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The presentation with a ‘STEMI’ heart attack is a dangerous medical event. Even by 2012, approximately 7% of those who reach hospital die. The 2002 National heart attack and unstable angina audit was run by cardiologists and specialist physicians who wanted to record the low levels of service available. This audit shocked the Health Ministry into action, with subsequent audits from 2007 and 2012 demonstrating ongoing improvements in services available to manage patients, which the paper describes. However, the paper also describes the need for ongoing improvements from 2012, especially in the rapid access to a cardiac angiogram, with a stent or cardiac surgery for those who need this treatment. This should occur within 24 hours.

A retrospective observational study of mortality rates in elderly patients with shock in a New Zealand district hospital ICU

Owen Keet, Stephanie Chisholm, Jennifer Goodson, Troy Browne

The decision whether to admit and treat the very elderly patient with septic shock in ICU is a complex decision. Although age in itself is not a reason to deny a patient ICU admission, it is taken into account in context of the burden of chronic and acute disease. The patient selection and subsequent treatment at Tauranga Hospital, a secondary level New Zealand hospital, produced results that saw most of the patients during a five-year period, including those >85 years, being discharged alive from hospital. This study suggests that with carefully considered selection, elderly patients greater than 85 years may have an acceptable long-term outcome following an episode of septic shock.

Prevalence of enduring power of attorney and barriers towards it in community geriatric population in Counties Manukau Health

So-Jung Park, Heather Astell

Enduring power of attorney is a simple and easy-to-set-up legal document which protects the wishes of the donor when long-term residential care needs to be arranged due to the patient’s increasing care requirements. This survey has shown the low prevalence of enduring power of attorney in the geriatric population, who arguably need it the most, predominantly due to the lack of knowledge in the general public and financial barriers. Increased efforts to educate and support uptake could have positive personal and social outcomes.

Effect of house officer clerking on short-term outcomes in paediatric orthopaedic patients

Yassar Alamri

This study examined any outcome differences between children seen and examined by junior doctors prior to their orthopaedic operations with those who were not. Children seen and examined by junior doctors had better documentation of their physical examination findings and allergies. However, no difference in clinical outcomes (eg, complication rates) was detected.
Trends in New Zealand stroke thrombolysis treatment rates
Qiliang Liu, Annemarei Ranta, Ginny Abernethy, P Alan Barber
Stroke affects 9,000 New Zealanders every year. Stroke can be devastating, leaving half of survivors dependent on others for care. Most strokes are due to a clot blocking an artery supplying blood flow to part of the brain. Dissolving these clots by injecting a drug called alteplase into a vein can improve a person’s chance of going home independently. Alteplase treatment rates in New Zealand have been low compared to other countries. The National Stroke Network established a database to monitor all people treated with alteplase in an effort to increase treatment rates. This study reports that over the 18 months of the study, 623 New Zealanders were treated with alteplase. By mid-2016, 8.4% of people with stroke were receiving this therapy up from 3% in 2009. The efficiency and speed with which alteplase is being given has also improved. This is important because “time is brain”, with more brain cells saved from dying the earlier that treatment is given. These results are encouraging but there is still room for improvement.

Provision of stroke thrombolysis services in New Zealand: changes between 2011 and 2016
Qiliang Liu, P Alan Barber, Ginny Abernethy, Annemarei Ranta
Stroke affects 9,000 New Zealanders every year. Stroke can be devastating, leaving just over half of survivors dependent on others for care. Most strokes are due to a clot blocking an artery supplying blood flow to part of the brain. Dissolving these clots by injecting a drug called alteplase into a vein can improve a person’s chance of going home independently. This study shows that the way in which alteplase is provided across the country has improved over the last five years. However, regional variations still exist with treatment, with alteplase limited to working hours in four of the 20 DHBs. This is because there aren’t enough senior doctors who can supervise this treatment.

The proposal for a third medical school in New Zealand: a community-engaged graduate entry medical program
Ross Lawrenson, Ian Town, Roger Strasser, Sarah Strasser, Judy McKimm, Rees Tapsell, Nigel Murray
Many high-needs communities and patient groups in New Zealand have shortages of doctors. Medical education internationally is changing towards a more socially accountable model of training. A community-engaged graduate entry medical program has been proposed to help meet the workforce needs of our most disadvantaged populations.
Improvements in acute stroke treatments in New Zealand—no one should be left behind

John Fink

Stroke is a major health burden to New Zealanders. Approximately 6,000 New Zealanders suffer from a stroke every year. Stroke is the third largest cause of death behind heart disease and all cancers combined. However, unlike coronary heart disease and cancer, the major burden of stroke is chronic disability rather than death. Most of us know someone who has survived stroke, but now lives with a permanent disability as a result. Long-term institutional care following disabling stroke is a major financial cost for individuals and district health boards. Acute treatments for stroke reduce disability, but time is brain—the faster treatment can be delivered, and to more stroke patients, the greater the benefit.

Delivering quality acute stroke care across New Zealand is not an easy challenge. There is no “new money” available for this treatment and stroke services must be provided out of DHBs’ existing operational budgets, and compete for attention and funding with other priorities. Smaller hospitals and DHBs face additional challenges associated with small generalist workforces, including limited after-hours cover compared with larger services, which may call on a larger pool of clinicians and can foster stroke specialist expertise. Despite these challenges, the two studies published in this issue of the New Zealand Medical Journal show that substantial progress has been made. Stroke thrombolysis is now offered in all 21 DHBs, and the workforce with expertise and experience in acute stroke care has expanded.

The proportion of stroke patients (ischaemic or unspecified) treated with thrombolysis nationally has increased from 6.5% in the first quarter of 2015 to 8.4% by mid 2016. The establishment of reportable targets for DHBs’ acute stroke care by the Ministry of Health has been a significant development that has helped to drive change, including a specific target for stroke thrombolysis rates. The national stroke thrombolysis registry has added further impetus for improving quality of thrombolysis services with transparent reporting of quality measures such as onset to needle time, door to needle time and haemorrhagic complications.

Of particular encouragement is the finding that some of the largest improvements have been achieved in the smaller DHBs. A 24/7 service is now offered in four out of seven small DHBs. Small DHBs now give thrombolysis to 5.6% of incident stroke patients, close to the previous national target of 6%.

But some problems with, and disparities in, access to acute stroke services still hide behind these data. While all DHBs report that they offer acute stroke thrombolysis, some remain very inactive at providing it, with thrombolysis rates as low as 2%. This compares very poorly against the highest performing centres at nearly 20%. The 6% target for stroke thrombolysis was arbitrary and pragmatic, and is appropriately being increased to 8% for 2017 and 10% for 2018. Continued improvement will be needed to meet these targets. Many DHBs have multiple hospital sites admitting acute stroke patients, some of which have no effective thrombolysis service. This means the reported figure that 92% of the population lives in a DHB offering a 24/7 stroke thrombolysis service is misleading. The proportion of the population that truly has access to acute stroke thrombolysis 24/7 is not being reported.
How can the necessary improvements be made? The Central Region pilot of “telestroke” services to provide expert stroke-physician after-hours backup to generalists has proven to be a powerful source of improvement and could be replicated in other New Zealand regions if there is sufficient will to do so among clinicians and funders. Implementation of a “code stroke” contact system with pre-hospital notification to acute stroke teams has been an important source of improvement within existing resources, but is not as yet implemented in eight DHBs (and not all hospitals within the other 13). All hospitals admitting acute stroke patients need to be working towards implementation of these strategies. Reporting processes need to be more sophisticated to be able to measure progress in each hospital, not just at ‘DHB’ level.

Looking ahead to the next five years, the pace of improvements in acute stroke treatment in New Zealand is likely to continue to accelerate. These studies on stroke thrombolysis in New Zealand do not address the most powerful of all acute stroke treatments: endovascular clot retrieval. This revolutionary treatment, which now offers the chance of “cure” for some of the most severe acute strokes, is available 24/7 to Aucklanders, seven days per week until 11pm in Christchurch and “office hours” in Wellington. Additional resources will be needed for access to this treatment to improve. Robust mechanisms for rapid identification of potentially eligible patients and rapid transfer to an endovascular centre need to be developed if patients outside those metropolitan areas are to have a chance of benefitting from this life-changing treatment as well.

What are stroke services like at the hospital where you or your loved ones live? As some centres continue to develop excellence in treatments based on examples of international best practice it remains important for us collectively to ensure that no one is left behind.

Competing interests:
Nil.

Author information:
John Fink, Department of Neurology, Canterbury District Health Board and University of Otago, Christchurch.

Corresponding author:
Dr John Fink, Department of Neurology, Canterbury District Health Board and University of Otago, Riccarton Avenue, Christchurch.
john.fink@cdhb.health.nz

URL:

REFERENCES:
Admitting elderly patients to ICU: is it just about survival?

Jay Ritzema, Paul Young

Demand for elective and emergency intensive care unit (ICU) beds for elderly patients is increasing. There are many potential factors that may be driving this demand, including: an ageing population, increasing proportions of elderly patients having surgical procedures that require peri-operative high dependency care and changing expectations about the appropriateness of admitting elderly patients to ICU.

One common reason for admission to the ICU is to monitor and treat hypotension or shock. In this issue of the NZMJ, Keet et al report the mortality rate of patients admitted to Tauranga Hospital ICU with shock, the most common aetiology, of which was sepsis. Mortality data are provided for patients aged less than 75 years, 75–84 years and for those greater than 85 years of age. Mortality rates at hospital discharge were 22%, 42.5% and 23.1% respectively; by one year these mortality rates had increased to 34.8%, 61.6% and 61.5% respectively. While an independent association between patient age and short-term mortality after an admission to ICU has been reported previously, the data presented in the current study are not adjusted for case-mix, co-morbidities or illness severity, so it is not possible to establish whether the age of the patients independently influenced mortality rates.

While the investigators conclude that acceptable long-term outcomes are possible for elderly patients with septic shock, we submit that a more nuanced conclusion is appropriate. The data presented demonstrate that more than 60% of the patients 75 years or older who were admitted to ICU with shock were in the last year of their lives. As there are no data presented on the quality of life of the survivors at one year, it is difficult to know whether truly acceptable long-term outcomes were achieved or not. Quality of life is a crucial issue because elderly patients who are admitted to ICU with severe sepsis appear to have an increased risk of moderate to severe cognitive impairment and of developing new functional disability in the year following their admission. Moreover, only one quarter of octogenarians admitted to ICU for any reason in one study regained their baseline level of physical function at one year. The majority of octogenarians who survived to hospital discharge in one tertiary Australian ICU were discharged to a hospital-level care facility, rehabilitation facility or nursing home. All of these factors mean that there is a high risk that elderly patients who survive ICU will have a relatively poor quality of life.

At the very least, the high observed one-year mortality rate in the current study suggests that in elderly patients admitted to ICU with shock, a discussion about advanced care planning should be strongly considered prior to hospital discharge. Careful consideration of the appropriateness of ICU admission is prudent for every patient, but it is important to emphasise that in a population of patients that may have a limited life expectancy, short-term survival may not be the principal outcome to consider. For the elderly patients with septic shock in particular, whether or not to admit to ICU at all is a decision that should primarily be made by considering whether or not the ICU admission is likely to leave the patient with a satisfactory quality of life if they survive to hospital discharge and/or whether it increase the chances of a “good death”.

Even if mortality is considered the most important outcome, it is often unclear whether admission to ICU will reduce mortality risk compared to ward-based care. Among the oldest cohort of patients in the current study, five out of 13 patients did not require vasopressor support. These patients may have been admitted to ICU for haemodynamic monitoring only without ultimately requiring any ICU-level intervention. This
may not be an uncommon scenario. In one multi-centre prospective observational study of mainly medical patients in an emergency department with an indication for ICU admission, ICU admission compared with admission to a standard ward did not improve six-month survival of patients aged 80 years and older after adjustment for confounders such as illness severity and co-morbidities. A cluster-randomised trial investigating the effect of systematic ICU admission on long-term mortality for selected critically ill elderly patients vs standard ICU admission triage practice is currently underway and should provide further useful information.

When considering ICU care for elderly patients in the New Zealand context there are a number of issues that are important. Firstly, is there currently equality of access to ICU for older New Zealanders between hospitals and regions? That is, are older patients with similar diagnoses, illness severities and comorbidities equally likely to be admitted to ICU in different parts of the country? Although previous data suggest that in relation to an ICU admission triage decision where a previously healthy 95-year-old patient age unexpectedly required ICU admission after elective surgery approximately 90% of intensive care specialists would admit the patient, there are no studies that specifically evaluate ICU triage decision-making of New Zealand specialists for elderly patients in other scenarios. Moreover, case-mix and illness severity of elderly patients admitted to similar ICUs around New Zealand have never been systematically compared. It is also unknown whether the outcomes of elderly patients admitted to New Zealand ICUs are similar after adjusting for case-mix or whether they are similar to the outcomes of patients admitted to ICUs elsewhere in the world. Finally, it is unknown whether the threshold for ICU admission to elderly patients is reducing with time and, if it is, whether the resultant increases in ICU admissions for elderly patients are a sound investment of healthcare dollars. This latter issue is perhaps the most important and, as outlined above, can only be determined if one considers more than just survival.

Keet et al’s data should prompt clinicians to reflect on the goals of care when ICU admission is considered. When triaging ICU referrals, the primary considerations ought to be not only whether the patient has a reasonable chance of surviving for the next year, but whether ICU treatment is likely to result in an outcome that is consistent with individual patient’s views of an acceptable outcome. Even if elderly patients with septic shock survive to hospital discharge, they appear to remain at very high risk of dying in the next year and should be encouraged to adjust their life priorities and treatment priorities accordingly.

**Competing interests:**
Nil.

**Author information:**
Jay Ritzema, Registrar, ICU, Wellington Hospital, Wellington; Paul Young, Intensivist, Wellington Hospital, Wellington.

**Corresponding author:**
Paul Young, Intensive Care Unit, Wellington Regional Hospital, Riddiford Street, Newtown, Wellington 6021.
paul.young@ccdhb.org.nz

**URL:**
REFERENCES:


Does New Zealand need a third medical school?

Peter Crampton

This is an important question. I would like to lay out here some of the considerations that are necessary to take into account in answering the question. The perspective I bring is that of the University of Otago’s Pro-Vice-Chancellor of the Division of Health Sciences and Dean of the Otago Medical School. In these two roles I have a considerable interest in health and medical workforce issues in general and specifically in the question of a third medical school. My medical background is in general practice and public health.

Otago’s Division of Health Sciences, which includes the Otago Medical School, has a strong commitment to what the World Health Organization defines as social accountability:

“the obligation to direct their education, research and service activities towards addressing the priority health concerns of the community, region and/or nation they have a mandate to serve. The priority health concerns are to be identified jointly by governments, health care organisations, health professionals and the public.”

For this reason, it is my belief that the focus of the third medical school discussion should be on the national interest: what investment is needed to meet the medical workforce requirements of New Zealand’s diverse rural and urban communities now and in the future?

My comments in this editorial should be read with two caveats in mind. First, last year I received a verbal briefing from the Vice Chancellor of the University of Waikato about his plan to launch a bid for a third medical school, but otherwise the only information I have is from general media sources. I do not have access to more detailed information about the Waikato proposal. Second, this editorial is necessarily brief and omits discussion of many important factors that I care about very much, such as the Pacific medical workforce (in New Zealand and in Pacific nations), the importance of interprofessional education and the regulatory requirements of the Medical Council of New Zealand and the Australian Medical Council.

What problem are we trying to fix?

My understanding from media sources is that the University of Waikato proposal is focused on meeting the needs of New Zealand’s rural and Māori communities. In particular the proposal draws attention to the need for more New Zealand-trained general practitioners to address disparities in rural health status and to reduce the reliance on overseas-trained doctors. These are important objectives that resonate with many communities around the country. Very similar issues are evident in rural and remote Australian and Canadian communities. In identifying these objectives, it is important to distinguish between three sets of issues:

1. How many doctors should we train?
2. What sort of doctors should we train (demography and discipline)?
3. Where do we want them to work (distribution)?

These three sets of issues, while they are related, invite somewhat different policy responses.

The issue of medical workforce supply is focused on our medical schools graduating sufficient numbers of new doctors to meet anticipated population demand over coming decades. In 2008, the government approved the funding of an additional 200 medical places to meet the predicted medical workforce requirements for the next 20 years. This increase has been implemented over the past eight years and reaches steady state in 2020. The quantum was determined from future workforce planning begun in 2005, and planning continues today through Health Workforce New Zealand. The increase in 2008 was influenced by...
the assumption that New Zealand would continue to lose 25% of its medical graduates to Australia, a loss that has been markedly curtailed since 2008 with the massive expansion of medical programmes in Australia (1,400 graduates per year in 2000 versus 3,672 by 2018 (unpublished data Medical Schools Outcomes Database)).

The regulatory framework for New Zealand’s medical schools dictates that medical graduates must be equipped to take up any branch of medicine. We are not permitted to graduate new doctors who are specialists—for example, we cannot pre-determine a subset who must go into rural general practice—and moreover we place a positive value on ensuring that all doctors, whatever their specialty, have a broad general training experience.

The planned increase in medical graduates is resulting in New Zealand having more graduates per 100,000 of population than, for example, in the US or Canada (Table 1). The overall OECD data (see source data) suggest that the existing plan for the New Zealand medical workforce is consistent with many OECD peers.

This in turn raises the challenge of encouraging young doctors to take up the types of roles that are needed by New Zealand’s diverse communities, which I discuss further below. The challenge of achieving the right medical workforce distribution is huge, and Australia provides a fascinating case study of how it is possible to achieve a significant oversupply of doctors without addressing the issue of distribution, thereby leaving rural areas under-doctored. ³

What questions do we need to answer in order to guide our decision making?

In considering a third medical school, in general terms a number of questions must be answered in order to enable decision makers to make an informed decision. The following list of questions (Table 2) is by no means exhaustive, but it gives a flavour of the type and scope of questions that need to be answered. For example, in considering the problems that another medical school might cause or make worse, three points are noted in the table: 1) recruitment of medical academic staff to a new medical school would inevitably involve loss of key staff from existing medical schools; 2) redistribution of hospital and community clinical training opportunities refers to the proposed introduction of a further 240 undergraduates into the upper North Island (60 students in each of the four years of the proposed Waikato programme), which in turn would put severe pressure on available training places. Additional training placements would be difficult to find particularly in critical specialties such as general practice, paediatrics, psychiatry, obstetrics and gynaecology; 3) additional pressure on the postgraduate training pipeline was reflected, for example, in 2016 when the DHBs had to create 47 extra first-year house surgeon positions to employ graduating category one applicants (New Zealand graduates who were New Zealand/Australian citizens or permanent residents); despite this increase in positions, nine category one first-year house surgeon applicants were not matched to a job.

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**Table 1: Medical graduates per 100,000 population in selected OECD countries, 2000–2014.**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010</th>
<th>2014</th>
<th>2020*</th>
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</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>7.4</td>
<td>7.3</td>
<td>8.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Australia</td>
<td>7.4</td>
<td>12.1</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>5.1</td>
<td>7.2</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>14.4</td>
<td>17.2</td>
<td>21.9</td>
<td></td>
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<tr>
<td>UK</td>
<td>7.5</td>
<td>13.5</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>6.4</td>
<td>6.6</td>
<td>7.3**</td>
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</tbody>
</table>


* Based on a predicted population of 4.86 million and 580 domestic graduates by 2020.

** 2013 data.
What policy instruments are effective in addressing rural medical workforce issues?

As the Waikato proposal focuses on meeting the needs of rural communities, it is important to pay heed to two sets of factors: 1) the system-wide issues that bear on rural recruitment and retention, and 2) in relation to medical education, the international evidence on training medical students who actively choose to take up rural careers.

Of these two sets of factors, system-wide issues are probably the most important as no matter how effective medical education is, if the employment conditions in rural areas are not attractive for graduates, rural communities will continue to struggle to attract and retain young doctors. System-wide issues are chiefly the responsibility of the Ministry of Health, the district health boards, PHOs, iwi and rural communities (Table 3).

In terms of the role of medical schools in graduating students who are more likely to choose a rural career, the international evidence suggests that two strategies work: 1) recruiting medical students who either come from a rural area or who have had significant rural exposure during their childhood and school education, and 2) providing all students with positive and enriching learning experiences in rural settings. Over the past decade or more, both Otago and Auckland medical schools have implemented policies in response to this international evidence. For example, at Otago we routinely select at least 50 students each year specifically on the basis of their rural background. This affirmative selection pathway is called the ‘Rural Origins Sub-Category’ and offers preferential entry to medical school for students with a rural background who also meet academic admissions standards. We know that these

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**Table 2:** Questions we need to answer in order to guide our decision making.

