic isolator or cabinet that may also be used to compound cytotoxic drugs. 2) Compounds that should be prepared in an aseptic facility but separated from cytotoxic drugs. (If these are prepared in the same cabinet or isolator, appropriate cleaning measures should be used to minimise cross-contamination). 3) Compounds that may be prepared on a bench within a ward or pharmacy setting using personal protective equipment and/or closed containment systems.

**References:**


**Bacteria from the outer ear in middle ear infections. Rebecca White (1), Tony Cecire (2), Ray Cursons (1). 1) Molecular Genetics, University of Waikato; 2) Department of Otolaryngology, Waikato Hospital.**

*Alloiooccus otitidis* has appeared regularly in otological literature for more than 20 years. As a commensal of the outer ear canal, questions arise as to its role in middle ear infection. How it can enter the middle ear is a mystery particularly in children with intact tympanic membranes.

**Background:** Bacteria usually enter the middle ear via the Eustachian tube because they reside in the nasopharynx. We have questioned whether *Alloiooccus (Ao)* may reside – even temporarily – in the nasopharynx of children with otitis media. If so, perhaps other outer ear commensals can reach the nasopharynx. *Turicella otitidis* (To), *Corynbacterium auris* (Ca) are 2 outer ear commensals which have also been found in middle ear fluid.

**Materials and Methods:** *Materials* - We compared the bacteriological profile of children with middle ear effusions to a group of children with no history of middle ear infection. In
both groups we compared the proportion of 3 outer ear bacteria (Ao, To and Ca) to that of the 3 most common bacteria of the nasopharynx (Streptococcus pneumoniae, Haemophilus influenzae and Moraxella catarrhalis – Sp, Hi and Mc). Swabs were taken of the ear canals and the nasopharynx of both groups. In the group of children with middle ear infection, middle ear fluid was also aspirated at the time of inserting grommets. Methods – Bacteria were identified by nested PCR on specimens collected.

Results: We found that both outer ear commensal bacteria and nasopharyngeal bacteria were present in their respective sites in the same ratios found in previous studies. In the ear canals of both groups, Ao was the dominant bacteria followed by To then Ca. In the nasopharynx of both groups, Mc was the dominant bacteria followed by Hi and Sp. A surprising finding was the presence of Mc and Hi in the ear canals in both groups of children.

Conclusion: The presence of Mc and Hi in the ear canals may be due to contamination of the ear canals by nasal secretions via an external route (nose to hands to outer ears). Contamination should not result in uniform trends in the proportions of bacteria at various sites. Another mechanism to explain nasopharyngeal commensals in the outer ear canal and outer ear commensals in the middle ear may involve bacteria traversing the tympanic membrane in either direction.

References:


A three year analysis of the long term impact of High Dose Rate Brachytherapy in combination with external beam radiation therapy for Prostate Cancer on Quality of Life and Sexual Function. Dennis de Jong\(^1\), Helen M Conaglen\(^2\), Cris Hartopeanu\(^3\), John V Conaglen\(^2,3\), Leanne K Tyrie\(^3\). 1. University of Waikato, Hamilton, New Zealand; 2. Sexual Health Research Unit, Waikato Clinical School, University of Auckland, Hamilton, New Zealand; 3. Waikato Hospital, Hamilton, New Zealand

Introduction: Prostate cancer is one of the most common types of malignancy in men. It can be divided into low, intermediate and high risk depending on criteria such as Gleason’s score, PSA and clinical stage at diagnosis. High dose rate brachytherapy (HDR-BT) in combination with external beam radiotherapy (EBRT) is one method of treating the intermediate and high risk groups. Although this treatment is minimally invasive, it can have negative impacts on quality of life and sexual function. A prior two year investigation found that men did not recover their mean pre-treatment levels of quality of life and sexual function. Following on from that study, this analysis investigates the impact of HDR-BT and EBRT, on quality of life and sexual function at three years, utilising the construct of the Minimally Important Difference (MID) to examine why some men appear to recover from these treatments better than others.
Method: Baseline and three year follow-up quality of life and sexual function data from 50 men was analysed using a Wilcoxon Signed Rank Test in conjunction with the MID. Measures included the IPSS, EORTC QLQ-30, EORTC PR-25, and IIEF-5.

The analysis examined the changes for a) All of the men; b) Men who had changes less than MID; c) Men who had changes greater than MID.

Results: At three years, the effects of HDR-BT/EBRT resulted in distinct differences across all measures with the exception of the IPSS. Differences between baseline and 3 years were relatively small across all measures when all the men were included in the analysis. However, when grouped by MID, those men with changes less than MID experienced improvements in functioning and decreases in symptoms across most measures. In contrast, the men whose changes were greater than MID experienced declines in function and increases in symptoms across most measures.

Discussion: This finding goes some way to explaining the apparent ‘average’ lack of recovery at two years across the group, and indicates that there are two trajectories for men when undergoing HDR-BT/EBRT for prostate cancer. However, the findings raise the question of why some men do well, while others decline markedly despite the same treatments and no apparent differences in the 2 groups at baseline.

Familial clustering of Hirschsprung’s disease has no pattern. Miranda Bailey, Mathew George, Anne Kim, Stuart Brown, Askar Kukkady, Udaya Samarakkody Waikato Hospital, Hamilton, New Zealand

Purpose: Hirschsprung’s disease (HD) is a common condition treated in tertiary paediatric surgical centres. We analysed the pattern of disease in the familial clusters of HD.

Methodology: Patients with a family history of HD treated at Waikato Hospital from 1989 to 2011 were included. The demographics, family tree of the affected individuals, level of transition of aganglionosis, associated anomalies, outcome from surgical treatment, post operative incidence of enterocolitis and other complications, as well as genetic investigations when available were analysed.

Results: Seven familial clusters consisting of 13 patients fulfilled the criteria out of a total of 68 patients treated for HD. Two families were identified with affected individuals over multiple generations. The others included siblings and step siblings, first cousins from twin sisters and second cousins. There is a very strong male preponderance in this cluster (12/13). The age of diagnosis ranged from 2 days to 5 years despite the known family history. The level of transition was variable in the same generation as well as across generations. An unusually high incidence of Total Colonic Aganglionosis (TCA) was seen in this cluster (5/13) as compared to non familial HD. One patient’s level is not established. None had any associated anomalies. The long-term outcome following surgical treatment is remarkably good in all 13. Genetic results with mutations are available from only a limited number of family members. Both male and female carriers of the disease were identified from the family trees.

Conclusion: Familial occurrence of HD does not follow a pattern. Incidence of TCA is high. The outcome of surgical treatment is excellent. Treating clinicians should promote genetic testing actively.
News about three more drugs used in treating Alzheimer’s disease

A couple of months ago Pfizer learned that their biological drug bapineuzumab had failed to show any benefit in two large trials. Then, on 24 August, Eli Lilly said that its drug solanezumab had not hit its goal of significantly slowing the memory decline and dementia in Alzheimer’s patients. Both of the failed drugs targeted amyloid-β, a protein that forms plaques in the brains of patients with the disease and that has long been the prime suspect for causing it. In reviewing these disappointments, the director of Alzheimer’s research at the Mayo Clinic notes that targeting the amyloid plaques is appropriate but the treatments are not effective because they are too late. Another new drug crenezumab is to be tried earlier, in members of a large family who have a rare mutation predisposing to middle age onset Alzheimer’s.


Does it matter whether atrial fibrillation or heart failure develops first?

Atrial fibrillation (AF) and heart failure often co-exist. It is unknown whether the sequence in which AF and heart failure develop is of significance regarding prognosis. These cardiological researchers studied 182 patients admitted with AF and heart failure. They report that 75% of them had developed AF first. The AF first group less often had coronary artery disease and they had higher ejection fractions than the heart failure first group. The composite endpoints of cardiovascular hospitalisation or all-cause mortality favoured the AF first cohort and the researchers conclude that the prognosis in the AF first group was relatively benign.