<table>
<thead>
<tr>
<th>1. What are the medical workforce needs in relation to:</th>
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<tbody>
<tr>
<td>• Numbers of doctors</td>
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<tr>
<td>• Distribution of medical workforce</td>
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<tr>
<td>• Demography of medical workforce</td>
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<tr>
<td>• Discipline/specialty of medical workforce?</td>
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</tbody>
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<tr>
<th>2. To what extent are these medical workforce needs under the control of medical schools and medical education?</th>
</tr>
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<tbody>
<tr>
<td>• Student selection, curriculum and assessment criteria are under the control of medical schools</td>
</tr>
<tr>
<td>• Health system factors (see Table 3) are under the control of the Ministry of Health, district health boards, PHOs, iwi and communities</td>
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</tbody>
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<table>
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<tr>
<th>3. To what extent are these needs related to postgraduate training and support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• From a policy perspective, the training pipeline from undergraduate study to vocational specialisation is an integrated system</td>
</tr>
<tr>
<td>• Without further investment, there is finite capacity within the DHBs and community-based health providers to employ and vocationally-train increasing numbers of medical graduates.</td>
</tr>
</tbody>
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<tr>
<th>4. For those medical workforce needs that are under the control of medical schools, to what extent are they being addressed already and to what extent would another medical school help?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Selection of regional and rural-background students</td>
</tr>
<tr>
<td>• Selection of Māori students</td>
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<tr>
<td>• Selection of Pacific students</td>
</tr>
<tr>
<td>• Training experiences in regional and rural areas.</td>
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<table>
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<tr>
<th>5. What problems might another medical school cause or make worse?</th>
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<tbody>
<tr>
<td>• Recruitment of medical academic staff</td>
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<tr>
<td>• Redistribution of hospital and community clinical training opportunities</td>
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<tr>
<td>• Additional pressure on the postgraduate training pipeline.</td>
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</table>
students are more likely to want to work in rural areas. By the same token, we also know that neither we nor rural communities can force them into rural jobs if the system-wide issues are not propitious.

At Otago we provide a variety of rich and positive learning experiences in rural communities. All Otago students have a rural/provincial experience during their training, including many who have a year-long experience in rural or provincial settings (the fifth-year Rural Medical Immersion Programme and the sixth-year provincial placements).

An additional strategy that we have adopted at Otago is the provision of targeted postgraduate training opportunities for rural doctors. There is emerging evidence that these programmes are having a positive impact on New Zealand’s rural hospital medical workforce.

Is our investment in the above educational initiatives having the desired effect? For Otago medical graduates from 2012 to 2014, over 50% have not yet made a career decision, but of those who have, 22.2% have chosen general practice, and another 4% have chosen rural practice; of those who have not decided, for 36.6% their first or second choice is general practice; a further 7% have chosen rural practice as their first or second choice (unpublished data Medical Schools Outcomes Database).

The Māori medical workforce
New Zealand has a shameful record of not training enough Māori doctors, and our Waikato colleagues have drawn attention to this issue by placing an emphasis on training more Māori doctors. Six years ago, in response to this poor record and other issues of under-representation in health professional groups, Otago developed a policy called ‘Mirror on Society’. This policy states:

“Ideally the make-up of health professional classes should be equivalent to holding a mirror up to society. In order to achieve this we aim to attract and support the most academically able students from a wide variety of backgrounds. The gender, ethnic, socioeconomic and rural/urban composition of our graduates should, more or less, reflect the diverse communities in Aotearoa.”

<table>
<thead>
<tr>
<th>1. Working conditions</th>
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<tbody>
<tr>
<td>• On-call obligations</td>
</tr>
<tr>
<td>• Presence of a highly skilled primary health care team (nurses, midwives, receptionists, manager, etc)</td>
</tr>
<tr>
<td>• Defined pathways of care that meet the patients’ needs</td>
</tr>
<tr>
<td>• Provision for annual leave, sick leave and educational leave</td>
</tr>
<tr>
<td>• Physical infrastructure that is fit-for-purpose</td>
</tr>
<tr>
<td>• Salary structure commensurate with urban community-based and hospital-based colleagues</td>
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</tbody>
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<table>
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<tr>
<th>2. Career development opportunities</th>
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<tbody>
<tr>
<td>• Provision for peer support</td>
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<tr>
<td>• Provision for continuing medical education</td>
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<tr>
<td>• Provision for further postgraduate training and career development</td>
</tr>
<tr>
<td>• Access to an active academic community</td>
</tr>
<tr>
<td>• Provision for training medical students and doctors across the spectrum of junior medical students, senior medical students, first and second year house surgeons and vocational trainees</td>
</tr>
<tr>
<td>• Perceived status of role</td>
</tr>
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<tr>
<th>3. Social opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Work opportunities for partner</td>
</tr>
<tr>
<td>• Educational opportunities for children</td>
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<tr>
<td>• Opportunities to develop a personal social network</td>
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</tbody>
</table>

Table 3: Health system factors that help or hinder the recruitment of rural doctors.
The sociodemographic profile of health professional students is important because, in part, these characteristics influence future career choices in terms of place of practice and types of populations served.\textsuperscript{4,5,9}

We believe indigenous health is a crucial area of responsibility for New Zealand’s universities. These Universities have a dual obligation to both honour the contractual obligations defined in the Treaty of Waitangi and to take action to correct the inequitable health and education outcomes experienced by Māori.

Figure 1 shows the trend in Otago’s Māori medical student numbers over the past decade. Last year, 45 new Māori doctors graduated from Otago and this year 62 new Māori students were taken into the programme (21% of the domestic intake into medicine). The University of Auckland is also markedly increasing its numbers of Māori medical graduates. New Zealand is on the way to having at least a representative number of Māori doctors. The trend illustrated in Figure 1 has required considerable investment over a long period of time. Outreach into high schools, a bridging programme, a dedicated pathway of admission and ongoing student support are all required to overcome educational inequity and ensure a graduation rate for Māori students commensurate with non-Māori students.

Does New Zealand need a third medical school?

It is clearly a challenging task to draw together the information required to provide satisfactory answers to all the questions and issues listed above. A third medical school is a huge social investment for our small country. The system, through its leadership structures, most notably the Ministry of Health and the Tertiary Education Commission (through which we receive our funding), must in the first instance define the problem, in its own terms, that this investment is aiming to address. A number of different conclusions may be drawn. For example, if it is determined that New Zealand needs to train a higher number of doctors, then at some stage another medical school may be needed. If it is determined that our current medical students need more rural exposure during their training, then investment in rural infrastructure and support is needed;
If we need more Māori graduates, then more pipeline support before medical school may be needed; if we need more graduates to select general practice as their career, then further investment in system-wide rural infrastructure may be required.

While there is no easy fix for rural medical workforce shortages, the University of Otago is committed to playing a significant role in finding the best solutions and ensuring that any new investment results in the maximum gains possible for rural communities and their healthcare workforce.

In the absence of both a thorough and impartial analysis and wide consultation with the numerous stakeholders, it seems hasty to jump one way or the other on the question of a third medical school. There is considerable potential to inflict net harm on our rather fragile and stressed health system by inserting a third medical school into the mix without first undertaking very careful analysis and planning. We need to heed the views of the many individuals and organisations that have a vital interest in the complex issues that surround medical education and postgraduate career pathways. The question of a third medical school carries with it many potential risks and benefits, and my plea to decision makers is festina lente—make haste slowly.

To be published in the New Zealand Medical Student Journal.

Competing interests:
Nil.

Acknowledgements:
Over the past seven years there have been occasional discussions and debates about the merits and timing of a possible third medical school, and in this paper I have drawn on the wisdom and insights of many colleagues.

I am grateful for the comments on an earlier draft of this editorial provided by colleagues.

Author information:
Peter Crampton, Division of Health Sciences, University of Otago, Dunedin.

Corresponding author:
Peter Crampton, Division of Health Sciences, University of Otago, PO Box 56, Dunedin 9054.
peter.crampton@otago.ac.nz

URL:

REFERENCES:

John Elliott, Tom Kai Ming Wang, Greg Gamble, Michael Williams, Philip Matsis, Richard Troughton, Andrew Hamer, Gerry Devlin, Stewart Mann, Mark Richards, John French, Harvey White, Chris Ellis

ABSTRACT

AIMS: To audit the management of ST-segment elevation myocardial infarction (STEMI) patients admitted to a New Zealand Hospital over three 14-day periods to review their number, characteristics, management and outcome changes over a decade.

METHODS: The acute coronary syndrome (ACS) audits were conducted over 14 days in May of 2002, 2007 and 2012 at New Zealand Hospitals admitting patients with a suspected or definite ACS. Longitudinal analyses of the STEMI subgroup are reported.

RESULTS: From 2002 to 2012, the largest change in management was the proportion of patients undergoing reperfusion by primary PCI from 3% to 15% and 41%; \( P<0.001 \), and the rates of second antiplatelet agent use in addition to aspirin from 14% to 62% and 98%; \( P<0.001 \). The use of proven secondary prevention medications at discharge also increased during the decade. There were also significant increases in cardiac investigations for patients, especially echocardiograms (35%, 62% and 70%, \( P<0.001 \)) and invasive coronary angiograms (31%, 58% and 87%, \( P<0.001 \)). Notably even in 2012, one in four patients presenting with STEMI did not receive any reperfusion therapy.

CONCLUSIONS: Substantial improvements have been seen in the management of STEMI patients in New Zealand over the last decade, in accordance with evidenced-based guideline recommendations. However, there appears to be considerable room to optimise management, particularly with the use of timely reperfusion therapy for more patients.

Cardiovascular disease remains the leading cause of death globally at 31% in 2012.\(^1\) In New Zealand, cardiovascular disease accounted for 33% of all deaths in 2013.\(^2\) Diagnosis and management of patients with an acute coronary syndrome (ACS) has markedly evolved over the last 20 years. Local and international guidelines have summarised these improvements.\(^3-5\) Some important milestones include the improvements in the range of antithrombotic therapy, the utility of cardiac troponins and the
improvements in invasive and reperfusion strategies, especially in the acute setting of ST-elevation myocardial infarction (STEMI).

Audits of suspected ACS admissions were undertaken in New Zealand in 2002 and 2007, and across Australia and New Zealand in 2012, allowing a longitudinal review of these ACS patients and the quality of their care over a 10-year period. We reviewed the characteristics, management and in-hospital outcomes of STEMI patients from these three ACS cohorts.

Methods
Study population and centres
The three audits were conducted by the New Zealand ACS Audit Group (which consisted of one or more cardiologists or general physicians from all public hospitals in New Zealand admitting ACS patients). The number of centres increased from 36 in 2002 to 39 in each of 2007 and 2012. Detailed methodology of how each audit was undertaken has been previously reported. In brief, all patients admitted to hospital overnight with a suspected or definite ACS during the study period of two weeks in mid-May of 2002, 2007 and 2012 were included. This study reports the subgroup of patients with a discharge diagnosis of STEMI.

There has been a small growth in the number of centres with the capacity for PCI during this decade. The number of interventional and non-interventional centres as defined in these studies was eight and 28 respectively in 2002, nine and 30 in 2007 and 10 and 29 in 2012 (Table 1). Hospitals which admitted suspected ACS patients, but did not have onsite coronary angiogram facilities in any of the three audits were: Kaitaia, Dargaville, Rawene, Kawakawa,

Table 1: Hospital angiogram and PCI availability during each of the audits.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Auckland City (Green lane 2002)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>++North Shore, Auckland</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>++Mercy, Auckland (P)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>++Ascot, Auckland (P)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>++Middlemore, Auckland</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Waikato, Hamilton</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>+Tauranga</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y (Y)</td>
<td></td>
</tr>
<tr>
<td>+New Plymouth</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Wellington</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>+Hastings</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>+Palmerston North</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>++Wakefield, Wellington (P)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>+Nelson</td>
<td>Y</td>
<td>N</td>
<td>Y (Y)</td>
<td></td>
<td>Y (Y)</td>
<td></td>
</tr>
<tr>
<td>Christchurch</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Dunedin</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Hospitals in bold: Regional centre with service available 24 hours, seven days.
++ Hospital service available during the working week.
+ Hospital service available several days a week.
Hospitals shown in brackets had only one PCI operator at the time of the audit, hence not defined as “Intervention Centre”.
Y=Yes, N=No, (P)=Private hospital, PCI=percutaneous intervention Cath=Catheter laboratory.
Whangarei, Waitakere, Thames, Whakatane, Rotorua, Tokoroa, Te Kuiti, Taupo, Gisborne, Taumarunui, Wanganui, Masterton, Hutt, Blenheim, Greymouth, Ashburton, Timaru, Oamaru, Clyde and Invercargill hospitals.

Reperfusion-eligible STEMI patients and major comorbidities

Reperfusion-eligible STEMI patients are those who present with ≥20 minutes of ischaemic chest pain, with ST-segment elevation of ≥1mm, in two contiguous leads, or ≥2mm in leads V1 to V3 (≥1.5mm for women), or left bundle branch block not known to be old, <12 hours of pain onset or <24 hours if there is continuing ischaemic symptoms or haemodynamic compromise. Relative contraindications to fibrinolytic therapy and/or primary PCI need to be considered.

In the 2002 and 2007 audits,6,7 a subjective clinical assessment was made to indicate major comorbidities which might discourage invasive management, and included (but were not limited to) significant renal failure, prior CVA/Dementia, significant pulmonary disease and significant cancer. In the 2012 audit,8,9 major bleeding and chronic liver disease were added to this list.

Data collection

Study protocols, case report forms and definitions of variables were provided to all centres for all three audits. Demographics, past history, presentation, investigations, treatments and discharge diagnoses were prospectively recorded for each patient’s acute care episode, including hospital transfers. The National Multicentre Ethics Committee decided, after input from all centres, that the New Zealand ACS audits were of health service delivery and consent waiver was applied, allowing collection of National Health Index (NHI) numbers to assist with data collection.10

Statistics

Mean (standard deviation) or median (interquartile range) were used to present continuous variables as indicated, and frequency (percentage) for categorical variables. Wilcoxon/Kruskall Wallis test and Fisher’s exact or chi-squared test as appropriate were used for between group comparisons for continuous and categorical variables. Confidence intervals for rates were calculated using a mid P method (www.openepi.com accessed 31/05/2016). SAS (v9.4, SAS Institute Inc) was used to perform statistical analyses, with all tests being two-tailed, and P<0.05 deemed statistically significant.

Results

Over the 14 day audit periods, similar numbers of patients with STEMI were admitted in the three audits: 2002: n=101, 2007: n=86 and 2012: n=99, a total of 286 patients. Table 2 shows the baseline characteristics. There were no major differences in age, sex or ethnicity across the three groups, with male Caucasians being the largest group of patients. Dyslipidaemia was more frequently reported in the 2012 cohort, and hypertension least frequently reported in the 2007 cohort. There was no difference between the cohorts in the previous history of cardiovascular diseases or interventions.

The investigations undertaken and treatments given to STEMI patients are listed in Table 3. There has been a significant increase in patients undergoing echocardiography (from 35% to 70%, P<0.0001) and invasive angiography (31% to 87%, P<0.0001) over time, with fewer patients having exercise tests (18% to 4%, P=0.0026). The acute reperfusion strategy changed with a rise in primary PCI (from 3% to 42%, P<0.0001) and a decrease in fibrinolytic therapy (55% to 31%, P<0.0010). In addition, more patients overall received PCI during their hospital stay (13% to 66%, P<0.0001).

There was also an increase in the use of most antiplatelet and anti-thrombotic agents, including aspirin, P2Y12 inhibitors, heparin and IIb/IIIa inhibitors during in-hospital treatment. Discharge medications after STEMI admission are shown in Figure 1. There have been significant increases in the prescription of all five of these evidence-based myocardial infarction medications, particularly marked for a second antiplatelet agent: a P2Y12 inhibitor, from 14% to 98%, (P<0.0001).

In-hospital mortality did not significantly change, although numbers are small (14 to 7 patients, P=0.17). Length of stay decreased from a median of 5 (4,7) to 3.7 (2.9, 6.1) days (P=0.0084) (Table 3).
Table 2: Baseline patient demographic data for STEMI patients 2002, 2007 and 2012.

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>101</td>
<td>86</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td><strong>Median age [years] (range)</strong></td>
<td>72 (27–93)</td>
<td>68 (37–95)</td>
<td>68 (33–97)</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Sex (male)</strong></td>
<td>60 (59%)</td>
<td>61 (71%)</td>
<td>73 (74%)</td>
<td>0.073</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>80 (79%)</td>
<td>68 (79%)</td>
<td>79 (80%)</td>
<td>0.99</td>
</tr>
<tr>
<td>Māori</td>
<td>8 (7.9%)</td>
<td>6 (7.0%)</td>
<td>9 (9.1%)</td>
<td>0.87</td>
</tr>
<tr>
<td>Pacific</td>
<td>1 (1.0%)</td>
<td>3 (3.5%)</td>
<td>1 (1.0%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Indian</td>
<td>3 (3.0%)</td>
<td>1 (1.2%)</td>
<td>8 (8.1%)</td>
<td>0.048</td>
</tr>
<tr>
<td>Other Asian</td>
<td>0</td>
<td>0</td>
<td>8 (1.9%)</td>
<td>0.0004</td>
</tr>
<tr>
<td>Not reported</td>
<td>0</td>
<td>5 (5.8%)</td>
<td>0</td>
<td>0.0029</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>9 (0.9%)</td>
<td>0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Smoking history</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>29 (29%)</td>
<td>31 (36%)</td>
<td>21 (21%)</td>
<td>0.082</td>
</tr>
<tr>
<td>Previous</td>
<td>35 (35%)</td>
<td>17 (20%)</td>
<td>39 (39%)</td>
<td>0.013</td>
</tr>
<tr>
<td>Never</td>
<td>33 (33%)</td>
<td>35 (41%)</td>
<td>39 (39%)</td>
<td>0.47</td>
</tr>
<tr>
<td>Not reported</td>
<td>4 (4.0%)</td>
<td>3 (3.5%)</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>CVS history</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>59 (58%)</td>
<td>31 (36%)</td>
<td>52 (53%)</td>
<td>0.0075</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>10 (9.9%)</td>
<td>9 (10%)</td>
<td>16 (16%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Dyslipidaemia</td>
<td>20 (20%)</td>
<td>22 (26%)</td>
<td>49 (49%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Prior MI</td>
<td>24 (24%)</td>
<td>13 (15%)</td>
<td>15 (15%)</td>
<td>0.2</td>
</tr>
<tr>
<td>Prior PCI</td>
<td>4 (4.0%)</td>
<td>7 (8.1%)</td>
<td>11 (11%)</td>
<td>0.16</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>4 (4.0%)</td>
<td>1 (1.2%)</td>
<td>3 (3%)</td>
<td>0.5</td>
</tr>
<tr>
<td>Prior PAD</td>
<td>9 (8.9%)</td>
<td>5 (5.8%)</td>
<td>5 (5.1%)</td>
<td>0.51</td>
</tr>
<tr>
<td>Prior TIA/Stroke</td>
<td>14 (14%)</td>
<td>7 (8.1%)</td>
<td>7 (7.1%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Prior AF</td>
<td>7 (6.9%)</td>
<td>4 (4.7%)</td>
<td>11 (11%)</td>
<td>0.24</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptom onset to door: hours, median (q1,q3)</td>
<td>2.6 (1.5, 7.9)</td>
<td>2.5 (1.0, 6.0)</td>
<td>2.2 (1.1, 4.9)</td>
<td>0.21</td>
</tr>
<tr>
<td>Symptom onset to door &gt;12 hours, n (%)</td>
<td>21 (23%)</td>
<td>12 (15%)</td>
<td>13 (16%)</td>
<td>0.24</td>
</tr>
<tr>
<td>Symptom onset to door &gt;24 hours, n (%)</td>
<td>13 (14%)</td>
<td>8 (10%)</td>
<td>5 (5.3%)</td>
<td>0.13</td>
</tr>
<tr>
<td>Cardiogenic shock (Killip class 4)</td>
<td>6 (6.3%)</td>
<td>1 (1.2%)</td>
<td>4 (4.1%)</td>
<td>0.22</td>
</tr>
</tbody>
</table>

CVS: Cardiovascular; MI: Myocardial infarction; PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass grafting; PAD: Peripheral artery disease; TIA: Transient ischaemic attack; AF: Atrial fibrillation. STEMI: ST segment elevation myocardial infarction.

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>101</td>
<td>86</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td><strong>Investigations in hospital</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest X-ray</td>
<td>89 (89%)</td>
<td>77 (90%)</td>
<td>88 (88%)</td>
<td>0.95</td>
</tr>
<tr>
<td>Echocardiogram</td>
<td>35 (35%)</td>
<td>53 (62%)</td>
<td>70 (70%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Exercise test</td>
<td>18 (18%)</td>
<td>10 (12%)</td>
<td>4 (4%)</td>
<td>0.0083</td>
</tr>
<tr>
<td>Invasive angiogram</td>
<td>31 (31%)</td>
<td>50 (58%)</td>
<td>87 (87%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No ETT or angiogram</td>
<td>57 (57%)</td>
<td>29 (34%)</td>
<td>11 (11%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No Echo. or angiogram</td>
<td>50 (50%)</td>
<td>16 (19%)</td>
<td>9 (9.2%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Treatments in hospital</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibrinolytic therapy*</td>
<td>56 (55%)</td>
<td>47 (55%)</td>
<td>31* (31%)</td>
<td>0.0006</td>
</tr>
<tr>
<td>Primary PCI</td>
<td>3 (3.0%)</td>
<td>13 (15%)</td>
<td>42 (42%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No reperfusion**</td>
<td>42 (42%)</td>
<td>26 (30%)</td>
<td>26 (27%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any heparin</td>
<td>61 (60%)</td>
<td>68 (79%)</td>
<td>73 (73%)</td>
<td>0.014</td>
</tr>
<tr>
<td>Tirofiban</td>
<td>5 (5.0%)</td>
<td>2 (2.3%)</td>
<td>0</td>
<td>0.077</td>
</tr>
<tr>
<td>Eptifibatide</td>
<td>2 (2.0%)</td>
<td>1 (1.2%)</td>
<td>16 (16%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Abciximab</td>
<td>1 (1.0%)</td>
<td>2 (2.3%)</td>
<td>12 (12%)</td>
<td>0.0007</td>
</tr>
<tr>
<td>Aspirin</td>
<td>87 (88%)</td>
<td>81 (94%)</td>
<td>98 (99%)</td>
<td>0.0015</td>
</tr>
<tr>
<td>P2Y12 inhibitor</td>
<td>14 (14%)</td>
<td>63 (73%)</td>
<td>95 (97%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>All PCI</td>
<td>13 (13%)</td>
<td>39 (45%)</td>
<td>66 (66%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>CABG</td>
<td>4 (4.0%)</td>
<td>4 (4.7%)</td>
<td>6 (6%)</td>
<td>0.78</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>14 (14%)</td>
<td>5 (5.8%)</td>
<td>7 (7.1%)</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Length of stay, median (q1,q3)</strong></td>
<td>5 (4,7)</td>
<td>4 (3,7)</td>
<td>3.7 (2.9, 6.1)</td>
<td>0.0084</td>
</tr>
</tbody>
</table>

PCI: Percutaneous coronary intervention; UF: Unfractionated; CABG: Coronary artery bypass graft; ETT: Exercise treadmill test; Echo: Echocardiogram.
* Includes three patients in 2012 with pre-hospital fibrinolysis.
** Neither fibrinolytic therapy nor primary PCI.

Delays to administration of fibrinolytic therapy, primary PCI, rescue PCI and in-hospital angiography are detailed in Table 4. There was no significant decrease in median door to needle times for fibrinolysis between 2002 and 2012 [48 (Q1,Q3: 25,130) vs 48 (Q1,Q: 28,84) minutes, P=0.89]. Data on door to device times was not collected in 2002 and 2007. In 2012, the time from door to first device deployment in the infarct artery was <120 minutes in 79% and <90 minutes in 67% of patients. Median delay was 82 (Q1,Q3: 56,93) minutes. Of the five patients undergoing rescue PCI in 2012, the fibrinolysis to device time was 7.1 (Q1,Q3: 5.4, 8.0) hours.

Although there was a reduction in the percentage of patients not receiving any reperfusion therapy (42% to 27% P<0.0001), more than a quarter of STEMI patients in 2012 still did not receive this life-saving treatment. Across all three audits, 190 (67%) of STEMI patients were reperfused (primary PCI or fibrinolysis) compared to 95 (33%) who were not given reperfusion therapy. Reperfused patients were younger, and took less time from symptom onset to presentation to hospital as compared with patients not given reperfusion therapy [7.9 (Q1,Q3: 1.1, 66.8) vs 30.4 (Q1,Q3: 19.9, 120), p=0.0008 hours] (Table 5). In multivariable analysis (Figure 2), age >69 years...
### Table 4: Time to reperfusion treatment of STEMI patients: 2002, 2007 and 2012.

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>101</td>
<td>86</td>
<td>98</td>
</tr>
<tr>
<td><strong>Reperfusion time frames</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number with pre-hospital fibrinolysis, n (%)</td>
<td>-</td>
<td>-</td>
<td>3 (3.1%)</td>
</tr>
<tr>
<td>Number with in-hospital fibrinolysis, n (%)</td>
<td>56 (55%)</td>
<td>47 (55%)</td>
<td>28 (29%)</td>
</tr>
<tr>
<td>Median DTNT, (Q1,Q3)*</td>
<td>48 (25, 130)</td>
<td>36 (25, 75)</td>
<td>48* (28, 84)</td>
</tr>
<tr>
<td>% DTNT &lt;30 mins</td>
<td>16 (31%)</td>
<td>12 (27%)</td>
<td>9 (31%)</td>
</tr>
<tr>
<td><strong>Rescue PCI time frames</strong></td>
<td>n=5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTNT (initial fibrinolysis) min (Q1,Q3)</td>
<td>25 (20,25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rescue PCI: fibrinolysis to device time hrs (Q1,Q3)</td>
<td>7.1 (5.4, 8.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Primary PCI time frames</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number with primary PCI (%)</td>
<td>3 (3.0%)</td>
<td>13 (15%)</td>
<td>42 (42%)</td>
</tr>
<tr>
<td>DTDT (All PPCI) mins (Q1,Q3)</td>
<td>82 (56,93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTDT % &lt;90 mins</td>
<td>28/42 (67%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTDT % &lt;120 mins</td>
<td>33/42 (79%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Angiogram time frames</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pts with routine angiogram (excluding PPCI/Rescue PCI)</td>
<td></td>
<td>18 (18%)</td>
<td></td>
</tr>
<tr>
<td>Time to routine angiogram (hours)</td>
<td>98 (64, 146)</td>
<td>51 (29, 89)</td>
<td>36 (21,67)</td>
</tr>
<tr>
<td>Time to routine angiogram &lt;24 hours n(%)</td>
<td></td>
<td>5 (28%)</td>
<td></td>
</tr>
</tbody>
</table>

*Excluding pre-hospital fibrinolysis.

### Table 5: Characteristics of STEMI patients: by audit year and receiving perfusion therapy or not.

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2007</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reperfusion therapy</strong></td>
<td>59 (58%)</td>
<td>42 (42%)</td>
<td>59 (69%)</td>
</tr>
<tr>
<td><strong>No reperfusion therapy</strong></td>
<td>42 (42%)</td>
<td>59 (69%)</td>
<td>27 (31%)</td>
</tr>
<tr>
<td><strong>Age, mean (SD)</strong>*</td>
<td>67 (14)</td>
<td>73 (12)</td>
<td>65 (13)</td>
</tr>
<tr>
<td><strong>Male</strong>*</td>
<td>39 (66%)</td>
<td>21 (50%)</td>
<td>43 (73%)</td>
</tr>
<tr>
<td><strong>Time delays and symptoms</strong></td>
<td>2.16</td>
<td>10.75</td>
<td>2</td>
</tr>
<tr>
<td>Onset to hospital, median (Q1,Q3)*</td>
<td>(1.33, 4.11)</td>
<td>(1.92, 24.00)</td>
<td>(1.00, 4.23)</td>
</tr>
<tr>
<td>Onset to hospital &gt;12 hours, n (%)</td>
<td>3 (5.4%)</td>
<td>18 (49%)</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Onset to hospital &gt;24 hours, n (%)</td>
<td>3 (5.4%)</td>
<td>10 (27%)</td>
<td>4 (7.6%)</td>
</tr>
<tr>
<td>Major co-morbidity which may discourage invasive management*</td>
<td>4 (6.7%)</td>
<td>11 (25%)</td>
<td>1 (1.7%)</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>7 (12%)</td>
<td>7 (17%)</td>
<td>0</td>
</tr>
</tbody>
</table>

* Reperfusion therapy significantly different from no-reperfusion therapy, all P< 0.0007
** P=0.0023
Figure 1: Discharge medications of STEMI patients in each audit year with n (%) at each year.

- **Aspirin**: 77 (89%), 79 (92%) P< 0.0011, 90 (99%)
- **P2Y12 Inhibitors**: 14 (14%), 53 (62%) P< 0.0001, 89 (98%)
- **Beta-blockers**: 68 (76%), 71 (83%) P=0.030, 75 (83%)
- **ARB or ACE**: 43 (51%), 61 (71%) P< 0.0001, 74 (82%)
- **Statins**: 58 (67%), 76 (88%) P< 0.0001, 89 (95%)

Figure 2: STEMI Patients and reperfusion: Multivariable analysis of odds (95% CI) of not being reperfused.
(n=138, 50%) was associated with a two-fold increased likelihood of not being reperfused (OR 2.0 (95% CI 1.12, 3.63) P=0.018). Further, compared to the 220 (83%) patients presenting to ED <12 hours after symptom onset, those who presented >12 hours (n=46 (17%)) had a seven-fold increase in odds of not being reperfused (OR 7.7 (95% CI 3.6, 16.2) P<0.0001. Sex and year of audit did not predict the rate of non-reperfusion (Figure 2).

Discussion

Audits of the number, management and outcome of suspected ACS patients conducted in 2002, 2007 and 2012 in New Zealand allow longitudinal comparisons of the ACS admissions over a decade.6–9 For STEMI patients, baseline demographics largely did not change over time. However, the optimal management of these patients did change, as well as the ability of the medical services to better deliver this management.

Widespread uptake of a rapid invasive interventional strategy is the main change in STEMI management since the first NZACS audit in 2002. The change in preferred reperfusion strategy, from fibrinolytic therapy to primary PCI is very evident. Patients with STEMI who can be brought to a cardiac catheter laboratory within 120 minutes (door to device time) should receive primary PCI.3–5 The alternative management is for patients to receive fibrinolytic therapy, which remains an effective method of reperfusion, and includes pre-hospital fibrinolytic therapy for more remote areas.11 Following fibrinolytic therapy, there then needs to be a routine policy of transfer to a Regional Centre for subsequent invasive coronary angiography and revascularisation embedded in the management plan.13–15 Routinely, patients should be transferred to receive their angiogram within 24 hours. However, those patients who clinically fail to reperfuse by 60 minutes after fibrinolytic therapy is started need to be transferred as an emergency, to allow emergency salvage of myocardium with ‘rescue’ PCI.3–5 Future service improvements, with helicopter rescue for some patients within geographical reach of a PCI centre, will further increase the numbers who access a primary, or rescue, PCI. It is notable that overall more patients received invasive angiography (31% to 87%, P<0.0001) between 2002 and 2012. Further, more were managed with in hospital revascularisation with either PCI or CABG (17% to 72%, P<0.0001).

Despite our findings, there remains room for improvement in the delivery of reperfusion and revascularisation care to STEMI patients. In 2012, the primary PCI rate of 42% is still not optimal. However, a direct comparison of this rate in 2012 in New Zealand is not different from the primary PCI rate in Australia (42% v 37%, P=0.34).16 Ongoing data from the All New Zealand Acute Coronary Syndrome Quality Improvement Programme (ANZACS QI) may show a future increase in patients receiving primary PCI.17

However, a significant number of patients do not receive either reperfusion therapy. This is associated with increased hospital mortality. When patients from across the three New Zealand audit cohorts are combined from 2002, 2007 and 2012 (n=286), the in-hospital mortality without reperfusion therapy was higher: 16.8% v 5.3%, p=0.0024, compared to those patients receiving reperfusion therapy. This is consistent with the findings of the combined 2012 Australia and New Zealand audit of STEMI patients (n=419), which found a mortality increase in hospital: 11.7% v 4.9%, P=0.011 for patients who did not receive reperfusion therapy compared to those who did receive this therapy.18 This important patient group needs further study.

In addition, although we have seen a move away from exercise treadmill testing for inducible ischaemia, towards coronary angiography to define the coronary anatomy, as the method to risk assess a patient, in 2012 still 11% of patients did not receive either test following their STEMI presentation. Although there may be good reasons to not undergo stress testing or coronary angiography, such as a frail elderly patient with major comorbidities, this is unlikely to account for all patients in this subgroup.

Reducing the ischaemia (symptoms) to device time is critical. The determinants are multifactorial, from increasing patient awareness to seek help when symptoms occur, to improving access for transport to interventional centres from around the country.15–18 It is clear that systems of care with streamlined and uniform treatment protocols in the ambulance and hospitals are needed.
Echocardiography is now more frequently performed as recommended in guidelines. It is important for the assessment of left ventricular and valve function, the presence of left ventricular thrombus and of other possible complications of myocardial infarction. However, the availability of this essential cardiological tool is still limited across the country and remains an important deficiency in service provision.19,20

Increased use of anti-platelet therapies is a reflection of both the published evidence base and funding by PHARMAC. The beneficial use of a second antiplatelet P2Y12 inhibitor agent in an ACS was first demonstrated in the original Clopidogrel in Unstable Angina to Prevent Recurrent Events (CURE) trial published in 2001,21 with the use of dual anti-platelet therapy for patients receiving a stent becoming an important part of management,3–5 but the uptake was low in our 2002 cohort at only 14%, due to previous funding restrictions.22 A change in PHARMAC policies then allowed this to increase to 73% by 2007. The Platelet Inhibition and Patient Outcomes (PLATO) trial published in 2009 showed ticagrelor to be superior to clopidogrel in ACS with a reduction in mortality.23 Dual antiplatelet therapy of aspirin and either ticagrelor or clopidogrel were prescribed to 98% of the 2012 cohort in accordance with the latest evidence and guidelines.

The prescription rates of all five evidence-based ACS medication classes have increased, reflecting better optimisation of secondary medical prevention therapy over time. Although medical therapy prescription at discharge is near 100% for dual anti-platelet therapy, the 95% rate for a statin and the 83% rate for a beta-blocker and 82% for an ACE inhibitor or an ARB could possibly be increased, although these percentages may reflect intolerance or contraindications to medications.

Clearly, ongoing review of STEMI care is important in guiding practice. The New Zealand ASC audits have given the ability to explore longitudinal comparisons of ACS care over time. As a result of these audits which produced a momentum for change, and the subsequent understanding by the Ministry of Health of the importance of ongoing audit of ACS medical practice, ANZACS-QI has been designed and implemented since 2013 and is funded by the Ministry of Health.17 This enables real time reporting of demographics, management and outcomes of STEMI patients and provides the opportunity to improve patient care.

Study limitations
This study has some limitations. It was an observational study with modest power given the study size. Despite this, these audits document an important evolution of the management of STEMI among consecutive, unselected patients in New Zealand over a decade. Details and timing of PCI were not available from earlier audits for comparison. We relied on local co-investigators to report relevant data which was not centrally verified. It is also to be noted that the investigators were aware that an audit was occurring, and it is unknown as to how this might have affected rates of prescribing evidence-based therapies and intervention rates.

Conclusion
Data collected in the 2002 Audit provided the momentum for change in resourcing and treatment of ACS in New Zealand. This paper confirms that there have been significant improvements in the management of STEMI patients in two subsequent audits over the last decade in terms of invasive management, investigations and medical therapy before and after discharge. Our study also highlights the importance of ongoing audit of the care of STEMI patients within the ongoing Ministry of Health-funded ANZACS-QI database. There is still room for improvement.
Dr Hamer reports affiliation with Capricor Inc and Amgen Inc outside the submitted work. A part of Dr Hamer’s income was reimbursed to Nelson Marlborough District Health Board by the Ministry of Health for New Zealand Cardiac Network responsibilities during the time that this research was performed; Dr White reports grants and non-financial support from GlaxoSmithKline during the conduct of the study, grants from Sanofi Aventis, grants from Eli Lilly and Company, grants from National Institute of Health, grants from Merck Sharpe and Dohm, grants and personal fees from AstraZeneca, grants from Omthera Pharmaceuticals, grants from Pfizer New Zealand, grants from Intarcia Therapeutics Inc, grants from Elsai Inc and grants from DalGen Products and Services outside the submitted work.

Acknowledgements:

The authors would like to thank the many investigators who assisted with the three National audits, and who are acknowledged in each of the three primary papers.1–9

Author information:

John M Elliott, Cardiologist, Christchurch Hospital, Christchurch; Tom Kai Ming Wang, Cardiology Registrar, Green Lane Cardiovascular Service, Auckland City Hospital, Auckland; Greg D Gamble, Statistician, University of Auckland, Auckland; Michael JA Williams, Cardiologist, Dunedin Hospital, Dunedin; Philip Matis, Cardiologist, Wellington Hospital, Wellington; Richard Troughton, Cardiologist, Christchurch Hospital, Christchurch; Andrew Hamer, Cardiologist, Nelson Hospital, Nelson; Gerry Devlin, Cardiologist, Waikato Hospital, Hamilton; Stewart Mann, Cardiologist, Wellington Hospital, Wellington; Mark Richards, Cardiologist, Christchurch Hospital, Christchurch; John K French, Cardiologist, Liverpool Hospital, SW Sydney Clinical School (UNSW) Sydney, Australia; Harvey D White, Cardiologist, Green Lane Cardiovascular Service, Auckland City Hospital, Auckland; Chris J Ellis, Cardiologist, Green Lane Cardiovascular Service, Auckland City Hospital, Auckland. For the NZ Regional Cardiac Society ACS Audit Group.

Corresponding author:

Dr Chris Ellis, Cardiologist, Green Lane Cardiovascular Service, Auckland City Hospital, Grafton, Auckland 1023. chrise@adhb.govt.nz

URL:


REFERENCES:


11.

12.
White HD. Systems of Care: Hub and Spoke for both Primary PCI and Angioplasty Following Fibrinolysis. Circulation. 2008; 118(3); 219–222.

13.

14.

15.

16.

17.
**Appendix 1**
Abbreviations/definitions

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE</td>
<td>Angiotensin Converting Enzyme</td>
</tr>
<tr>
<td>ARB</td>
<td>Angiotensin Receptor Blocker</td>
</tr>
<tr>
<td>ACS</td>
<td>Acute Coronary Syndrome</td>
</tr>
<tr>
<td>CABG</td>
<td>Coronary Artery Bypass Graft</td>
</tr>
<tr>
<td>CAD</td>
<td>Coronary Artery Disease</td>
</tr>
<tr>
<td>CVA</td>
<td>Cerebrovascular Accident</td>
</tr>
<tr>
<td>IQR</td>
<td>Interquartile Range</td>
</tr>
<tr>
<td>LBBB</td>
<td>Left Bundle Branch Block</td>
</tr>
<tr>
<td>MACE</td>
<td>Major Adverse Cardiac Event</td>
</tr>
<tr>
<td>MI</td>
<td>Myocardial Infarction</td>
</tr>
<tr>
<td>NSTEMI</td>
<td>Non ST Segment Elevation Myocardial Infarction</td>
</tr>
<tr>
<td>PAD</td>
<td>Peripheral Arterial Disease</td>
</tr>
<tr>
<td>PCI</td>
<td>Percutaneous Coronary Intervention</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>STEMI</td>
<td>ST segment Elevation Myocardial Infarction</td>
</tr>
<tr>
<td>TIA</td>
<td>Transient Ischaemic Attack</td>
</tr>
<tr>
<td>P2Y&lt;sub&gt;12&lt;/sub&gt;</td>
<td>P2Y&lt;sub&gt;12&lt;/sub&gt; protein inhibitor</td>
</tr>
<tr>
<td>IIb/IIIa</td>
<td>Glycoprotein IIb/IIIa inhibitors</td>
</tr>
<tr>
<td>PHARMAC</td>
<td>Pharmaceutical Management Agency</td>
</tr>
</tbody>
</table>
A retrospective observational study of mortality rates in elderly patients with shock in a New Zealand district hospital ICU

Owen Keet, Stephanie Chisholm, Jennifer Goodson, Troy Browne

ABSTRACT

AIM: Admitting very elderly, critically ill patients to ICU is controversial. We compared our mortality data in a subgroup of elderly patients to internationally published outcomes.

METHODS: Tauranga Hospital ICU retrospectively investigated their mortality outcomes for patients with septic shock. The ANZICS adult database (AORTIC), Tauranga Hospital computer records and medical records were used to identify the study cohort and provide information on demographics, admission times and shock types between January 2009 and December 2014. Patients were divided into groups; not old (<74 years), old (75–84 years) and very old (>85 years) to compare survival statistics at ICU discharge, hospital discharge, 28 days, six months and 12 months.

RESULTS: Patients in the >85 year group at Tauranga ICU had a 38.5% survival.