Gout and hyperuricaemia in Australia

This report is of a systemic review and meta-analysis of the situation in Australia. Twenty-five journal articles and five reports have been included. It appears that the prevalence of gout in Australia has increased from 0.5% in 1968 to 1.7% in 1995/96. Apparently 9.7% Aboriginal men and 2.9% Aboriginal women had gout in 2002. There has also been a rise in the serum uric acid levels in blood donors. The authors conclude that the rate of gout and hyperuricaemia is high in relation to comparable countries and is increasing. Furthermore, the prevalence of gout in elderly male Australians is second in the world only to New Zealand. The latter is one record we could well do without.

Tiotropium in poorly controlled asthma

Some patients with asthma have frequent exacerbations and persistent airflow obstruction despite treatment with inhaled glucocorticoids and long-acting beta-agonists (LABAs). Tiotropium, a long-acting anticholinergic bronchodilator approved for the treatment of chronic obstructive pulmonary disease (COPD) but not for the treatment of asthma has been reported as being useful for such patients. This report concerns a study of 912 asthmatics who were receiving inhaled glucocorticoids and LABAs. They were randomised to have inhaled tiotropium (total daily dose of 5µg) or placebo in addition to their usual treatments. The trialists report that the addition of tiotropium significantly increased the time to the first severe exacerbation and provided modest sustained bronchodilation. Adverse effects were similar in both groups of patients. The exclusion criteria included previous heart disease, COPD or concurrent use of anticholinergics.


Communication therapy in the first four months after stroke for aphasia and dysarthria

It is widely agreed that speech and language therapy is beneficial after a stroke which features aphasia or dysarthria. This randomised study puts this belief to the test. 170 adults (mean age 70years) with an appropriate stroke were randomised within 2 weeks of admission to best practice communication therapy specific to aphasia or dysarthria or no such therapy for 4 months in hospital and after discharge. The primary outcome evaluated at 6 months was functional communication ability. Although functional communication improved by 6 months there were no added benefits of contact with a qualified therapist (beyond initial assessment) in the first 4 months after stroke compared with a non-therapist.

BMJ 2012;345:e4407.
Professional Misconduct (Med10/151P)

Charge

The Professional Conduct Committee (PCC) brought three charges against Dr Sajan Singh Bhatia (the Doctor). The charges are detailed below:

1. The Doctor practised medicine between 22 December 2008 and 15 July 2009 while not holding a current Annual Practising Certificate (APC).

2. Between 13 February 2007 and 15 July 2009 the Doctor failed to comply with conditions imposed on his scope of practice by the Health Practitioners Disciplinary Tribunal (HPDT) in that he:
   a. Failed to attend a peer review group meeting at least once every 6 weeks;
   b. Failed to confirm his attendance at peer review group meetings to the Medical Council;
   c. Failed to undergo a clinical audit every 3 months;
   d. Failed to provide the results of clinical audits to the Medical Council;
   e. Failed to work under supervision as required.

3. Between 7 December 2008 and 18 June 2009 the Doctor failed to provide a patient with the appropriate standard of medical care or treatment including:
   a. Failing to arrange and administer BCG treatment;
   b. Failing to undertake upper urinary tract imaging;
   c. Failing to consider the possibility of cancer recurrence
   d. Failed to appropriately or adequately communicate with a patient.
   e. Failed to arrange or put into place alternate care arrangements for a patient.

The PCC charged that each charge separately amounted to professional misconduct.

Findings

The Tribunal found the Doctor guilty of professional misconduct for each charge.

Background

At the time these charges were brought, the Doctor was a practising urologist in Invercargill.

The Doctor did not attend the hearing and was not represented. The Tribunal understood that the Doctor resided in South Australia at the time of the hearing.
**Charge 1**—In September 2007 the Southern Cross Hospital in Invercargill changed its credentialing policy and the Doctor was asked for his credentialing papers. The Doctor offered a variety of excuses each time he was asked for them, until eventually in February 2009 he supplied the completed papers but not his APC. Subsequently, the hospital followed up with the Medical Council as the Doctor’s name no longer appeared on the Medical Register.

On 24 June 2009 the Doctor was advised by letter from the Southern Cross Hospital that he could no longer operate there. The hospital confirmed that since 10 December 2008 the Doctor had carried out 13 operations on surgical lists at the Southern Cross Hospital.

**Charge 2**—The Registrar of the New Zealand Medical Council confirmed that conditions as ordered at a previous HPDT hearing were placed on the Doctor’s practice from 2007. In November 2008 the Medical Council advised the Doctor it would not renew his APC because he had not attended peer review meetings and that he had two audits by educational supervisors but not a clinical audit as required by the HPDT.

**Charge 3**—The Patient had suffered from bladder cancer since 2000. In January 2009 she discussed with the Doctor instituting another form of treatment called BCG which he said he would organise for her. She said he never organised that treatment.

Prior to a regular check up in May 2009, the Patient went to the Doctor’s office complaining of frequent and painful urination and that her urine was claret coloured. The Doctor prescribed her antibiotics, medication to stop her urinating so frequently and medication to help her sleep. The Patient took the medication but was not better and later admitted to the A & E and diagnosed with kidney stones. Another urologist, at the hospital diagnosed that she had a tumour on her left kidney.

**Reasons for Findings**

**Charge 1**—This charge related to the Doctor practising medicine while not holding a current practising certificate under section 100 (1)(d). The Tribunal considered that section 100 (1)(d) is a strict liability offence in that the Tribunal simply needed to find that at the relevant time the Doctor did not have a practising certificate and that he was still practising. The Tribunal found the section did not require the Tribunal to undertake an analysis of whether the APC was withdrawn for reasons that it accepted as valid.

The criteria for discipline as set out in section 100 (1)(d) states that the practitioner has practised while not holding a current practising certificate. The Tribunal found the use of the words “not holding” suggested that it is the fact of the being without an APC which constituted the offence, rather than the “knowing” of the absence of the APC.

However, the Tribunal then went onto consider that even if its interpretation was incorrect, and it was necessary for the Tribunal to consider if the Doctor knew he was practising without an APC; it did not accept the Doctor’s version of events and his claim that he had no knowledge until June 2009. The Tribunal found on the balance of probabilities that the Doctor was aware he had no practising certificate. The Tribunal considered the facts suggested that the Doctor was aware he had no practising certificate at the very latest by March 2009 and was continuing to practise. The Tribunal considered the onus must be on him to ensure that the APC was actually issued.
The Tribunal was satisfied that the charge was proved under section 100 (1)(d) and warranted the imposition of a disciplinary sanction.

**Charge 2**—The conditions imposed by the Medical Council were those conditions imposed upon the Doctor at a previous HPDT hearing and by the Medical Council after the competence assessment. Five conditions were imposed as set out above under Charge 2.

The Tribunal considered it must determine whether, objectively, the Doctor did comply with the conditions upon his practice. It found that the Doctor adopted a very laconic attitude to the compliance with the conditions and the education programme and did not trouble himself to clarify whether or not the supervision was clinical supervision, clinical audit or educational support (or all three).

The Doctor’s wife was ill at the time and subsequently died. This undeniably would have distracted the Doctor from his practice and the conditions on his practice. However, the Tribunal was left with a sense of frustration in trying to determine whether or not the Doctor simply did not comply with the conditions or was muddled by the apparent overlap between the two and his belief that Dr Davidson and Dr English were providing all the clinical oversight/supervision/education that he needed. He obviously understood that he had separate peer review obligations as he has tried to involve Dr Ngaei in his peer review team.

The Tribunal found that the Doctor did not take responsibility to resolve the issues and did not comply with the conditions imposed on his practice. The Tribunal found the charge established and it warranted disciplinary sanction.

**Charge 3**—The Tribunal, when considering particular (a), found that the Doctor failed to arrange and administer the BCG treatment for his Patient. The Tribunal noted there was no evidence that it would have prevented her cancer. Although the Patient subsequently had the treatment and benefited from it, the Tribunal did not find that the Doctor’s oversight in failing to undertake the procedure was sufficiently serious on its own to warrant disciplinary sanction.