CONCLUSION: With careful selection, elderly patients with septic shock may have an acceptable outcome.

A dmitting very elderly patients to intensive care units (ICU) is a controversial issue. With current demographic projections, increasing life expectancy and increasing complexity of interventions, we will see many more elderly patients seeking intensive care services.1–4 Balancing the benefit intensive care can offer to these patients is often a complex and multidisciplinary decision.2–3 Pursuing unrealistic goals and expectations is not in the interest of individuals or the public resources.

A review of the very elderly and ICU care concluded that there are contradicting views in the literature, and it is reasonable that selected patients may benefit from ICU level care, but more research is required to identify this group.1 Emergent admissions in this age group are associated with particularly poor outcomes.6–7

This was highlighted in a recent study looking at ICU outcomes in elderly patients with unplanned admissions requiring inotropes for circulatory failure.8 This secondary analysis of a large multicentre randomised controlled trial showed that a mere 2% of the over 85-year-old group survived to one year.8–9

This study raised questions as to the benefit of treating this defined group of very elderly patients, who are commonly referred to intensive care services. We used the study as a basic framework to investigate what our ICU shock mortality rates were, and to draw conclusions on our current practice.

Method

The Bay of Plenty Clinical School Research Unit approved this study. The study was carried out at Tauranga Hospital ICU, Bay of Plenty, New Zealand.

Mortality was compared in patients admitted to Tauranga Hospital ICU with circulatory failure in three age groups: not old (<74 years), old (75–84 years) and very old (>85 years) between 1 January 2009 and 31 December 2014. The study was designed
around the method in the Biston study, and measured standard mortality outcomes.\textsuperscript{7}

The ANZICS adult database, AORTIC (Australasian Outcomes Research Tool in Intensive Care), was used to retrospectively find all those patients admitted to Tauranga Hospital ICU with a diagnosis of shock within the specified time period. All shock types were included, for example septic, hypovolaemic, anaphylactic and cardiogenic shock. All patients transferred from the neighbouring hospital in Whakatane who required ICU support were also included.

**Inclusion criteria:** those with shock under the care of an intensivist where shock was defined as MAP <70mmHg, or systolic BP <100mmHg, and/or requiring inotropic support within the first 24 hours only.

**Exclusion criteria:** those <18 years, and physiology not suggestive of shock, did not meet inclusion criteria.

The AORTIC database provided data on APACHE II scores (Acute Physiology and Chronic Health Evaluation) and SOFA scores (Sequential Organ Failure Assessment) for each patient at ICU admission. Age adjusted APACHE scores were also recorded. The hospital computer-based record system (Webpas), was used to identify hospital and ICU admission dates, and mortality dates. Medical records confirmed types of shock and inotrope usage within the first 24 hours of ICU admission. Some patients included in the study did not require inotropes within the first 24 hours or at all during their ICU admission, however, these patients were still included if their physiology met the inclusion criteria.

The outcomes measured were patient status (dead or alive) at ICU discharge, hospital discharge, 28 days, six months and 12 months.

**Results**

AORTIC identified 260 admissions to Tauranga Hospital ICU with shock between 2009 and 2014. Three patients had two admissions for shock. After review of AORTIC data, 10 patients were excluded from the study population, as they did not meet the inclusion criteria. This left a final study cohort of 250 patients, with only one patient having had two admissions of shock.

The demographic data is summarised in Table 1 and Table 2.

APACHE II score was similar across the three age groups—19, 22 and 21—in ascending group order. When adjusted for

<table>
<thead>
<tr>
<th>Table 1: Main demographic data.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>SOFA</td>
</tr>
<tr>
<td>APACHE II</td>
</tr>
<tr>
<td>APACHE II minus age</td>
</tr>
<tr>
<td>Urinary</td>
</tr>
<tr>
<td>GI</td>
</tr>
<tr>
<td>Pulmonary</td>
</tr>
<tr>
<td>Soft tissue</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Septic shock</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
</tr>
<tr>
<td>Other shock</td>
</tr>
</tbody>
</table>

±Indicates standard deviation.
age, the groups were more comparable, but the <74 year group appeared to have a slightly worse prognostic prediction, with an age adjusted APACHE II of 16, compared to the other groups both scoring 15. There was no pattern to SOFA scores; (seven, eight and six in ascending group order).

Septic shock was the most common shock type across all groups (94.8%). Gastrointestinal and urinary were the most frequent origin of sepsis. Only 4.4% of patients were admitted with cardiogenic shock, of which none were in the very old group. Only 0.8% of patients were admitted for other shock types (anaphylactic and hypovolaemic).

As age increased, fewer patients had an interhospital transfer. In the >85 year group, eight (61.5%) patients required vasopressor support in the first 24 hours of ICU care. Noradrenaline was the most common vasopressor agent given (62.5%).

Discussion

The European study highlighted the fact that the long-term outcome for very elderly patients was particularly poor after a critical illness involving cardiovascular failure that required inotropic support.8 Outcomes for both acute medical and surgical ICU admissions in this age group have been shown to be poor in many studies, however, the extremely poor survival rate in the Biston study of 2% at one year was unexpected.7–10 Tauranga is situated in a region of New Zealand with a relatively high proportion of elderly demographic, and the findings of the Biston study had some relevance to our practice.11 The fact that the Biston study was a secondary analysis of a study looking at inotrope use may have a selection bias, putting this cohort of patients in a very sick group with profound irretrievable shock. This is reflected in their high ICU mortality, although they did mention that many of their patients in the very elderly group had isolated septic shock of urinary tract origin, which is associated with a better prognosis.12

Our retrospective observational study focused on shock in the elderly, rather than inotrope or vasopressor use. A significant number of patients in the very old group in our study were discharged from the ICU (92.3%) and survived to hospital discharge (76.9%) (Figure 1). 38.5% of our patients in the very old group survived to 12 months, which surpassed the 2% survival found in the Biston study.8 Findings from a large Australasia and New Zealand retrospective analysis have shown a trend to a reduction in mortality in sepsis in all age groups.

Table 3: Mortality rates at each outcome.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>&lt; 74 (n=164)</th>
<th>75–84 (n=73)</th>
<th>&gt;85 (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU discharge</td>
<td>16.5% (27)</td>
<td>30.1% (22)</td>
<td>7.7% (1)</td>
</tr>
<tr>
<td>Hospital discharge</td>
<td>22% (36)</td>
<td>42.5% (31)</td>
<td>23.1% (3)</td>
</tr>
<tr>
<td>28 days</td>
<td>23.2% (38)</td>
<td>49.3% (36)</td>
<td>46.2% (6)</td>
</tr>
<tr>
<td>6 months</td>
<td>28.7% (47)</td>
<td>56.2% (41)</td>
<td>53.8% (7)</td>
</tr>
<tr>
<td>12 months</td>
<td>34.8% (57)</td>
<td>61.6% (45)</td>
<td>61.5% (8)</td>
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</table>

Table 2: Ethnicity demographics.

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>&lt;74yrs</th>
<th>75-84yrs</th>
<th>&gt;85yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ European</td>
<td>56.7%</td>
<td>64.4%</td>
<td>84.6%</td>
</tr>
<tr>
<td>Māori</td>
<td>32.3%</td>
<td>13.6%</td>
<td>0.0%</td>
</tr>
<tr>
<td>European Other</td>
<td>6.1%</td>
<td>22.0%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Asian, Pacifica, Indian</td>
<td>4.9%</td>
<td>0.0%</td>
<td>0.0%</td>
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</tbody>
</table>
The hospital mortality for the 2012 >85 year old group was 30.4% (CI 27.9–32.9). Our hospital mortality rate of 23.1% may represent further realisation of this trend, but more likely random variation and small sample size. The six patients receiving vasopressors in the Tauranga >85 year group (61.5%) had outcomes similar to those who merely met the criteria for shock. Numbers are too small for statistical analysis, but it is interesting that vasopressor use did not predict poor outcome.

The one-year survival of our 75 to 84-year-old group is similar to the greater than 85-year-old group, indicating possible selection bias in which we would most likely not treat sicker patients in the very old group. The differences in vasopressor use between the studies were not reflected by the SOFA scores. Inotrope or vasopressor use as a predictor of outcome may be flawed in that it may not in some cases represent cardiovascular failure. Vasopressors may be required to support circulatory function with the addition of sedation and intermittent positive pressure ventilation (IPPV). The use of vasopressors may also represent a specific goal in treatment defined by individualised cardiovascular parameters and fluid volume use. IPPV may be a better predictor of mortality. Initiating IPPV is a significant step in the management of septic shock and indeed any ICU patient. Limitations are often placed around this intervention, accounting for why our cohort had better outcomes.

The ethnic composition of each group was less diverse as the age increased. For New Zealand, it was interesting but not unexpected to see that the Māori cohort was not represented in the very old group. Twenty-five percent of the Bay of Plenty region’s population is Māori. The Māori demographic are known to have a shorter life expectancy (73.0 years for Māori males and 77.1 years for females) compared to non-Māori counterparts (80.3 years for non-Māori males and 83.9 years for females).

A major limitation of our study is the small numbers and retrospective nature of the cohort. Although we appear to be achieving an acceptable balance in mortality statistics
in a group of patients that universally have been reported to have a poor outcome, the study does not indicate a clear-cut selection criteria in which we were able to achieve these outcomes. Decisions are made on case-by-case bases, often with multidisciplinary and family input. There is a need to define and improve this process of selecting the patients from this elderly cohort that will benefit from intensive care treatment. Research and validation of frailty scores in many clinical domains, including critical care is showing promise in integrating the spectrum of disease burden and functional reserve with outcomes.\textsuperscript{17-18}

**Conclusion**

The decision whether to admit and treat the very elderly patient with septic shock in ICU is a complex decision. Although age in itself is not a reason to deny a patient ICU admission, it is taken into account in context of the burden of chronic and acute disease.\textsuperscript{19-22} The patient selection and subsequent treatment at a secondary level New Zealand hospital produced results that saw most of the patients during a five-year period, including those >85 years being discharged alive from hospital. This study suggests that with carefully considered selection, elderly patients greater than 85 years of age may have an acceptable long-term outcome following an episode of septic shock.

**Competing interests:** Nil.

**Author information:** Owen Keet, Intensive Care, Tauranga Hospital, Tauranga; Stephanie Chisholm, Medical School, Auckland University, Auckland; Jennifer Goodson, Intensive Care, Bay of Plenty District Health Board, Bay of Plenty; Troy Browne, Intensive Care, Tauranga Hospital, Tauranga.

**Corresponding author:** Dr Owen Keet, Intensive Care, Tauranga Hospital, Cameron Road, Tauranga 3143. owenkeet@bopdhb.govt.nz


**REFERENCES:**


Prevalence of enduring power of attorney and barriers towards it in community geriatric population in Counties Manukau Health

So-Jung Park, Heather Astell

ABSTRACT

AIM: Enduring power of attorney (EPA) is a simple and easy-to-set-up legal document which protects the wishes of the donor, as well as preventing significant psychological and social cost for the patient and their family when long-term residential care needs to be arranged due to the patient's increasing care requirements. It also reduces the significant cost in hospital beds days for the district health board involved while awaiting the Protection of Personal and Property Rights order. However, the prevalence of EPA is low in the geriatric population who arguably need it the most. This study aims to identify the barriers in obtaining an EPA in this population.

METHODS: Using a cross-sectional design, 100 individuals seen in community geriatric clinics or home visits in Counties Manukau Health between June to September 2015 were surveyed.

RESULTS: There was no significant difference in prevalence of EPA between those with cognitive impairment and those without (40.4% and 35% respectively with difference in proportion 5% (95% CI: -14% to 24%, p 0.61)). New Zealand Europeans were more likely than other ethnic groups to have EPA (63.5% vs 10.4%, with difference in proportion of 53% (95% CI: 37% to 69%, p <0.001)). Forty-three participants without EPA gave lack of information as their reason for not having obtained one. The majority of those without EPA (49 participants) felt that their doctor or lawyer would be the best person to convey such information to them, as opposed to mass media such as TV or internet.

CONCLUSION: EPA has not been widely acknowledged as an important aspect of health and legal planning by the participants of this survey, predominantly due to the lack of knowledge in the general public and financial barriers. Increased efforts to educate and support uptake could have positive personal and social outcomes.
Unfortunately, the number of people who have an EPA is low. There have been international studies to detail the prevalence of EPA or its equivalent in various countries. In an American retrospective analysis of advance care planning (ACP) in patients with mild cognitive impairment (MCI) or Alzheimer’s dementia (AD), 71% had ACP before being seen in an Alzheimer’s disease research centre, but only 39% of the remaining 21% initiated ACP in the five years following diagnosis of MCI 49 and AD.3 Closer to home, an Australian study has shown that only 34% of older adults in the community and 73% of those in an aged care facility had EPA in place.4 Specific to New Zealand there has been an online questionnaire conducted to identify barriers to EPA. Half the respondents were over the age of 65 and majority were health or legal professionals, of which 17% reported that they have obtained an EPA.5

There have been some attempts at identifying the characteristics of those who make health care plans for the future, including appointing an EPA. The decision is deemed multifaceted, requiring positive input from the participants and families as well as the clinicians. People often had not considered such a future plan and are made aware of it when an urgent need arises, at which time the subject person may already lack capacity to appoint an EPA.

Furthermore, the need to provide more information about EPAs was identified in the recent review of the 2007 amendments to EPA by the Minister of Senior Citizens, as the general public, health and legal professionals are at large unaware of its extent and limits.5

This study aims to identify the barriers in obtaining an EPA in the geriatric population who often lack an appointed attorney when they are no longer able to make decisions for themselves. This study is, to the best of our knowledge, the first study specifically targeting the geriatric population in New Zealand.

Method

Study design and participants
A survey was conducted of people over the age of 55 years who were of Māori or Pacific Islander ethnicity or over the age of 65 years of other ethnic groups living in the CMH region who were referred to the gerontology service of Middlemore Hospital. Referrals were made by their general practitioners or other speciality medical services either for a general geriatric outpatient appointment or for a community gerontology assessment. Geriatricians and nurse specialists completed a two-page survey on 100 consenting consecutive participants encountered during community home visits and outpatient clinics.

Participants
This survey (Appendix 1) collected information on baseline characteristic of the participants, whether they had a current EPA or will and enquired the reason for the absence. Participants and families were then educated on EPA with reference to the information brochures from the Office of Senior Citizens (Ministry of Social Development) or alternatively a simplified single-page information sheet (Appendix 2) that was available to handout or consult while answering questions. Participants were then asked if they would consider obtaining an EPA in the near future. If a clear answer could not be obtained from the participants, their next of kin were contacted. This was a cross-sectional observational study and no identifiable personal information was recorded. In order to reduce potential bias from leading multiple-choice questions, participants were allowed to answer open-ended questions in their own words. The surveyor then chose the appropriate response option from the list provided, allowing for multiple reasons.

The survey was continued for the three-month period of June 2015 to September 2015. Residential care residents were excluded, as the study aimed to gather information from the community geriatric population rather than the residential care population who were more likely to have significant cognitive impairment and already established EPA.4

Survey design
A teleconference was held with the Ministry of Social Development in order to coordinate this survey with the recent Public Awareness Information Campaign conducted by the Office for Senior Citizens and answer questions raised from this previous survey. A biostatistician was consulted on survey design.
Cognitive dysfunction
Participants were deemed to have
cognitive dysfunction either if there was
a previous diagnosis of dementia or if the
geriatrician or nurse specialist assessing the
patient at the time of the survey conducted
a cognitive assessment and made a new
diagnosis of cognitive dysfunction of any
severity. Various cognitive assessment tools
were used but not unified.

Competency
Patient’s competency to appoint an EPA
was at the assessing geriatric doctor or
nurse specialist’s clinical judgement.

Sample size
We had intended to recruit a sample size
of 300 to have a margin of error for esti-
mation of a proportion of +/-5%, but in the
timeframe of the study we could only recruit
100 participants.

Statistical analysis
The Type I error rate for individual statis-
tical tests was 0.05 and no adjustment was
made for multiple statistical testing. Demo-
graphics characteristics of participants
for those with EPA and without EPA were
presented in terms of counts and propor-
tions. Chi-square or fisher exact test was
used to assess the association between EPA
and the demographics factors. Difference in
proportions with 95% confidence interval
of EPA, welfare EPA and property EPA were
produced, between those with and those
without cognitive impairment and between
ethnicity with their respective p-values.
Sample size estimation and analysis were
carried out using SAS version 9.3.

Ethical approval
This study was approved by the Counties
Manukau Health Research office (Research
registration number 2122). This study was
out of scope of HDEC review (HDEC ref: 15/
CEN/86).

Verbal informed consent was obtained
from participants prior to them completing
the survey. Confidentiality was maintained
by not recording any identifiers of partici-
pants from the paper survey, and data was
computerised after collection.

Results

Patient characteristic
These are described in Table 1. Half
the participants were male, the majority
of the sample, 64/100, were aged over 75
years of age and 52/100 were NZ European.
Whether the participant had an EPA was not
different by age and sex. As shown in Table
2, NZ Europeans were more likely than
other ethnic groups to have an EPA; 33/52
(63%) compared to 5/48 (10%), difference in
proportions 53% (with 95% CI 37% to 69%,
p<0.001). Other characteristics between
those with EPA and those without EPA were
not significantly different.

Cognitive impairment
These are described in Table 3.
Fifty-two out of 100 participants (52%) had
cognitive impairment. Those with
cognitive impairment were not more likely
to have EPA compared to those without;
21/52 (40.4%) compared to 17/48 (35.4%),
difference in proportion 5% (95% CI -14%
to 24%, p=0.61). Of those with cognitive
impairment, only three participants were
deemed incompetent to appoint an EPA.

EPAs and wills
Out of 59 participants aware of the
concept of EPA, 38 had any EPA in place
(38/59, 64%). Most of those aware of EPA
had a will in place (51/59, 86.4%), compared
to only 13 out of 41 participants unaware
of EPA having a will in place (13/41, 31.7%).
Those without a will did not have EPA
(0/36).

Of the 52 NZ Europeans, 48 had wills
(48/52, 92.3%) whereas only 16 out of 48
other ethnic group participants had wills
(33.3%).

Difference between EPA for
property and welfare
More people had EPA for property than
welfare (37% vs 34% respectively). Thir-
ty-three participants had both, one had EPA
only for welfare and four had EPA only for
property. Participants were either unaware
of the existence of the other EPA or had felt
they did not require the other one at the
time of setup.
Source of information

Those who were aware of EPA had a variety of sources from which they first heard of it from. Sixteen participants were informed of EPA from their lawyers, compared to eight participants being informed from their doctors. Nine participants knew about EPA as they were the appointed attorney for their family/friends in the past. Nine others were informed of it through their friends and family. Other sources included social workers, needs assessors, a real estate agent and Public Trust.

Although almost all (53/59, 89.8%) of those who were aware of EPA defined its role as appointing another person to make decisions on your behalf, five people had the misconception that it took effect upon death. Upon questioning what might happen when they lack capacity and do not have an appointed EPA, 53 out of 67 participants (53/67, 79.1%) thought the family would automatically be allowed to make decisions for them. Four thought medical professionals will step in to make the decisions, one left it up to God and the rest had no opinion.

Forty-six participants out of the 67 (69%) who did not have either EPAs were simply unaware of its existence. Allowing for multiple reasons, 18 (18/67, 26.8%) thought they did not require an EPA, four people did not have the funds for its setup and one did not have an appropriate person to appoint as attorney. Seven said they intended to obtain one but hadn’t had the time to do so yet. One Cambodian Chinese respondent gave a cultural reason for not obtaining an EPA, as...

“It is bad luck to think of such things (worsening dementia/health) in our culture.”

Sixty-seven participants who lacked either EPA were given information on it. After education, most participants replied that they would be positively looking into obtaining an EPA, however, 17 participants declined (17/67, 25.3%). Allowing for multiple reasons, 10 replied that they did not have the financial capacity to fund an EPA, and 11 still did not feel the need for one.

<table>
<thead>
<tr>
<th>Table 1: Participant characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>55–64</td>
</tr>
<tr>
<td>65–74</td>
</tr>
<tr>
<td>75–84</td>
</tr>
<tr>
<td>85–94</td>
</tr>
<tr>
<td>Ethnicity</td>
</tr>
<tr>
<td>NZ European</td>
</tr>
<tr>
<td>Other European</td>
</tr>
<tr>
<td>Māori</td>
</tr>
<tr>
<td>Pacific Island</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Other European included: 2 English, 2 South African, 1 Irish, 1 Scottish, 1 Dutch, 1 Greek.
Pacific Island included: 8 Samoan, 3 Cook Island Māori, 2 Niuean, 1 Tongan.
Asian included: 6 Indian, 3 Chinese, 2 Korean, 2 Taiwanese, 1 Cambodian Chinese.
Others included: 1 Iraqi, 1 Chilean.
Only five participants correctly estimated the price of setting up an EPA with the Public Trust, 17 participants overestimating the price greatly, and 45 participants simply weren’t able to guess.