The Tribunal found the Doctor failed to undertake upper urinary tract imaging for the Patient after initial measures to address her symptoms failed and that particular (b) did warrant disciplinary sanction.

The Tribunal found that on the facts, the Doctor did consider cancer recurrence and therefore particular(c) was not established. The Tribunal found that although the Doctor’s responses to the Patient were probably clinically inadequate, particular (d) related only to the communication, and the Tribunal did not believe his communication skills at that time were such that he should be found guilty of professional misconduct.

The Tribunal also did not find particular (e) proved. Dr Bhatia’s relationship with the Patient had ended by the time he finally acknowledged he did not have a practising certificate. He continued to treat her after 18 December 2009 and while he should not have done so, the Tribunal considered that charge 1 addressed this point.

In respect of charge 3 overall the Tribunal found particular (b) established and warranted disciplinary sanction. Particular (a) was proved but not sufficient on its own to warrant disciplinary sanction. Particulars (c), (d) and (e) were not proved

The Tribunal found that when taken together, established particulars (a) and (b) were sufficiently serious as to warrant disciplinary sanction.
Penalty

The Doctor was censured and his registration was cancelled. He was ordered to pay 25% of the costs. The Tribunal expressed its strong disapproval for the Doctor’s conduct.

The Tribunal directed that a copy of the decision be published on the Tribunal’s website. The Tribunal further directed that a notice stating the effect of the decision be published in the New Zealand Medical Journal.

The full decisions relating to the case can be found on the Tribunal web site at [www.hpdt.org.nz](http://www.hpdt.org.nz)

Reference No: Med10/151P.
Major David Eilenberg


Eilenberg was a consultant psychiatrist, first at Northwick Park Hospital, Harrow, and then in Auckland, New Zealand, where he emigrated in 1975.

He was an exceptionally able clinician with administrative ability and an intense interest in medical ethics.

He was born in Pitsea, Essex, the older of the two children of Sidney Eilenberg, a confectioner, and Annie Eilenberg née Shube.

Sidney Eilenberg went to England from Poland in 1915. His wife and her parents had arrived from Poland some years earlier.

Major, a name deliberatively chosen by his father for its distinctiveness and which caused lifelong confusion with the military rank, was educated at Hackney Downs School, a London County Council grammar school formerly the Grocers’ Company’s School.

The school’s alumni include Steven Berkoff, Michael Caine and Harold Pinter, among many other notable men.

Eilenberg graduated from the London Hospital Medical School in 1949. After house officer appointments at the London Hospital, Eilenberg did his National Service in the medical branch of the RAF (from 1953 to 1955), serving in the Middle East with the rank of squadron leader. He then became a registrar and a senior registrar at the Maudsley Hospital, from 1955 to 1961.

The Maudsley was the specialist NHS hospital which, in partnership with the Institute of Psychiatry, provided training in psychiatry for United Kingdom and some Commonwealth graduates. The Maudsley was then the world’s leading postgraduate school of psychiatry. Eilenberg flourished. He published, as an author or co-author, 10 papers based on research conducted during his training, a remarkable achievement for a junior doctor.

Prominent in both are his interest in medical aspects of psychiatry and the importance of administration in providing health care. His other papers reported controlled drug trials, case reports, neurophysiology of ECT and the prognosis of neurosis in pregnancy.

To broaden his experience, Eilenberg spent a year (from 1961 to 1962) at the Mayo Clinic as a staff psychiatrist. From there he published three papers, one on liaison psychiatry, showing his developing interest in this specialty (Eilenberg MD. ‘Survey of in-patient referrals to an American psychiatric department’. Br J Psychiatry 1965 111 1211-4). He joined the Mayo Clinic chapter of Sigma Xi, a society dedicated to promoting integrity in science and engineering.

Eilenberg returned to England to be a consultant psychiatrist, first at Wembley Hospital (from 1963 to 1970) and then at Shenley and Northwick Park hospitals (from 1970 to 1974). At Shenley he was a member of the hospital management committee. He was also a member of the North-West Metropolitan Regional Hospital Board (from 1970 to 1974).

Northwick Park Hospital was established in 1970 jointly by the NHS and the Medical Research Council (MRC) to provide for clinical research. Here Eilenberg became a key figure in establishing the new NHS psychiatric service and ensuring its cooperation with the MRC Clinical Research Centre, where TJ Crow was appointed by the MRC as head of their division of psychiatry in January 1974.

Such was Eilenberg’s stature that he became chairman of the ethical committee for Northwick Park Hospital, a committee that played a key role in facilitating clinical research across all disciplines. A British Medical Journal sponsored discussion on the ethics of clinical research between Eilenberg, LJ Witts, Nuffield Professor of Medicine at Oxford, and R Williams, director of liver research at King’s College Hospital, shows Eilenberg’s grasp of the principle issues (‘New horizons in medical ethics: research investigations in adults’. BMJ 1973 2[5860] 220-4). Essentially Eilenberg argued for promoting a culture of ethical concern among all professions involved in clinical research.

In 1974, to the astonishment of his colleagues, Eilenberg said he and his family were moving to Auckland, New Zealand, as he put it, ‘to go back 50 years in time’. They arrived on New Year’s Day 1975. The upper age for permanent migration to New Zealand was then 45 years. Eilenberg was 49. Because of his distinction an exception was made and he was appointed director of the division of psychiatry at Auckland Hospital. His superior clinical ability, grasp of medical administration and mentorship were appreciated. And his advice on psychiatric aspects of medical and especially neurological illness was sort after. He retired from his hospital post in 1985 to work part-time in the geriatric unit at Auckland Hospital as a valued liaison psychiatrist until 2002.

He was a clinical teacher in Auckland’s Medical School. He had also a private consulting practice at the Bexley Clinic in Auckland, where he continued until 2008.

After his death a colleague, who had known him since 1975, remarked, ‘He made an enormous contribution to Auckland psychiatry in both the formal training of young psychiatrists and as a role model for new consultants, encouraging participation in administration, service delivery and negotiation with management.’

Eilenberg’s chief interest, outside his family, was golf. His regret was not to have gone to Auckland 10 years earlier.
In 1955 Eilenberg married Elizabeth Joan Rothwell, a senior charge nurse at the London Hospital and daughter of Frederick Rothwell, vicar of Denmead, Hampshire. Eilenberg was survived by Elizabeth and their two sons, Richard, a dentist, and Philip, an accountant. A third child, Nigel, died in 2011.

Dr Brian Barraclough (Psychiatrist, Dept of Psychological Medicine, Auckland University) wrote this obituary. It originally appeared in *Munk’s Roll*, a Royal College of Physicians publication.
Dr Raj Gupta—Senior Consultant Cytopathologist and retired Head of Cytology Unit, Wellington Hospital and School of Medicine—served a distinguished career in the medical profession which in June 2009 saw him complete 50 years of practice in the field of pathology.

28 years of those 50 years were served in Wellington, New Zealand (1981–2009) where he was consulted in over 50,000 cases. Dr Gupta was a leading and recognised international authority in the specialist area of cytopathology where he made a significant contribution towards the increased understanding of this complex medical area.

Dr Gupta was born in India in 1932 and earned his MD at Agra University in 1957. He emigrated to North America in 1962 where he trained in pathology at the Massachusetts General Hospital Harvard Medical School-affiliated training program at Worcester Memorial Hospital and served as Senior Resident in Anatomic Pathology (1964). He completed his postgraduate study in cytopathology at the Postgraduate Institute of Cytology at Johns Hopkins University (1972).

Dr Gupta was a Fellow of the College of American Pathologists (1971), Fellow of the International Academy of Cytology (1977), Diplomate of the International Board of Cytopathology (1980), Fellow of the Royal College of Physicians and Surgeons (Canada 1979), and Affiliate of the Royal College of Pathologists of Australia.