Most people felt that a more personal approach via their own health care or legal professional was the best way to approach participants regarding EPA setup (28/67 and 10/67 respectively, 41.7% and 14.9%) rather than mass media such as TV, radio, papers or internet (14 /67, 20.8%).

Discussion

The major barrier to the establishment of EPA is the lack of knowledge of its existence, purpose and importance in the population. General public knowledge is lacking, and among those who are aware of EPA, ambivalence is widespread and the responsibility to start such a conversation is assumed to be in the hands of either the health care or legal professional.6

Baseline characteristics of those with EPA

We could not identify any particular characteristics apart from ethnicity for those who have an EPA, perhaps influenced by the number of participants, which was too small for significant subgroup analysis. Previous studies on patient characteristics on those who completed an ACP or EPA have been divided. American studies have noted that those who are older, married, female, white, well-educated and know someone with cognitive impairment are more likely to have an advance care plan or EPA.3,6 Others found that those who were single or not in a legally recognised relationship were more likely to have completed an advanced directive,7 presumably as they did not have a partner to rely on for making substitute decisions.8

Some studies have found poor health or recent hospitalisation to be positive factors towards obtaining an ACP, perhaps attributable to recommendation from medical staff. This raises the idea that milestones in a patient’s life such as a new diagnosis of a chronic illness or change to residential care could be ideal opportunities to trigger discussions of EPA by health care professionals. A general practitioner would be the ideal key person to start such a conversation, but this may require funding and training to support scheduled EPA discussions as being one of the important goals in clinical practice.

Ethnicity

Māori, Pacific Islanders and Asians have a collective nature with expectation for heavy family/whanau involvement during times of illness as opposed to the more individualistic worldview of NZ Europeans.9 This may have resulted in the higher prevalence of EPA seen in NZ Europeans observed in this study, as Māori, Pacific Islanders and Asians feel little need to appoint a single individual as EPA when the whole family

Table 2: Comparison of EPA proportions between those of European ethnicity compared to other ethnic groups.

<table>
<thead>
<tr>
<th></th>
<th>NZ European N (%)</th>
<th>Other ethnicity N (%)</th>
<th>Difference in proportions (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any EPA</td>
<td>33 (64)</td>
<td>5 (10)</td>
<td>53 (37.4, 68.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Welfare EPA</td>
<td>29 (56)</td>
<td>5 (10)</td>
<td>45.4 (29.3, 61.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Property EPA</td>
<td>32 (62)</td>
<td>5 (10)</td>
<td>51.1 (35.3, 66.9)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 3: Comparison of EPA proportions between those with and without cognitive impairment (CI).

<table>
<thead>
<tr>
<th></th>
<th>Cognitive impairment N (%)</th>
<th>No Cognitive impairment N (%)</th>
<th>Difference in proportions (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any EPA</td>
<td>21 (40)</td>
<td>17 (35)</td>
<td>5 (-14, 24)</td>
<td>0.61</td>
</tr>
<tr>
<td>Welfare EPA</td>
<td>20 (39)</td>
<td>14 (29)</td>
<td>9.3 (-9.2, 27.7)</td>
<td>0.33</td>
</tr>
<tr>
<td>Property EPA</td>
<td>21 (40)</td>
<td>16 (33)</td>
<td>7.1 (-11.8, 25.9)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
interdependence is culturally expected. Furthermore, among the Māori, Pacific Islander and Asian population, the ‘bad luck’ brought by speaking of death and illness due to underlying belief that spoken words will influence reality may have been a barrier in implementing EPAs as well as advanced care planning. Language barriers between elderly Māori, Pacific Islander and Asian participants and health care providers may also play a role.

Finance

Another barrier to the appointment of EPA is financial. Many did not know the cost of setting up an EPA and often overestimated the cost. This correlates with the lack of information the general public has on EPA and contributes to the reluctance people feel about setting one up. The Public Trust in collaboration with senior concessions provided by the government such as Supergold card provide a cost-efficient way of appointing an EPA, but unless this information is more widely spread it will be underutilised.

The higher number of people with EPA for property compared to welfare coincides with previous studies and may reflect the fact that society accepts financial future planning as an acceptable responsibility.\(^8\)\(^10\) Conversations regarding finances are often more acceptable as they do not involve thoughts on one’s own mortality and failing health. On one hand this may provide legal professionals an opportune chance to discuss EPA for welfare as well as property while drawing up a will. The drawback is that those without a significant amount of money do not feel a need to formally plan for the future by writing a will, and at the same time appoint an EPA.\(^3\) Māori and Pacific Islanders in the CMH region are living in more socioeconomically deprived areas compared to other ethnic groups.\(^1\) The lack of a will as well as EPA in Māori and Pacific Islanders may be partially explained by the reduced priority for a will/EPA compared to other daily expenses, which may be due to financial deprivation.

Limitations

Lastly, this study is limited in that we could only gather a small number of participants during the available study period, which puts the study at risk of type II error. There may have been potential bias in those who have consented to the survey, as well as the reasons for the patient's referral to the CMH gerontology services. Thus, this study will only be generalisable to this particular population group. Potential for bias further increases due to lack of randomisation. Assessment of competency to appoint an EPA was left at the discretion of the surveyor, potentiating further bias.

Conclusion

This study illustrates that many survey participants from CMH are unaware of the importance of Enduring Power of Attorney in terms of legal and health planning. Increased efforts to educate and support uptake could provide positive and personal and social outcomes.

Competing interests:
Nil.

Acknowledgements:
I would like to express gratitude to Dr Shankar Sankaran, Alistaire Hall and Brigid Mills for their comments on an earlier version of this manuscript.

Author information:
So-Jung Park, Department of Geriatrics, Counties Manukau Health, Auckland; Heather Astell, Department of Geriatrics, Counties Manukau Health, Auckland.

Corresponding author:
Dr So-Jung Park, Department of Geriatrics, Counties Manukau Health, Auckland.
so-jung.park@waitematadhb.govt.nz

URL:
REFERENCES:

Appendix 1
Prevalence of EPA and its barriers in community geriatric population of CMH

A. Have you heard of an enduring power of attorney (EPA)? Y/N
   If YES:
   a. How did you first hear of it?
   ____________________________________________________________________________________
   b. What is your understanding of an EPA?
   ____________________________________________________________________________________

Now give information regarding EPA and any answer questions, with aid from information sheet or brochure.

B. Do you have a will? Y/N
C. Have you got an EPA for:
   a. Personal care and welfare Y/N
   b. Property Y/N

   If YES for both, stop survey

   If NO for both, why have you decided not to have one? Questioner, please ask open-ended question. Choose the most appropriate option from below after listening to the answer. You may circle multiple options.
   a. Lack of information
   b. I don't think I need one
   c. Financial difficulty
   d. Lack of appropriate person to appoint
   e. Other—state reason
   ____________________________________________________________________________________

   If you only have one type of EPA, why not the other? Questioner, please ask open-ended question. Choose the most appropriate option from below after listening to the answer. You may circle multiple options.
   1. Unaware of other
   2. Financial difficulty
   3. Did not feel need for other—state reason why
   ____________________________________________________________________________________

   4. Other reason
Questioner, please ask question below for people who DO NOT have a welfare EPA:

D. If you are unable to make decisions for yourself (for example, if unwell in hospital), what do you think would usually happen?

______________________________________________________________________________________

E. How much do you think an EPA would cost to set up? (for both property and welfare)

- $0–$100
- $101–200
- $201–$300
- $301–$400
- $401–$500
- >$501
- No idea

F. Now that you have been given information regarding EPA, would you consider obtaining an EPA in the near future? Y/N

Questioner, please ask open-ended question. Choose the most appropriate option from below if participants respond “No”. You may circle multiple options.

If NO, why not?

- a. I don’t think I need one
- b. Financial difficulty
- c. Lack of appropriate person to appoint
- d. Other—state reason

______________________________________________________________________________________

G. What would have been the most suitable approach to let you know about this earlier?

- a. TV or radio
- b. Newspaper or magazine
- c. Internet including email, facebook
- d. GP
- e. Community venues eg, library, aged concern
- f. Other—please describe below

______________________________________________________________________________________

TO BE COMPLETED BY DOCTOR/NURSE

Existing cognitive dysfunction Y/N

Competence to appoint an EPA Y/N

Survey should be conducted with the caregiver (next of kin) if there is lack of competence. If not present at the consultation, caregiver (with patient’s consent) to be contacted and survey conducted over the phone.
Patient demographic, surveyor please fill out:

<table>
<thead>
<tr>
<th>Age</th>
<th>55–64</th>
<th>65–74</th>
<th>75–84</th>
<th>85–94</th>
<th>&gt;95</th>
</tr>
</thead>
</table>

**Sex—please circle:**  Male / Female

**Ethnicity:**
- NZ European
- Other European: please state ____________________________
- Māori
- Pacific Island: please state ____________________________
- Asian: ____________________________
- Other: ____________________________
Appendix 2

1. What is an Enduring Power of Attorney?
   An Enduring Power of Attorney (EPA) is a legal document that gives someone else the authority to act for you, should there come a time when you are unable to make decisions for yourself. There are two types of EPAs.
   - **Property**—covers your money and assets. It can come into effect before you lose mental capacity. You may have more than one attorney for this EPA.
   - **Personal care and welfare**—covers your health and accommodation. It comes into effect only if a medical professional or the Family Court decides you have become ‘mentally incapable’. You may have only one attorney for this EPA.

2. Why is it important to have an EPA?
   Your ability to make your own decisions could be taken from you at any time through illness or injury. If you do not have an EPA, legal decisions about you have to be made by going to court. This can cause unnecessary stress and expense to your next of kin.

   Having an EPA can also protect you from financial abuse, as you choose your attorney yourself. The person you have chosen (your attorney) is more likely to respect your wishes and make decisions in your best interest. It is their responsibility to involve you in decisions as much as you are able.

3. Who can I appoint?
   You can appoint anyone you trust as your attorney. Usually a family member, friend or a trustee corporation like a public trust (for property EPA only) is chosen. They must be over 20 years of age, not bankrupt and not mentally incapable themselves. You may also name other people you want your attorneys to consult with on EPA decisions.

4. How do I get an EPA?
   You need to get in touch with a lawyer, a qualified legal executive or a representative of a trustee corporation to be your witness in appointing an EPA. Documents must be signed in front of the witness, who will make sure that you and your attorney understand the meaning of these documents and meet the legal requirements.

   Setting up an EPA does cost money as it involves legal professionals who charge for their time. Prices can be variable so it will pay to shop around. Some places offer discounts with a SuperGold Card.

5. What does ‘mentally incapable’ mean?
   You are mentally incapable when you are no longer able to make decisions for yourself as deemed by a health professional. This means that you lack the capacity to understand the consequences of your decision, or unable to communicate your decision. Just because your decision is not one an average person would make does not make you mentally incapable.
Effect of house officer clerking on short-term outcomes in paediatric orthopaedic patients

Yassar Alamri

ABSTRACT

AIM: Children who are admitted with acute orthopaedic problems are often fit and healthy. The house officer (ie, intern) is required to carry out the formal clerking/admission of inpatients. However, they are often also busy with sick ward patients, which leads to delays in formal clerking of these children until after they have been to the operating theatre (OT). The aim of this study was to assess what information, if any, is missed in children who were seen by a house officer prior to going to OT, compared to those who were not.

METHODS: All patients admitted to the paediatric surgical ward, under the orthopaedics service care, between 1 September 2015 and 30 November 2015 were included in this study. Information on age, sex, medical background, details of the admission and post-operative complications were collected.

RESULTS: A total of 139 children were admitted during the study period. The median age was 7.4 years (range, 0.2–17.5) and a male:female ratio of 1.3:1. In this study, there was no statistically significant difference in patient characteristics, post-operative complications or length of hospital stay. However, patients clerked by house officers had better documentation of their regular medications and non-orthopaedic examination findings.

CONCLUSION: To the author’s knowledge, this is the first study to examine the effect of house officer admission on paediatric orthopaedic patient outcomes. A suggested solution would be to encourage documentation of medication history and examination findings by the anaesthetic registrar, since all patients must be reviewed pre-operatively.
Methods

Study setting
This prospective study was conducted at Christchurch Public Hospital (CPH), Canterbury, New Zealand. CPH is the largest tertiary hospital of New Zealand’s South Island. It serves a population close to 540,000 and has a 600–650 bed capacity. In 2013, 18.7% of Canterbury’s population were under the age of 15. Ethical approval was not required as this was a simple clinical audit with no intervention, clinical or otherwise.

Case selection
All patients admitted to the paediatric surgical ward, under the orthopaedics service care, between 1 September 2015 and 30 November 2015 were included in this study. This included acute admissions, as well as elective admissions who would have been seen, but not clerked, in the outpatient clinic. The clerking of patients was opportunistic—every effort was made to clerk the patient pre-operatively.

Data collection
Patients’ notes were manually reviewed by the lead author. Information on age, sex, medical background, details of the admission and post-operative complications were collected. A case was considered ‘clerked’ if the patient had been seen by the house officer prior to their operation (or prior to consultant ward-round for non-operative management).

Statistical analysis
Descriptive statistics were used to analyse most of the data. Comparisons were conducted using an independent-samples student t-test. Regression analysis was used to test for correlations. Statistical significance was determined if type I error rate was <5% (p-value <0.05). All analyses were performed using SPSS Statistics® software package (version 22.0.0.0).

Results

Sample characteristics
A total of 139 children were admitted during the study period. The median age was 7.4 years (range, 0.2–17.5) and a male:female ratio of 1.3:1. The median length of hospital stay was one day (range, 12 hours–7 days). Of all the patients seen, 69 had some (mostly minor) past medical history (PMHx; 50%), 20 took regular medications (14%), 15 had allergies (11%) and 19 had non-orthopaedic findings on examination (13.6%). The most common examination findings were innocent murmur (8; 42%) and congenital umbilical hernia (3; 16%).

Acute vs elective admissions
Acute trauma cases constituted the majority of admissions (99 cases; 71%). The most common mechanisms of trauma were falls (53.5%), blunt trauma (11%) and rugby-related injuries (7%). These injuries most often resulted in fractures of the radius and/or ulna (29%), supracondylar fractures of the humerus (19%) and distal lower-limb injuries (14%).

Elective admissions were predominantly related to corrective surgeries for congenital talipes equinovarus or removal of K-wires. Acute and elective patients did not differ in their sex, medical background or post-operative complications. Elective patients, however, were significantly younger (6.7 ± 4.4 years) than acutely admitted patients (8.4 ± 4.2 years; p=0.04).

Clerked vs non-clerked patients
All patients were seen by a house officer prior to their discharge. However, only 100 patients (71.9%) met the definition of being clerked by a house officer. Table 1 shows the main differences between the two groups.

Discussion
To the author’s knowledge, this is the first study to examine the effect of house officer admission on paediatric patient outcomes admitted under the orthopaedic service. Clerking patients, as well as having a role as service provision, is an educational activity for the house officer to sharpen their clinical acumen. In this study, there was no statistically significant difference in patient characteristics, post-operative complications or length of hospital stay. However, patients clerked by house officers had better documentation of their regular medications and non-orthopaedic examination findings.

Children who require surgical management for their orthopaedic injuries are often placed first on the OT list. This makes it particularly challenging for house officers, who are often still on ward rounds by the time the child is called for theatre, to clerk these patients.
Children often sustain their orthopaedic injuries during high-energy activities and are most often fit and well otherwise. This is in contrast to most adult patients who present to the orthopaedic wards; commonly elderly with multiple comorbidities (eg, osteoporotic neck of femur fracture) or patients who are quite sick (eg, septic arthritis). Therefore, house officers, especially when busy afterhours, may understandably elect to triage paediatric patients lower on their list of jobs.

In order to rectify identified problems, we suggest several solutions. In accordance with international trends to dedicate specialty-specific house staff, our institution has recently introduced a paediatric orthopaedic post. This is a full-time PGY-1 house officer post to jointly look after paediatric orthopaedic and spinal orthopaedic patients; this is because the workload of either component is insufficient for a full-time post. However, this did not fully address the identified problems, since spinal ward rounds still interfered with morning admissions.

A suggested solution would be to encourage documentation of medication history and examination findings using alternative means. These include other health staff input, electronic prescribing and pre-operative time-out checks. Our institution has recently introduced electronic prescribing, which allows the clinician easy access to the patient's regular medication and known allergies based on previous interactions.

Since all patients must be reviewed pre-operatively by the anaesthetic team, this could be an avenue to check medications and document physical examination findings. Though, anaesthetic documentation has also been shown to suffer from several deficiencies. This may be in part because the patient’s team has already written a pre-operative admission note (or a clinic letter in some cases). However, due to the high turnover on the orthopaedic paediatric service and the relative inexperience of newly qualified house officers, pre-operative anaesthetic assessment is suggested to

Table 1: Differences in clerked vs non-clerked patient characteristics and note documentation.

<table>
<thead>
<tr>
<th></th>
<th>Clerked</th>
<th>Non-clerked</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>7.9</td>
<td>8.0</td>
<td>0.91</td>
</tr>
<tr>
<td>SD</td>
<td>4.5</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Sex (% female)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.5%</td>
<td>46%</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Admission type (% acute)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present (%)</td>
<td>51%</td>
<td>48%</td>
<td>0.77</td>
</tr>
<tr>
<td>Recorded (%)</td>
<td>93.3%</td>
<td>82%</td>
<td>0.07</td>
</tr>
<tr>
<td>PMHx</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present (%)</td>
<td>13.5%</td>
<td>16%</td>
<td>0.69</td>
</tr>
<tr>
<td>Recorded (%)</td>
<td>95.5%</td>
<td>78%</td>
<td>0.007*</td>
</tr>
<tr>
<td>DHx</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present (%)</td>
<td>9%</td>
<td>14%</td>
<td>0.39</td>
</tr>
<tr>
<td>Recorded (%)</td>
<td>98%</td>
<td>96%</td>
<td>0.59</td>
</tr>
<tr>
<td>Allergies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present (%)</td>
<td>13.5%</td>
<td>14%</td>
<td>0.94</td>
</tr>
<tr>
<td>Recorded (%)</td>
<td>100%</td>
<td>42%</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Examination findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive (%)</td>
<td>13.5%</td>
<td>14%</td>
<td>0.94</td>
</tr>
<tr>
<td>Recorded (%)</td>
<td>100%</td>
<td>42%</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Analgesia prescribed</td>
<td>99%</td>
<td>98%</td>
<td>0.7</td>
</tr>
<tr>
<td>Complication rate (%)</td>
<td>2%</td>
<td>2%</td>
<td>0.93</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.8</td>
<td>1.4</td>
<td>0.13</td>
</tr>
<tr>
<td>SD</td>
<td>1.3</td>
<td>1.2</td>
<td></td>
</tr>
</tbody>
</table>

DHx = history of regular medication use; PMHx = any past medical history; SD = standard deviation; * = statistically significant.
be more thorough (our institution utilises an anaesthetic proforma—this includes a pre-operative section for significant past medical history, medications and allergies, cardiovascular examination findings and other anaesthetic-specific details such as the Mallampati score\(^6\)). This way, not only can the anaesthetic proforma effectively replace the house officer admission note, but also provide a place all where physical examination findings and complete drug list may be easily accessible by all members of the patient’s care team. Nursing notes, which often include medication history, can be incorporated into the proforma to complement the anaesthetic notes.

A few limitations inherent to the design of our study ought to be mentioned. Due to the observational nature of the study, random allocation of patients was not feasible. However, demographic and clinical parameters chosen \textit{a priori} were not significantly different between the two groups. The results presented remain a single-centre’s experience evaluated in a relatively small population. However, data from multiple sources were sought in order to corroborate the findings reported. This study remains the first study to objectively report on the ramifications of house officer clerking. Larger better-designed studies are needed to definitively investigate the effects of clerking on patient outcomes.

In conclusion, this study has demonstrated similar short-term outcomes in paediatric patients who present for inpatient orthopaedic intervention, whether clerked by a house officer or not. From a medico-legal point of view, however, documentation especially of medical history and examination findings was inadequate in children not clerked by a house officer. This can be easily corrected by incorporating electronic prescribing and adequately completed anaesthetic assessment with the patient’s notes.

\textbf{Competing interests:}

Nil.

\textbf{Author information:}

Yassar Alamri, Department of Medicine, New Zealand Brain Research Institute, Christchurch.