Dr Gupta served as Associate Professor of Pathology from 1965–1979 at the State University of New York School of Medicine and its affiliate University Hospitals in Buffalo, New York and Consultant Pathologist to the Niagara Regional and St Catherines General Hospitals and affiliate laboratories 1967–79 (Canada). From 1979–1981 he served as Professor of Pathology with the National University of Singapore Faculty of Medicine and its affiliate University Hospitals.

Dr Gupta moved to Wellington in 1981 to take up the position with Wellington Hospital and School of Medicine to develop the Cytology Unit—where he served as Senior Consultant Cytopathologist and Head of Cytology Unit until his retirement at the end of 2003. He continued to serve as Senior Consultant Cytopathologist at Aotea Pathology in Wellington until his retirement in June 2009.

Dr Gupta was specialised in fine needle aspiration cytology (FNAC) where he was particularly noted for his work. He introduced the FNA procedure to New Zealand in 1983 and spearheaded its use—with the result that the procedure is now widely used in the New Zealand clinical domain.
Fine needle aspiration (FNA) is a diagnostic procedure by means of which cellular material is aspirated by a syringe and a fine needle under negative pressure. The smear of the aspirate is then studied cytologically. Through this process, tumour grades can be established preoperatively, thus reducing the need for invasive operational procedures and enabling the early detection and diagnosis of medical conditions / cancers.

Dr Gupta had an extensive publication record as an author of over 250 medical articles in peer-reviewed journals. He published in the top high-ranked international journals in the field of cytopathology where he has illuminated major aspects of FNAC inspired from clinical problems and rare findings. His publications regularly receive citations. Titled examples of some of his later papers published include:

- Fine needle aspiration cytodiagnosis of nipple adenoma (papillomatosis)
- Fine needle aspiration cytology of pilomatrixoma of the arm and the role of cell block examination in the diagnosis
- Needle aspiration cytology of seromas of the breast from irradiated lumpectomy sites
- Diagnostic value of needle aspiration cytology in assessment of axillary lymphnodes
- Diagnosis of entamoeba Histolytica in a cervical smear
- Fine catheter aspiration cytology of peritoneal cavity improves decision in difficult abdomen

Dr Gupta was a distinguished member of the editorial boards for the prestigious international journals Acta Cytologica (2008), Diagnostic Cytopathology (1995) and The Breast Journal (1995). He was a member of the The International Committee of the Papanicolaou Society of Cytology (1994) and acted as an invited reviewer for the Journal of Experimental Biology and Medicine, American Review of Respiratory Diseases, Cytopathology, and Breast Cancer Research and Treatment.

As a strong proponent of continuing medical education, Dr Gupta regularly secured and organised visiting lectures for some leading American cytopathology experts to visit Wellington and share their knowledge with the New Zealand medical community. These experts included Dr Jan Silverman (Director Cytopathology, East Carolina School of Medicine), Dr Carlos Bedrossian (Editor-in-Chief of the journal Diagnostic Cytopathology), Dr Sudha Kini (Division Head of Cytopathology, Henry Ford Hospital) and Dr Tilde Kline (Director of Cytopathology, Thomas Jefferson School of Medicine).

Throughout his career in cytopathology Dr Gupta demonstrated a unique dedication and commitment to the field, and led a stimulating, encouraging and productive environment while Head of the Cytology Unit at Wellington Hospital. He mentored and delivered high-quality training to his technical staff and medical residents in cytopathology, who have been very appreciative of the knowledge they have acquired from him. His New Zealand medical clinician colleagues continued to consult with him on cases in his latter years. Dr Gupta’s career was marked by insight, accomplishment, and the ability to share his insight with others—for which he remained very modest. He died peacefully at Wellington Regional Hospital on 25 September 2012 aged 80 years, surrounded by his 4 children Deepak, Dinesh, Sunita, and Suvira and their families; his wife, Mrs (Smt) Swaran Lata Gupta, predeceased him in 1981. He also leaves behind 6 grandchildren Shikha, Anshuman, Krishant, Vikesh, Anjali, and Aaditya Raj. He is greatly missed and remembered by family and friends, including extended family in India (Delhi, Varanasi, Gwalior).