\textbf{Corresponding author:}

Dr Yassar Alamri, Department of Medicine, New Zealand Brain Research Institute, 66 Stewart St, Christchurch 8011.
yassar.alamri@nzbri.org

\textbf{URL:}


\textbf{REFERENCES:}

Trends in New Zealand stroke thrombolysis treatment rates

Qiliang Liu, Annemarei Ranta, Ginny Abernethy, P Alan Barber

ABSTRACT

AIMS: To describe trends in treatment delays and short-term outcome over the first 18 months of the New Zealand stroke thrombolysis register.

METHODS: The National Stroke Network introduced a central register of all ischaemic stroke patients treated with intravenous alteplase on January 1, 2015. The aim was to increase thrombolysis treatment rates and drive improvements in safety.

RESULTS: From January 1, 2015 to June 30, 2016, alteplase was given to 623 patients [344 men, mean (range) age 70 (22–98) years] out of a total of 8,857 ischaemic and unspecified stroke patients, giving a thrombolysis rate of 7.0%. Between the first and second halves of the audit, there were more patients thrombolysed [350 of 4,456 (7.9%) versus 273 of 4,401 (6.8%); p=0.001] and more treated within 60 minutes of hospital arrival [137 of 325 (42%) versus 71 of 250 (28%), p=0.001]. Door-to-needle time reduced from 77 minutes to 64 minutes (p=0.002) and the onset-to-treatment reduced from 162 minutes to 140 minutes (p=0.070). Rates of symptomatic intracranial haemorrhage (4.3% patients) and survival at day seven (93%) were stable.

CONCLUSIONS: There have been improvements in stroke thrombolysis rates and treatment delays in New Zealand hospitals since the institution of the National Stroke Network thrombolysis register. The Network will continue to adjust key performance indicators, and stroke thrombolysis targets for individual DHBs have been increased to 8% for 2017 and 10% for 2018.

Thrombolysis with intravenous alteplase within 4.5 hours after ischaemic stroke onset improves outcomes, with greater benefits seen with earlier treatment. The short therapeutic window means that a minority of ischaemic stroke patients are treated. The National Stroke Network introduced the National Stroke Thrombolysis Register as a quality improvement initiative on January 1, 2015. All stroke thrombolysis patients are entered into the register with regular reports to clinical and managerial staff at individual DHBs, the four regional stroke networks and at the annual Stroke Thrombolysis Data and Quality meetings. National targets for thrombolysis rates and treatment delays have been set with the aim to support clinicians driving improvements in hospital processes and thrombolysis rates. This has been the experience in other countries where large stroke registries and quality improvement efforts have enhanced stroke thrombolysis delivery.

The first six months of the register showed a national thrombolysis rate of 6.4% against a target of 6%. This is lower than rates seen elsewhere, which range from 7% in Australia up to 11% in the UK in 2015. In-hospital treatment delays were identified as an area for improvement. We report trends in thrombolysis rates, treatment delays and short-term outcomes over the first 18 months of the register. The aim was to determine if there have been improvements in treatment rates, delays and short-term outcomes.

Methods

Data from consecutive ischaemic stroke patients treated with intravenous alteplase from January 1, 2015 to June 30, 2016 were prospectively entered into the National Stroke Thrombolysis Register. Information recorded included demographic data, treatment-related times (stroke onset, hospital...
arrival, computed tomography (CT) scanning and alteplase bolus) and complications of thrombolysis, including symptomatic intracranial haemorrhage (sICH). Symptomatic ICH was defined as local or remote parenchymal haematoma (PH) type II on the post-treatment CT scan, combined with neurologic deterioration of four points or greater on the National Institute of Health Stroke Scale (NIHSS) within 24 hours of treatment. Survival at day seven was the major outcome measure. The databases were maintained by stroke nurses and physicians. Data from each hospital was then de-identified and submitted to a central co-ordinator on a quarterly basis.

Stroke thrombolysis rates were calculated using the number of ‘ischaemic strokes’ and ‘strokes unspecified’ as denominators, in accordance with Ministry of Health thrombolysis indicator reporting guidelines. Large district health boards (DHBs) were defined as those with a catchment population of more than 250,000 (seven DHBs), medium-sized DHBs 125,000–250,000 (six) and small as less than 125,000 (seven). The 20 DHBs are arranged into four regional stroke networks; the Northern Regional Alliance (Northland, Waitemata, Auckland and Counties-Manukau DHBs); the Midland Region (Waikato, Bay of Plenty, Lakes, Tairawhiti and Taranaki); the Central Region (Hawke’s Bay, MidCentral, Whanganui, Hutt Valley, Wairarapa and Capital and Coast) and the South Island Alliance (Nelson-Marlborough, Canterbury, West Coast, South Canterbury and Southern).

Statistical analyses were performed using Microsoft Excel XLSTAT version 2016.4. The Chi square test was used for categorical outcomes. Quarterly differences were analysed with the Mann-Whitney U test for comparison of two groups and the Kruskal-Wallis test for three or more groups. A test was considered statistically significant with a p-value of less than 0.05.

Table 1: Demographics, timing and outcomes of stroke patients treated with intravenous alteplase from January 1, 2015 to June 30, 2016.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alteplase (n)</td>
<td>94</td>
<td>85</td>
<td>94</td>
<td>116</td>
<td>106</td>
<td>128</td>
<td>623</td>
</tr>
<tr>
<td>Age, mean (range) years</td>
<td>69 (24–92)</td>
<td>71 (36–98)</td>
<td>69 (22–96)</td>
<td>68 (22–90)</td>
<td>73 (32–93)</td>
<td>70 (33–95)</td>
<td>70</td>
</tr>
<tr>
<td>Total strokes* (n)</td>
<td>1,447</td>
<td>1,457</td>
<td>1,497</td>
<td>1,498</td>
<td>1,439</td>
<td>1,519</td>
<td>8,857</td>
</tr>
<tr>
<td>Thrombolysis rates (%)</td>
<td>6.5</td>
<td>5.8</td>
<td>6.3</td>
<td>7.7</td>
<td>7.4</td>
<td>8.4</td>
<td>7.0</td>
</tr>
<tr>
<td>Onset-to-door time, median (IQR) minutes</td>
<td>77 (53–111)</td>
<td>70 (52–90)</td>
<td>65 (46–90)</td>
<td>64 (50–109)</td>
<td>70 (50–105)</td>
<td>75 (55–121)</td>
<td>71 (51–105)</td>
</tr>
<tr>
<td>Door-to-CT time, median (IQR) minutes</td>
<td>31 (23–42)</td>
<td>30 (17–39)</td>
<td>33 (24–44)</td>
<td>30 (22–43)</td>
<td>27 (20–41)</td>
<td>28 (20–37)</td>
<td>30 (21–41)</td>
</tr>
<tr>
<td>Door-to-needle time, median (IQR) minutes</td>
<td>77 (55–105)</td>
<td>73 (56–103)</td>
<td>76 (59–104)</td>
<td>67 (48–90)</td>
<td>66 (49–95)</td>
<td>64 (49–89)</td>
<td>70 (52–97)</td>
</tr>
<tr>
<td>Door-to-needle time, ≤60 minutes</td>
<td>26 of 84 (31%)</td>
<td>22 of 77 (29%)</td>
<td>23 of 89 (26%)</td>
<td>44 of 109 (40%)</td>
<td>38 of 93 (41%)</td>
<td>55 of 123 (45%)</td>
<td>208 of 575 (36%)</td>
</tr>
<tr>
<td>Onset-to-treatment time, median (IQR) minutes</td>
<td>162 (134–205)</td>
<td>148 (126–178)</td>
<td>154 (120–200)</td>
<td>149 (115–190)</td>
<td>144 (115–188)</td>
<td>140 (115–199)</td>
<td>150 (119–195)</td>
</tr>
<tr>
<td>sICH, n of N (%)</td>
<td>3 of 94 (3.2%)</td>
<td>5 of 85 (5.9%)</td>
<td>5 of 94 (5.3%)</td>
<td>7 of 116 (6.0%)</td>
<td>3 of 106 (2.8%)</td>
<td>4 of 128 (3.1%)</td>
<td>27 of 623 (4.3%)</td>
</tr>
<tr>
<td>Alive at day seven, n of N (%)</td>
<td>88 of 94 (94%)</td>
<td>81 of 85 (95%)</td>
<td>84 of 94 (89%)</td>
<td>111 of 116 (96%)</td>
<td>99 of 106 (93%)</td>
<td>118 of 128 (92%)</td>
<td>581 of 623 (93%)</td>
</tr>
</tbody>
</table>

* The denominator used was the number of patients coded as ischaemic or stroke unspecified.
### Results

There were 623 stroke patients [mean (SD) age 70 (15) years, 29% aged ≥80 years, 55% male] treated with intravenous alteplase over the 18 months from January 1, 2015 to June 30, 2016 (Table 1). Of these patients, 71% were European, 15% Māori, 5% Pacific, 5% Asian and 4% Other. Over the same time period, there were 8,857 patients admitted to New Zealand hospitals and coded as ischaemic stroke or stroke unspecified, giving a national stroke thrombolysis rate of 7.0%. Patients were more likely to be thrombolysed in the second than the first nine months of the audit [350 of 4,456 (7.9%) patients versus 273 of 4,401 (6.8%); Chi squared=9.00, p=0.001, respectively]. Half of the patients (50%) were admitted during working hours, defined as 0800–1700 hours, Monday to Fridays (not including holidays) and 27% on weekends or holidays. Twenty-seven patients (4.3%) had stroke while already in-hospital.

There was incomplete time data in 26 (4.2%) of the 623 patients, who were excluded from analysis of some of the treatment delay measures (Table 1). The median (IQR) door-to-needle time reduced over the 18 months of the audit, from 77 (55–105) minutes in January–March 2015, to 64 (49–89) minutes in April–June 2016 (p=0.002). Patients were more likely to be treated within 60 minutes of hospital arrival in the second than the first nine months of the audit [137 of 325 (42%) patients versus 71 of 250, 28%; Chi squared=10.99, p=0.001, respectively]. There was a non-significant reduction in the stroke onset-to-treatment time, shortening from 162 (120–200) minutes to 140 (115–199) minutes (p=0.070). There were no changes in the onset-to-arrival or door-to-CT times between quarters over the study period.

Four DHBs thrombolysed more than 65 patients, three DHBs between 40–65, eight DHBs between 10–39 and five small DHBs between 1–9 patients over the 18 months. The seven large DHBs thrombolysed most (416 of 623, 67%) patients (Table 2), with Capital and Coast DHB achieving a thrombolysis rate of 19.6% in one quarter of the audit. Thrombolysis rates increased with size of DHB from 59 of 1,056 (5.6%) patients in small DHBs, to 148 of 2,258 (6.6%) in medium DHBs and 416 of 5,543 patients (7.5%) in large DHBs (Chi squared=6.055, p=0.048).

### Table 2: Treatment delays by DHB size from January 1, 2015 to June 30, 2016.

<table>
<thead>
<tr>
<th></th>
<th>Large**</th>
<th>Medium</th>
<th>Small</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alteplase (n)</td>
<td>416</td>
<td>148</td>
<td>59</td>
<td>623</td>
</tr>
<tr>
<td>Total strokes* (n)</td>
<td>5,543</td>
<td>2,258</td>
<td>1,056</td>
<td>8,857</td>
</tr>
<tr>
<td>Thrombolysis rates (%)</td>
<td>7.5</td>
<td>6.6</td>
<td>5.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Onset-to-door time, median (IQR) minutes</td>
<td>71 (50–108)</td>
<td>74 (51–102)</td>
<td>64 (47–93)</td>
<td>71 (51–105)</td>
</tr>
<tr>
<td>Door-to-CT time, median (IQR) minutes</td>
<td>30 (22–43)</td>
<td>30 (20–38)</td>
<td>24 (17–32)</td>
<td>30 (21–41)</td>
</tr>
<tr>
<td>Door-to-needle time, median (IQR) minutes</td>
<td>69 (49–96)</td>
<td>71 (56–96)</td>
<td>80 (58–103)</td>
<td>70 (52–97)</td>
</tr>
<tr>
<td>Door-to-needle time, ≤60 minutes</td>
<td>149 of 386 (39%)</td>
<td>44 of 139 (32%)</td>
<td>15 of 50 (30%)</td>
<td>208 of 575 (36%)</td>
</tr>
<tr>
<td>Onset-to-treatment time, median (IQR) minutes</td>
<td>150 (118–197)</td>
<td>150 (119–190)</td>
<td>155 (126–190)</td>
<td>150 (119–195)</td>
</tr>
<tr>
<td>Onset-to-door time, ≤3 hours</td>
<td>273 of 403 (68%)</td>
<td>103 of 145 (71%)</td>
<td>37 of 53 (70%)</td>
<td>413 of 601 (69%)</td>
</tr>
</tbody>
</table>

* The denominator used was the number of patients coded as ischaemic or stroke unspecified.

** Large DHBs (n=7) population >250,000 people
Medium-sized DHBs (n=6) population 125,000–250,000 people
Small DHBs (n=7) population <125,000 people.
The Northern region thrombolysed the greatest number of patients (194), followed by the Central (161), Midland (140) and South Island (128) regions (Table 3). Thrombolysis rates were highest at 9.5% in the Central region, which also had the shortest median door-to-needle time (64 minutes) and treated the greatest proportion of patients (44%) within 60 minutes of hospital arrival.

The increasing treatment rates did not result in any increase in complications or mortality over the six quarters (Table 1). Rates of sICH, the most feared complication of stroke thrombolysis, remained stable over the audit (Chi squared=2.846, p=0.724), and was reported in 27 (4.3%) patients, of whom eight (30%) had died by day seven compared with 5.7% deaths in the 596 patients without sICH. Other complications of stroke thrombolysis included extra-cranial haemorrhage in nine (1.4%) and angioedema in two (0.3%) patients. Tenecteplase was given in error to two stroke patients, with sICH in one, both of whom were alive at day seven. Survival at day seven remained stable over the audit (Chi squared=4.177, p=0.524), and was reported in 93% patients.

**Discussion**

This audit has shown that the numbers of people treated with intravenous alteplase has increased over the 18 months of the register. Compared with earlier New Zealand studies, stroke thrombolysis rates nearly tripled from 3% in 2009, 8 to 6.4% in mid-2015, 9 and 8.4% by mid-2016. The efficiency of in-hospital processes have also improved with reductions in median door-to-needle time of 13 minutes and onset-to-needle time of 22 minutes. The increased thrombolysis rates have not come at the cost of increased sICH or short-term mortality. While this audit was not designed to determine whether the register and the targets set by the National Stroke Network have driven these improvements, it seems reasonable to assume that they have at least played a part.

There is room for improvement. Thrombolysis rates varied from 2–20% between different DHBs. Patients were more likely to be thrombolysed if they presented to large urban DHBs. The DHB with the highest thrombolysis rates was in a small densely

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**Table 3: Treatment delays by regional network from January 1, 2015 to June 30, 2016.**

<table>
<thead>
<tr>
<th></th>
<th>Northern</th>
<th>Midland</th>
<th>Central</th>
<th>South Island</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alteplase (n)</td>
<td>194</td>
<td>140</td>
<td>161</td>
<td>128</td>
<td>623</td>
</tr>
<tr>
<td>Total strokes (n)*</td>
<td>2,927</td>
<td>1,996</td>
<td>1,697</td>
<td>2,237</td>
<td>8,857</td>
</tr>
<tr>
<td>Thrombolysis rates (%)</td>
<td>6.6</td>
<td>7.0</td>
<td>9.5</td>
<td>5.7</td>
<td>7.0</td>
</tr>
<tr>
<td>Onset-to-door time, median (IQR) minutes</td>
<td>73 (48–107)</td>
<td>75 (52–105)</td>
<td>72 (54–109)</td>
<td>65 (48–94)</td>
<td>71 (51–105)</td>
</tr>
<tr>
<td>Door-to-CT time, median (IQR) minutes</td>
<td>28 (18–38)</td>
<td>29 (22–42)</td>
<td>30 (24–41)</td>
<td>33 (22–44)</td>
<td>30 (21–41)</td>
</tr>
<tr>
<td>Door-to-needle time, median (IQR) minutes</td>
<td>78 (57–107)</td>
<td>67 (55–95)</td>
<td>64 (41–95)</td>
<td>67 (51–87)</td>
<td>70 (52–97)</td>
</tr>
<tr>
<td>Door-to-needle time, ≤60 minutes</td>
<td>51 of 186 (27%)</td>
<td>46 of 128 (36%)</td>
<td>63 of 142 (44%)</td>
<td>48 of 119 (40%)</td>
<td>208 of 575 (36%)</td>
</tr>
<tr>
<td>Onset-to-treatment time, median (IQR) minutes</td>
<td>166 (131–212)</td>
<td>151 (119–195)</td>
<td>140 (115–188)</td>
<td>135 (115–171)</td>
<td>150 (119–195)</td>
</tr>
<tr>
<td>Onset-to-door time, ≤3 hours</td>
<td>111 of 190 (58%)</td>
<td>89 of 132 (67%)</td>
<td>114 of 155 (74%)</td>
<td>99 of 124 (80%)</td>
<td>413 of 601 (69%)</td>
</tr>
</tbody>
</table>

* The denominator used was the number of patients coded as ischaemic or stroke unspecified.
populated urban location, while many of those with lower rates were in large sparsely populated regions. For centres without 24-hour local stroke specialist access, Telestroke, where patients are managed by stroke specialists via video-link, has the potential to increase thrombolysis rates. This has been confirmed in the yet to be published 2016 Central Region Telestroke pilot, where an interim evaluation found that out-of-hours thrombolysis rates increased from 7% to 20% (personal communication Dr Annemarei Ranta). There is also potential to increase out-of-hours thrombolysis rates through ambulance bypass to a single afterhours thrombolysis centre, which is currently being considered in the Northern Region.

It is important that DHBs and regional stroke networks work towards reducing stroke onset to thrombolysis treatment times. The sooner alteplase can be administered, the greater the chance of a patient having an improved outcome. Every 10-minute delay in starting alteplase results in one less patient with improved outcome for every 100 patients treated. Treatment delays can be broadly divided into those which occur before and after hospital arrival. Approximately half of the onset-to-treatment time delays occurred in the pre-hospital phase. The median door-to-needle time of 64 minutes compares favourably with 65–75 minutes reported in large international registries. However, the register showed that only 43% of patients were thrombolysed within a door-to-needle time of 60 minutes, which is lower than the Brain Attack Coalition target of treating at least 80% of patients within this timeframe.

Multiple community and organisational changes can shorten treatment delays. The nationwide Face Arm Speech Time (FAST) media campaign launched in June 2016 aimed to raise public stroke awareness and reduce hospital presentation times. It is crucial that DHBs and regional stroke networks work in a coordinated way with ambulance services to reduce treatment times. This includes staff education programs and pre-notification via a ‘Code Stroke’ contact system (currently in place in 13 DHBs), where ambulance staff alert a rapid response stroke team about potential thrombolysis candidates. Patients can be met at the door, quickly assessed and directly transferred to the CT scanner where thrombolysis candidates should be given imaging priority. Stroke thrombolysis kits can be kept in the emergency department so that alteplase can be made up and the bolus delivered as soon as intracranial haemorrhage has been excluded. Such measures can result in alteplase treatment starting 22–28 minutes sooner.

The increased numbers of stroke patients thrombolysed, and the reductions in treatment delays, have not resulted in an increase in complications through rushed assessments. Rates of sICH, day seven mortality and other complications were stable over the register period. However, it is of concern that two patients were treated with tenecteplase. Safety campaigns have since been instituted to mitigate such risks, including clinician education, the use of designated stroke thrombolysis kits and an advocacy for supervision from senior medical officers (SMOs).

The register has a number of limitations. We were reliant on the individuals completing the database for its accuracy, with no resources available to support the external review of the thrombolysed patients. We cannot exclude the possibility that increasing thrombolysis rates are due to greater compliance with the register. However, while the register has only been in place since 2015, DHBs have been reporting thrombolysis rates to the Ministry of Health since 2011, so there is some familiarity with this type of reporting. It is possible that complications such as sICH have been under-reported. sICH also requires a degree of expertise in interpreting clinical and imaging data, and there may have been inconsistencies in how definitions were applied. These issues are addressed in regional stroke update days and the national thrombolysis database meetings. A functional scale such as the modified Rankin Scale at three months would be a better measure of outcome than survival at day seven. However, the database is completed by clinicians in 20 very different DHBs, and a decision was made to keep the information recorded as simple as possible, and achievable within currently available clinical resources. The reasons for any DHB or regional variations have not been
determined in a systematic way. These are issues that can be explored as the database develops over time.

The National Stroke Network set a target thrombolysis rate for individual DHBs of 6%. The target was exceeded nationally with those with higher thrombolysis rates making up for those with lower rates. The target was not meant to be aspirational but was set to be achievable by the majority of DHBs. The aim was to encourage improved thrombolysis rates over time, bearing in mind that rates of 20% have been achieved nationally and internationally. The Network is continuing to adjust key performance indicators, and stroke thrombolysis targets for individual DHBs have been increased to 8% for 2017 and 10% for 2018.

Competing interests:
Nil.

Author information:
Qiliang Liu, Trainee Intern, Department of Neurology, Auckland City Hospital and University of Auckland; Annemarei (Anna) Ranta, Neurologist and National Clinical Leader Stroke, Department of Neurology, Wellington Regional Hospital and University of Otago; Ginny Abernethy, National Stroke Network Coordinator, Stroke Foundation of New Zealand; P Alan Barber, Professor, Neurologist and Director of the Auckland Hospital Stroke Service, Department of Neurology, Auckland City Hospital and University of Auckland.

Corresponding author:
Professor Alan Barber, Neurology Department, Auckland City Hospital, Park Road, Grafton Auckland.
a.barber@auckland.ac.nz

URL:

REFERENCES:


Provision of stroke thrombolysis services in New Zealand: changes between 2011 and 2016

Qiliang Liu, P Alan Barber, Ginny Abernethy, Annemarei Ranta

ABSTRACT

AIMS: To obtain an overall picture of the organisation of stroke thrombolysis provision in New Zealand hospitals and compare changes between 2011 and 2016.

METHODS: Surveys were distributed to all New Zealand district health boards (DHBs) in 2011 and 2016, and included questions about the infrastructure, staffing, training, guidelines and audit provided for stroke thrombolysis.

RESULTS: Responses were received from all DHBs, with 86% offering stroke thrombolysis in 2011 and 100% in 2016. In 2016, thrombolysis rosters of large DHBs (those with a population >250,000 people) had a mean (range) of 14 (5–34) clinicians, approximately double that of medium-sized DHBs (population 125–250,000) who had eight (3–15) and small DHBs (population <125,000) with seven, (2–13) clinicians. While a similar distribution of senior medical officer clinical specialty was seen across medium and small DHBs in both years, large DHBs in 2016 had a higher number of neurologists (5, 1–12) and an increasing number of general physicians (8, 0–30) rostered to provide thrombolysis compared to 2011. Thrombolysis services at medium and small DHBs are chiefly managed by general physicians and geriatricians, while telestroke support was only available in three medium-sized DHBs. In 2016, all hospitals had developed thrombolysis guidelines and audited thrombolysed patients in the National Stroke Thrombolysis Register, which is an improvement compared with 2011 when only seven (39%) DHBs reported regular audit. Challenges in staffing and training remain greatest in smaller and geographically isolated DHBs.

CONCLUSION: While there have been improvements in the provision of stroke thrombolysis throughout New Zealand, regional variations in service quality remains. The needs for better solutions to geographical barriers and formal training must be addressed as priorities.

In acute ischaemic stroke, thrombolysis with intravenous alteplase improves outcomes. However, stroke thrombolysis rates remain low by international standards and vary between centres within New Zealand.1–3 A key barrier to efficient stroke thrombolysis is poor access to experienced stroke physicians, especially in regional settings.4,5 There is little information on stroke thrombolysis services in New Zealand. Most available information has come from large urban hospitals5,6 with less insight about the provision of thrombolysis in regional centres.8 We report the results of two surveys conducted in 2011 and 2016 to gain an overview of barriers to and changes in, thrombolysis provision in New Zealand.

Methods

All New Zealand DHBs were invited to participate in two surveys five years apart (2011 and 2016) that were designed to examine various organisational aspects of stroke thrombolysis. The 2011 survey asked about the provision of thrombolysis, training of and rosters for responsible clinicians, and the use of protocols, guidelines and audit. In 2016, the questions were modified so that more detail about the issues identified in 2011 were obtained. The 2016 survey was generated on SurveyMonkey (www.surveymonkey.com) and distributed via email. Reminder emails were sent at three weeks, and any outstanding surveys conducted
over the telephone at five weeks. Participants were advised that no individual DHB or hospital data were to be identified. Both surveys took 5–10 minutes to complete.

Surveys were completed at each DHB by a dedicated stroke physician, a general physician with an interest in stroke thrombolysis or in a few small hospitals where a physician was not available, by a stroke nurse specialist. DHB data were reported as that of the largest hospital in those DHBs with multiple hospitals. For stratification purposes, hospitals were divided into three groups according to the size of their DHB catchment population: large, with a population of more than 250,000 people, medium, 125–250,000 and small, less than 125,000, to enable comparison with similar DHBs. Out-of-working hours were defined as between 17:00–08:00 hours Monday through Friday, weekends and holidays. Otago and Southland DHBs were combined into the single Southern DHB after the first survey, so that 21 DHBs were surveyed in 2011 and 20 in 2016.

Results

Survey responses were returned by all DHBs. In 2016, six responses were received from hospitals other than the main DHB hospital and while results are reported by DHB, smaller hospital-specific data are reported where appropriate.

Provision of thrombolysis services

In 2016, all 20 (100%) DHBs provided routine thrombolysis for acute ischaemic stroke, compared with 18 of 21 (86%) in 2011 (Table 1). Sixteen DHBs serving 92% of the population currently provide a 24-hour service thrombolysis, compared with 13 (71%) in 2011. The increase in 24-hour provision is most marked in small DHBs, with four of the seven DHBs offering 24-hour services in 2016 compared to only two in 2011. One medium-sized DHB still only offers thrombolysis between 08:00–22:00 hours on weekdays only, and three small DHBs only do so between 08:00–17:00 hours on weekdays.

<table>
<thead>
<tr>
<th>DHB size</th>
<th>Large n=7</th>
<th>Medium n=6</th>
<th>Small n=7*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrombolysis provision</td>
<td>7/7 7/7</td>
<td>6/6 6/6</td>
<td>5/8 7/7</td>
<td>18/21 20/20</td>
</tr>
<tr>
<td>24-hour service provision</td>
<td>6/7 7/7</td>
<td>5/6 5/6</td>
<td>2/5 4/7</td>
<td>13/21 16/20</td>
</tr>
<tr>
<td>Mean (range) no. of SMOs on roster</td>
<td>6 (2–12)</td>
<td>14 (5–34)</td>
<td>6 (2–8)</td>
<td>8 (3–15)</td>
</tr>
<tr>
<td>No. (range) of SMOs with stroke fellowships</td>
<td>6 (0–2)</td>
<td>0 (-)</td>
<td>0 (-)</td>
<td>6 (0–2)</td>
</tr>
<tr>
<td>No. (range) of SMOs with stroke unit rotations</td>
<td>17 (0–10)</td>
<td>2 (0–2)</td>
<td>1 (0–1)</td>
<td>20 (0–10)</td>
</tr>
<tr>
<td>No. (range) of SMOs who attended all-day thrombolysis courses</td>
<td>5 (0–4)</td>
<td>4 (0–4)</td>
<td>14 (0–9)</td>
<td>23 (0–9)</td>
</tr>
<tr>
<td>% of SMOs on roster with ≥10 cases</td>
<td>81%</td>
<td>79%</td>
<td>31%</td>
<td>60%</td>
</tr>
<tr>
<td>Mean (range) no. of Neurologists</td>
<td>4 (1–10)</td>
<td>5 (1–12)</td>
<td>1 (0–2)</td>
<td>2 (0–6)</td>
</tr>
<tr>
<td>Mean (range) no. of General physicians/ Geriatricians</td>
<td>2 (0–8)</td>
<td>8 (0–30)</td>
<td>4 (0–8)</td>
<td>6 (0–9)</td>
</tr>
</tbody>
</table>

*There are eight small DHBs in 2011 and seven in 2016, corresponding to the before and after of the merging of Southland with Otago to form the single large Southern DHB.
A “Code Stroke” contact system with pre-hospital notification to acute stroke teams is currently used in 13 (65%) DHBs (Table 2). Twelve (60%) DHBs have clearly-labelled thrombolysis treatment kits in the emergency department (ED) for faster and safer alteplase access. Plain computed tomography (CT) is available 24-hours in all DHBs. CT angiogram (CTA) is offered in 18 (90%) DHBs, and is available 24-hours per day in 12 (60%). CT perfusion (CTP) is only available in three (15%) DHBs and is offered 24-hours in only one large urban hospital.

**Thrombolysis staffing and working hours**

There has been an improvement in staffing levels since 2011. In 2016, the numbers of senior medical officers (SMOs) responsible for the final decision on whether or not to proceed with stroke thrombolysis ranged from a mean of 14 in large DHBs, eight in medium-sized DHBs and seven in small DHBs, a marked increase since 2011 (Table 1). During working hours, thrombolysed patients were managed in the ED by SMOs with registrars in 14 (70%) DHBs, registrars with SMO phone back-up in two (10%) large DHBs and by the SMOs alone in two (10%) small DHBs (Table 2). After hours, including weekends and holidays, SMOs supervise thrombolysis in person in eight (40%) DHBs, while a resident medical officer (RMO) does this with SMO phone back up in eight (40%) DHBs. At the time of the 2016 survey, an after-hours telestroke service pilot was being run by the Capital and Coast DHB Neurology Department for three DHBs (Hawkes Bay, Nelson-Marlborough and MidCentral DHBs).

**Clinician training and exposure to thrombolysis**

Thrombolysis experience increased with 57% of SMOs having treated 10 or more cases in 2016 compared to 41% in 2011, with the largest improvement seen in small DHBs (Table 1). In 2016, there were six SMOs who had undertaken stroke fellowship training, 20 whose physician training included rotations through stroke units and 23 who had participated in all-day thrombolysis courses. SMOs with such training were a minority of those on thrombolysis rosters. For example,

### Table 2: Details of thrombolysis service provision by DHB size, 2016.

<table>
<thead>
<tr>
<th>DHB Size</th>
<th>Large n=7</th>
<th>Medium-sized n=6</th>
<th>Small n=7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff administering thrombolysis</strong>&lt;br&gt;<strong>Working hours (n/N)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMO in person with registrar</td>
<td>5/7</td>
<td>6/6</td>
<td>3/7</td>
<td>14/20</td>
</tr>
<tr>
<td>SMO alone</td>
<td>2/7</td>
<td></td>
<td></td>
<td>2/20</td>
</tr>
<tr>
<td>Registrar with phone back-up</td>
<td></td>
<td></td>
<td></td>
<td>2/20</td>
</tr>
<tr>
<td>Stroke CNS</td>
<td></td>
<td></td>
<td></td>
<td>1/20</td>
</tr>
<tr>
<td>ED SMO/ICU team</td>
<td></td>
<td></td>
<td></td>
<td>1/20</td>
</tr>
<tr>
<td><strong>Afterhours (n/N)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SMO in person with registrar</td>
<td>3/7</td>
<td>1/6</td>
<td>2/7</td>
<td>6/20</td>
</tr>
<tr>
<td>SMO alone</td>
<td>4/7</td>
<td>2/6</td>
<td>1/7</td>
<td>8/20</td>
</tr>
<tr>
<td>Registrar with phone back-up</td>
<td></td>
<td></td>
<td></td>
<td>3/20</td>
</tr>
<tr>
<td>Telestroke support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED SMO/ICU team</td>
<td>1/7</td>
<td></td>
<td></td>
<td>1/20</td>
</tr>
<tr>
<td><strong>Treatment provision (n/N)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Code Stroke”</td>
<td>5/7</td>
<td>5/6</td>
<td>3/7</td>
<td>13/20</td>
</tr>
<tr>
<td>Treatment kit</td>
<td>5/7</td>
<td>3/6</td>
<td>4/7</td>
<td>12/20</td>
</tr>
<tr>
<td>Patient information sheet</td>
<td>7/7</td>
<td>4/6</td>
<td>4/7</td>
<td>15/20</td>
</tr>
<tr>
<td>Thrombolysis protocols</td>
<td>7/7</td>
<td>6/6</td>
<td>7/7</td>
<td>20/20</td>
</tr>
<tr>
<td>Audit every patient</td>
<td>7/7</td>
<td>4/7</td>
<td>6/7</td>
<td>17/20</td>
</tr>
<tr>
<td>M&amp;M meetings</td>
<td>6/7</td>
<td>2/6</td>
<td>3/7</td>
<td>11/20</td>
</tr>
</tbody>
</table>
the six stroke fellowship trained SMOs worked at five of the seven large DHBs, where there were a mean of 14 (range 5–34) SMOs on the roster. Large DHBs had a mean of 2.5 (range 0–10) SMOs who had rotated through stroke units during their training. In small DHBs, where there were a mean of seven (2–13) SMOs on the roster, a mean of two (range 0–9) SMOs had attended all-day thrombolysis courses.

Formal protocols for the management of various aspects of stroke thrombolysis were used in all 20 DHBs in 2016. These included pre-thrombolysis inclusion and exclusion criteria, administration and dosing instructions for alteplase, post-thrombolysis nursing observations and complication management. In 2011, the use of thrombolysis registers with patient audit were only used in seven (39%) of the 18 DHBs providing stroke thrombolysis. Partly in response to this low number, the National Stroke Thrombolysis Register was implemented in all 20 New Zealand DHBs in January 2015. However, in even 2016, only 11 (55%) DHBs routinely reviewed individual patients with complications in Mortality and Morbidity (M&M) meetings.

**Discussion**

The major finding of this study is that there has been an improvement in stroke thrombolysis service provision over the past five years. In 2016, all 20 New Zealand DHBs routinely offered stroke thrombolysis, with 16 providing a 24-hour service. The number of SMOs on thrombolysis rosters has increased, as has the numbers of SMOs who have treated 10 or more patients. There is greater use of thrombolysis protocols and audit. However, regional variations still exist with four medium and small DHBs providing thrombolysis on weekdays only due to an insufficient number of SMOs on thrombolysis rosters.

There has been a steady increase in stroke thrombolysis rates from 3% of all ischaemic stroke patients in 2009 to 6.4% in mid-2015 and 8.4% in mid-2016. The 2010 New Zealand Clinical Guidelines of the Management of Stroke promoted a number of quality improvement initiatives for this purpose, and which led to organisational changes in acute stroke care across most DHBs since. The National Stroke Network was established and monitors the stroke thrombolysis rates with a current national target of 6% of all ischaemic strokes. In January 2015, the National Stroke Thrombolysis Register was instituted with data from all New Zealand stroke patients treated with thrombolysis entered into the database on a quarterly basis. The register has allowed for regular audit with the aim of driving improvements in the numbers of patients treated and reductions in treatment time delays, and has provided a focus for an annual national stroke thrombolysis data and quality meeting. Similar registers have driven improvements in treatment rates and times.

Most of the improvements seen since 2011 have been in small DHBs. Challenges remain in the often geographically large and rural, low population DHBs where treatment is usually delivered by staff with less case experience. Large DHBs face a parallel challenge in ensuring maintenance of clinician competency when individual physician experience is diluted by the large numbers of SMOs on thrombolysis rosters. International data suggests that service configurations providing frontline care by generalists without expert stroke-physician back-up results in low overall thrombolysis rates, excessive time-to-treatment delays, poor diagnostic accuracy, protocol violations and higher rates of complications including symptomatic intracranial haemorrhage. Employing on-site stroke-physicians in all New Zealand DHBs is not realistic due to low numbers and low population densities. There are various other ways in which these gaps are being addressed. These include the strengthening of regional networks with hub and spoke networks (a model being explored in the Northern region), and the use of 24-hour telestroke, which is being trialled in a Central Region pilot.

The use of thrombolysis protocols is now widespread, with 100% of hospitals having protocols for patient selection, alteplase dosing and the management of common complications. However, this cannot substitute for real-life thrombolysis case experience. Low patient volumes result in treating clinicians being less confident with greater risk of treatment delays and protocol violations.
This study has a number of limitations. The survey was only sent to lead stroke clinicians in each DHB and therefore data was only recorded for the largest hospital within a DHB. Several DHBs have more than one hospital and in some cases, the ‘secondary’ hospital has a drainage population larger than some small DHBs, for example, Waitakere Hospital in Waitemata DHB. This was done to keep the analysis and presentation of the results as simple as possible. Secondly, surveys offer a convenient means of reviewing clinical practices in a large number of hospitals, but the most appropriate individual within an institution may not be targeted, thus responses to a survey may not reflect actual practice. In both surveys, attempts were made to contact physicians with a known interest in stroke at each DHB. We did not verify responses, but made clear that no DHB would be identified. It is therefore reasonable to assume that the responses reflect the state of thrombolysis practice in New Zealand.

Competing interests: Nil.

Author information: Qiliang Liu, Trainee Intern, Departments of Neurology, Auckland City Hospital and University of Auckland; Annemarei (Anna) Ranta, Neurologist and National Clinical Leader Stroke, Department of Neurology, Wellington Regional Hospital and University of Otago; Ginny Abernethy, National Stroke Network Coordinator, Stroke Foundation of New Zealand; P Alan Barber, Professor, Neurologist and Stroke Service Clinical Lead, Department of Neurology, Auckland City Hospital and University of Auckland.

Corresponding author: Professor Alan Barber, Neurology Department, Auckland City Hospital, Park Road, Grafton, Auckland.
a.barber@auckland.ac.nz


REFERENCES:
The proposal for a third medical school in New Zealand: a community-engaged graduate entry medical program

Ross Lawrenson, Ian Town, Roger Strasser, Sarah Strasser, Judy McKimm, Rees Tapsell, Nigel Murray

ABSTRACT

New Zealand has a maldistributed workforce that is heavily dependent on recruiting international medical graduates. Shortages are particularly apparent in high needs communities and in general scope specialties in provincial regions. The University of Waikato in partnership with the Waikato District Health Board has proposed a third medical school for New Zealand which will concentrate on addressing the workforce needs of disadvantaged rural and provincial communities. The proposed program is a community engaged, graduate entry medical course.

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ABSTRACT

New Zealand has a maldistributed workforce that is heavily dependent on recruiting international medical graduates. Shortages are particularly apparent in high needs communities and in general scope specialties in provincial regions. The University of Waikato in partnership with the Waikato District Health Board has proposed a third medical school for New Zealand which will concentrate on addressing the workforce needs of disadvantaged rural and provincial communities. The proposed program is a community engaged, graduate entry medical course.

The University of Waikato, in partnership with the Waikato District Health Board, has submitted a proposal to the Government to set up a community-engaged medical program that will help address a number of critical medical workforce issues facing our provincial and rural communities, including the shortages of general practitioners and specialist disciplines with a general scope. In particular, this program is aimed at addressing the health needs of our disadvantaged provincial and rural communities. It is proposed that it will be a four-year graduate entry program that will purposefully select students who are committed to serving communities and populations with the greatest need.

New Zealand has wide disparities in health, especially in our rural and Māori communities. This is evidenced by the high amenable mortality rates in the more rural district health boards, such as Northland, Tairawhiti, Lakes, Whanganui and Hawkes Bay. Regional variations in the distribution of doctors has also led to an increasing dependence on the importation of international medical graduates (IMGs) to address the shortages. These shortages have been present for decades and, despite increased funding to the existing two medical schools, which commenced with the extra rural origin places in 2002, the shortages have continued.

The New Zealand health system imports twice as many overseas doctors each year than it trains locally. For example, from 2009 to 2013, we registered 1,806 New Zealand graduates and 5,945 IMGs. If we want to produce New Zealand-trained doctors to serve our under-served communities then we need a new paradigm where we select a different sort of student, provide them with a new curriculum and train them in a different environment. We argue that it is time to establish a third medical school with a fundamentally new model of medical training and academic culture to complement the two existing programmes.

Community engaged

The transformation of medical education from a pre-clinical (science-based) plus clinical curriculum to an integrated systems-based approach has been occurring in many jurisdictions. This has been facilitated...
where universities have engaged with their communities to ensure that their education and research are aligned with the health system's needs. Community-engaged medical programs are formed through a partnership between the educational providers and the communities they serve. It is believed that they improve medical education while at the same time meeting community needs and advancing health equity agendas. Where a new school has been started in a rural location, such as Northern Ontario School of Medicine (NOSM) in Canada and James Cook University (JCU) in Australia, the impact on the regional and rural workforce has been positive.

The Waikato District Health Board strategic plan has recognised health inequities as a priority and plans to use a multilevel approach to eliminate health inequity for Māori. Māori have the greatest health disparities with the highest levels of amenable mortality, the highest admission rates to hospital and the poorest access to accessible healthcare. The creation of a new medical school by the University of Waikato in partnership with the Waikato District Health Board provides the potential for partnership with communities to be built from the outset, engaging with rural communities, Iwi, Pasifika, general practitioners, primary care organisations and the NGO sector. Consultation on the needs of each community and the development of the program are an essential component of the foundation of the medical school.

While further research is needed on the relationships between learners, teachers and the community, key components include investment in training centres in each community, community involvement in the selection of students, the development of the curriculum and ongoing involvement in the governance of the program to ensure it is meeting community needs.

Changing face of medicine

With the ageing population and the increase in long-term conditions, it has been recognised that the focus of health care needs to change. There is a greater emphasis on improving health through health promotion and preventive health services as well as in reducing health inequalities. In 2001, New Zealand adopted a Primary Health Care Strategy, with the aim of improving health and reducing inequalities. It noted “the ratio of practitioners to patients is not closely matched to population need (some of the lowest number of doctors are in places of highest need)

In 2007, the ‘Better Sooner More Convenient’ discussion document was released, seeking to shift health care provision to “a high-quality patient-centred health system that cares about the wellbeing of New Zealanders”. It noted that the numbers of general practitioners had been falling since 1999 and the importance of reversing that trend. In 2016, the New Zealand Health Strategy; Future Direction was launched. In its foreword, the Minister noted “The health sector will need to be adaptable in coming years as developing technology changes how services can be delivered in ways we do not yet understand.

The support of being one team with a common purpose provides the base for adaptation and innovation needed for value and high performance that will in turn lead to a sustainable and enduring public health service”. The strategy recognises “... the need to continually invest in training so that our health workforce has the skills needed to meet the health needs and expectations of caring for New Zealanders”.

Serving highest needs and meeting the shortages and maldistribution of doctors

It is recognised that simply making health care equally available does not lead to fair and equitable outcomes. The poor outcomes for Māori and the number of children living in poverty are a particular emphasis within most DHB health strategies. While treatment differences have been noted, the solution to these problems are wider and require an appreciation of population-based solutions. Over the last 20 years, the New Zealand health system has depended on recruiting doctors from all over the world to come and meet the health care needs of the least popular specialties. Psychiatry, geriatrics, rehabilitation medicine, palliative care and obstetrics and gynaecology all have more than 50% IMGs as registered practitioners.

In 2008, the Medical Training Board noted that New Zealand had an overall shortage of medical practitioners, evidenced by the use of locums and reliance on overseas-trained
doctors, which they predicted would be exacerbated in the future as the population ages. They also noted there was a ‘maldistribution’ of the available medical workforce, with rural and non-metropolitan areas finding it increasingly difficult to recruit and retain doctors. Despite the increasing number of medical students being trained we are still dependent on the recruitment of large numbers of overseas trained doctors, most of who are not vocationally registered and work under supervision. Only a quarter of the over 1,000 IMGs registered each year remain working in New Zealand.

Overseas-trained doctors have a greater propensity to practice in minor urban and rural areas and in less affluent communities than New Zealand trained doctors. However, there is often a cultural disconnect between these doctors and the communities they serve. It will be important to address the overall number of doctors that we need to train to meet our workforce needs, given estimates on population growth. For example, conservative projections suggest Auckland will reach a population of two million by the early 2030s. The New Zealand active medical workforce has increased by on average 2.9% per annum from 2000–2014 (8,615 to 12,848), and at this rate of increase there will be 20,000 registered doctors in New Zealand by 2030 or an additional 7,000 doctors in the next 13 years. However, the demographic of the current medical workforce (with 40% over the age of 50) will lead to a considerable loss of doctors due to retirement over the same time period. This attrition, coupled with an ageing and increased population, means that the current output of the existing two New Zealand medical schools will not come close to meeting the medical workforce need.

The distribution of doctors by medical specialty is also a concern. In June 2016, we obtained data from the Medical Council of active medical practitioners by gender, year of qualification, medical school of qualification (Auckland, Otago or IMG), vocational registration (GP or other) and by region of practice. We calculated the proportion of vocationally registered GPs as a proportion of the registered medical practitioners for each year of qualification from 1975 onwards. We used the population data from the Medical Council 2013/2014 publication by DHB to calculate the number of doctors and number of GPs per 100,000 for each of the four Health Regions (Northern, Midland, Mid Central and Southern).

We found that the most deprived region with the highest proportion of Māori (the Midland Region) has 13% fewer doctors than the rest of the country (253 compared to 292 doctors per 100,000). Traditionally, the

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**Figure 1**: Percentage of medical school graduates vocationally registered in general practice by year of qualification (Source MCNZ 2016).
general practice and specialist workforces have been of similar size, meaning that we expect half of our graduates to become GPs. However, the proportion of graduates from the two existing medical schools becoming vocationally registered in general practice, has halved from over 45% prior to the 1990s to less than 20% this century. (See Figure 1). Between 1997 and 2009, New Zealand graduated 3,770 doctors,7 of whom 2,498 (66.2%) were still registered as practising in New Zealand in 2016. 393/2,498 (15.7%) of these doctors were vocationally registered in general practice (144/1,147 (12.5%) males were registered as GPs and 249/1,351 (18.4%) females). Despite the increased number of GP training posts that have been created, this trend is unlikely to change with the 2013 cohort of final year students, indicating that only 15% of them were considering GP as their first choice of career and only 2% said they wanted to live in a community of less than 10,000.26

Graduate entry

The 2011 HWNZ report on graduate entry programs noted that there was “a perception that current medical graduates are from a narrow band of the population and that the medical workforce would be stronger for greater diversity in educational and social background.”27 Currently, the students admitted to the programs are more likely to come from privileged schools and be of high socio-economic status.28

The literature review carried out by HWNZ noted that graduate entry programs “can produce comparable educational outcomes in shorter training time and for less cost; may increase diversity in entrants to medical study and can help the profession achieve a better match between medical graduates and the general population; can draw on students with more life experience and may help to change the culture of medicine; can result in increased student motivation, benefits to student well-being, improved learning strategies and professional outcomes.

Graduate entry can provide the opportunity for a wider range of students to meet the academic requirements for entry to medicine. The quality of the high school attended becomes less significant with graduate entry, allowing wider opportunity for students from low-decile, rural and provincial schools to demonstrate the required academic standing. Graduate entry also allows students more time to demonstrate their commitment to the ethos of the school through volunteering and work experience during their undergraduate degree, and through the development of community support for their application for medical school.

At present, approximately 25% of students entering the two New Zealand medical programs are graduates. These students are required to spend a further five years of study before graduating. A more intensive four-year graduate entry program could easily achieve the same exposure to teaching, while saving graduates a whole year of student debt and the opportunity costs of entering the workforce a year earlier.

Student selection

Three pillars influence the medical workforce, including selecting the right people, giving them the right experience during medical school and providing the right incentives after qualification.29 The very substantial excess in demand for places in medical training programs in New Zealand and the high academic standing of those applying for entry to medical training creates an opportunity to focus the selection of students on the characteristics that are most likely to lead to desired health workforce outcomes. While there is some evidence that graduate entry programs per se may change the nature of the students, the diversity is related more to selection policies than the nature of the program.27

The proposed University of Waikato Medical School will select students who have demonstrated high levels of academic achievement in an undergraduate degree and are predominantly from the communities in which medical practitioners are required. For instance, there is evidence that recruiting rural students will help the retention of doctors practising family medicine in rural areas.30 We will be seeking students who demonstrate a strong commitment to the ethos of a community-engaged medical school, to public and community service and to reducing health inequities. This will include seeking Māori students who can demonstrate engagement with their community, especially rural
communities. In particular, we want to meet the challenge of addressing improved health care access in provincial and rural communities. We recognise that we will need to develop appropriate systems, structures and processes to support effective community involvement in the provision of doctors to these populations, for example, Māori health teaching and learning. Linking with the Leaders in Indigenous Medical Education (LIME) Network will help ensure that we can build on the excellent work that is already in place in supporting the education of Māori doctors for the New Zealand workforce.

Longitudinal placements
Community-engaged medical training focuses on students learning about medicine through supervised interaction with patients in a community setting. Community-engaged graduate entry medical programs minimise the time that is spent learning medicine in university classroom and tertiary hospital settings, and maximise the time spent in community placements. Typically, most of the last two years of the four-year degree is spent in community placements. This approach to training has the effect of ensuring that the students build a deeper understanding of, and a stronger affinity with, clinical care in the community setting. It also leads to a greater proportion of students becoming doctors in the communities where they were trained.

Under the University of Waikato proposal, each student will spend at least a year of the four years in community placements. There will be a high level of community engagement with their education and community support for the students on clinical placements. By comparison, the rural training schemes run by Auckland involve placements outside the hospital setting that are as short as seven weeks, while the Otago rural immersion program is only available to 20 students per year.

To facilitate this approach to training, the University of Waikato proposal involves a commitment to invest in the physical infrastructure and the supervisory capability in 15 community education centres in the Midland Region. This will require additional investment, but has been shown in the Australian and Canadian settings to provide excellent educational experiences for students. The aspiration for the University of Waikato Medical School is to follow a similar model and achieve outcomes similar to the Northern Ontario School of Medicine (NOSM).

Challenges and concerns
The New Zealand health system faces a number of challenges in ensuring it has the medical workforce available to meet its future needs, which will require a multi-faceted approach by government and others. This proposal cannot address all such workforce challenges but offers a way forward. We recognise the concerns of existing providers and other bodies and have established mechanisms to address these. One concern from the two existing medical schools is the possible impact on clinical placements for their programs. Our proposal aims to create additional capacity both within the community as well as in Waikato Hospital.

As with the NOSM (which is based in a city of similar size to Hamilton with the support of linked community health providers across the region), the proposed program does not preclude students from other schools also being accommodated. Another concern is that the Medical Council only has access to a limited number of postgraduate year 1 (PGY1) house officer positions and these have not been increasing at sufficient pace to meet the demand from the existing programs. However, we also have an overall deficit in house officers in New Zealand. For example, in 2016, 268 IMGs who had qualified in 2013 or 2014 were working in New Zealand hospitals. The 2016 RDA strike was principally about long hours and the reliance on excessive rosters, another symptom of the deficit in junior doctors. So the shortage of PGY1 positions does not mean we have sufficient doctors—the bottleneck needs to be addressed—but the Waikato proposal will not need to be taken into account until 2024 at the earliest, and local solutions, such as increasing the number of community placements available, will help to meet the demand.

The shortage of general practitioners in our most needy and rural communities is not simply an undergraduate medical education issue. The numbers and nature of our postgraduate training also need to adjust, and there need to be the appropriate incentives in place to retain doctors in the
less popular specialties and locations. Fundamentally, the working conditions and status of general practice needs to improve to make the specialty more attractive.

The solution

We believe the time has come to re-imagine medical education within New Zealand. Our proposal will provide additional choice for those wanting to become doctors serving our provincial and rural populations where there are disproportionately high needs communities and patients. We acknowledge setting up a new medical school has increased start-up costs. However, some of the resources can be sourced through the University of Waikato.

The Waikato DHB has invested in staff and facilities to support training and research over many years. The community is also ready to support this initiative. The main additional cost is in developing the longitudinal placements—but as noted above this can be seen as a social investment, which has an immediate positive impact on the communities involved. Our proposal involves the community in selecting students and in developing the program that will produce the doctors that they need for the next half century and beyond. We will promote a model of education that is based on a team approach with an emphasis more on longitudinal attachments and less on the management of the complex episodic care of patients in tertiary institutions.

Waikato DHB has pioneered inter-professional learning in its nursing and allied health programs, and this approach, in conjunction with our other tertiary partners, would be expanded into medical education. We need to have students who have more exposure to the use of technology and especially the use of health information, telehealth and virtual care technologies to drive efficiency and better health outcomes. Again, the Waikato DHB has already shown its commitment in this arena. Most of all we want to see a model where student learning is based within the communities they will serve in the future, that students are aware of their concerns and will work jointly with their communities in finding solutions. Our proposed third medical school will provide real choice for graduates who wish to enter medicine. The unique curriculum and new academic culture will create a new breed of doctor; selected from the communities they will serve, supported throughout their careers by tailored professional development and modern technology to ensure they have satisfying and enjoyable professional lives serving the New Zealand public health service.

Competing interests:

Dr Town was retained as a consultant to the Business Case project currently being considered by the Government and paid fees for reviewing the drafts of the BC and attending relevant meetings; Dr Tapsell is the Director of Clinical Services for the Mental Health and Addictions service, Waikato District Health Board; Dr Lawrenson is both an employee of the University of Waikato and Waikato District Health Board; Dr Murray reports as Chief Executive Officer, Waikato District Health Board.

Author information:

Ross Lawrenson, Professor of Population Health, University of Waikato and Clinical Director Strategy and Funding, Waikato District Health Board; G Ian Town, Management Consultant, Christchurch; Roger Strasser, Professor of Rural Health, Dean and CEO, Northern Ontario School of Medicine; Sarah Strasser, Head of Rural Clinical School, University of Queensland; Judy McKimm, Professor of Medical Education and Director of Strategic Educational Development, Swansea University School of Medicine; Rees Tapsell, Director of Clinical Services, Mental Health and Addictions Services, Waikato District Health Board; Nigel Murray, Chief Executive, Waikato District Health Board.

Corresponding author:

Professor Ross Lawrenson, Waikato Hospital, Private Bag 3200, Hamilton.

ross.lawrenson@waikatodhb.health.nz

URL:

REFERENCES:


40. Biddle D. The future of health care in the Waikato is virtual health. Waikato Times August 5th 2015.
Acute confusion in a 64-year-old woman: diagnostic value of MRI

Joe James, Kamalasanan CG, NK Thulaseedharan, James Jose

A 64-year-old lady presented with sudden onset of slurring of speech followed by generalised weakness and altered sensorium. On examination she was haemodynamically stable but was stuporous. Pupils were equal and reactive to light. There was no neck stiffness. All deep tendon reflexes were exaggerated and plantar reflex was extensor bilaterally. Her blood sugar and electrolytes were normal. A computed tomography of the brain was also normal. Magnetic resonance imaging of the brain showed bilateral symmetric T1 hyperintensity in the globus pallidi (Figure 1). Liver function test showed total protein 5.7g/dL, albumin of 2.7g/dL and albumin/globulin ratio 0.9 with normal bilirubin and transaminase levels. What is the diagnosis?

Answer: Hepatic encephalopathy.

Ultrasound of the abdomen showed coarsened liver echoes, with dilated portal vein and periporal collaterals confirming cirrhosis with portal hypertension. Arterial ammonia was also elevated at 2450µg/dL (normal 19–60). Unlike other metabolic encephalopathies, hepatic encephalopathy can evolve very rapidly, mimicking a cerebrovascular accident. Liver function test may show only albumin/globulin reversal, which is non-specific and easily overlooked. Appearance of symmetrical T1 hyperintensity in the globus pallidus is characteristic of hepatic encephalopathy.¹ This finding is not observed in T2 sequence or on computed tomography. This is thought to be due to manganese deposition in basal ganglia.² Serum levels of manganese is increased in patients with cirrhosis. Imaging findings and serum manganese levels normalise after liver transplantation. Other causes of bilateral basal ganglia T1 hyperintensity include non-ketotic hyperglycemia, basal ganglia calcification and neurofibromatosis.

Learning Points:
- Hepatic encephalopathy can evolve very rapidly, mimicking a cerebrovascular accident
- MRI appearance of T1 hyperintensity in globus pallidus is characteristic of hepatic encephalopathy
- Manganese levels are increased in patients with cirrhosis, which gets deposited in basal ganglia to produce this appearance.
**Figure 1:** MRI brain.

Axial T1 weighted magnetic resonance imaging showing hyperintensity in bilateral globus pallidi (arrows).
Competing interests:
Nil.

Author information:
Joe James, Resident, Department of Internal Medicine, Government Medical College Kozhikode, Kerala, India; Kamalasanan CG, Associate Professor, Department of Internal Medicine, Government Medical College Kozhikode, Kerala, India; NK Thulaseedharan, Professor and Head, Department of Internal Medicine, Government Medical College Kozhikode, Kerala, India; James Jose, Professor and Head, Department of Neurology, Government Medical College Kozhikode, Kerala, India.

Corresponding author:
Dr Joe James, Department of Internal Medicine, Government Medical College Kozhikode, Njaralakatt House, Pottangadi Road, West NadakkavC, Calicut 673011, Kerala, India.
drjoejames@gmail.com

URL:

REFERENCES:
A History of New Zealand Women

Charlotte Paul

In her *History of New Zealand Women*, Barbara Brookes weaves different perspectives of Māori and Pakeha lives into a tapestry that enriches our sense of what it is to be a New Zealander. At best, Māori and Pakeha women have been learning from each other for 200 years. Before European settlement, Māori women’s customary roles were broader than those of Europeans. They had land rights that could be passed through the female line. In contrast, there were few legal rights for married women in settler society, and only in 1884 were all married women granted the right to own their own property—an argument partly premised on Māori customary rights. Meanwhile, missionary women such as Jane Kendall, Hannah King, and Dinah Hall, founders (with their husbands) of the first settlement of the Church Missionary Society at Rangihoua in 1814, believed they had a special role in educating Māori, though on occasion Māori women objected to being taught housekeeping instead of reading!

At worst, Māori women suffered grievously from contact with Pakeha. Introduced diseases, the land wars and the alienation of land led to catastrophic illness and loss of life. A Song of Sickness, perhaps initially composed by Hine Tangikuku of Ngāti Porou, expressed the desolation of communities as sickness took its toll. The waiata begins:

*The morning star swims in the sky*
*To this shore, where I*
*Lie wasted in a sea of pain.*
*Writhing like one insane*
*Fever-drunk, drifting*
*Like pollen in a dream, sifting*
*Like seed, I am not what I seem.*

Health and illness is a theme that runs through this history, and there are parallels to be drawn with contemporary society. In the late 19th Century, women’s concern...
focused on the evils of alcohol. Drink took money away from the domestic sphere and ruined lives. It was also another means through which Māori were dispossessed. Activist with the Women's Christian Temperance Union, Kate Sheppard, led the fight for votes for women. She argued that the state was ‘an enlargement of the family’ and women’s involvement was vital to both. The women’s franchise, finally gained in 1893, was opposed by the liquor lobby.

Women later argued for laws that improved the health of women and children through curbing men’s sexual liberty: raising the age of consent (from 12 years), the repeal of the Contagious Diseases Act, which allowed the compulsory medical examination of women thought to be prostitutes, and the forbidding of incest.

In describing antecedents to the founding of the Māori Women’s Welfare league, Brookes reports on a meeting in 1943 of the Northern District Hospital Boards. The Medical Officer of Health for the Manawatu, commenting on poor housing for Māori at Opiki, said that though the Department of Health had few statutory responsibilities, it ‘had many moral ones’.

The second wave of feminists emerging in the 1970s broke more bonds in society. Author and activist Germaine Greer visited New Zealand in 1971. A description of her points to a new ideal: ‘smart, learned, independent, funny and sexy’. This time round, Greer believed, feminism should unseat God, marriage, family and private property. Other groups of women responded with a counter-movement committed to an ideal of family life in which mothers provided a domestic anchor for their spouse and children. Brookes suggests that feminists were remaking traditions to include and value other ways of being, rather than destroying the family. Nevertheless, remaking traditions of family life, such that each member has a valued place, is still a work in progress.

As the narrative moves into the last 30 years, women speak with more diverse voices.

Women finally had powerful positions in public life. It was 1947 before there was a woman in Cabinet. Yet by 2001 New Zealand was called a ‘Woman’s Land’ because virtually every top job was held by a woman. Perhaps medicine has been behind in this regard. Only one woman, Robyn Briant, has ever chaired the Medical Council. There were only 17 women in the class of 120 when I graduated from the Otago Medical School in 1971; Brookes suggests that the lack of science teaching in girls’ secondary schools was partly responsible. In 2015, 43 percent of all doctors were women. Yet there are no younger women in medicine singled out for attention by Brookes, compared with highlighted contributions by women in other professional fields.

In sharp contrast to these spheres were the lives of women with little education and who had children at a young age. Brookes describes a new polarisation (in the late 20th century) between the experiences of well-educated women and those with little education, and there were new social ideas that had a better fit with the well educated and well off. Ideals of achievement, individual responsibility and choice were congruent with the lives of educated women without children. New government policies valued women as workers but not as mothers. Sole mothers with limited income had few choices.

In ‘shaping the new millennium’, Brookes celebrates the ways in which so many women have moved into new areas and made powerful contributions. She touches lightly on one of the so far intractable difficulties: not enough time and income to care for children. Caring, whether for children or for those who are sick or old, still most often falls on women. Perhaps, Brookes ventures, our policies would change if...
caring were universal, shared equally by men and women.

Barbara Brookes has written a big history that lights up the lives of many women; giving them names and quoting from their writing. She also charts the changes in social context that shaped such women's experiences and that they in turn shaped.

Finally, this is a book that celebrates women as makers. There are images of an early Māori cloak, a child's sampler, a quilt backed by flour bags, dresses, sewing kits and jewellery. There are beautiful paintings and photographs by New Zealand women, which also tell stories of women's lives, including the lovely cover image by Star Gossage.

**Competing interests:**
Charlotte Paul is a colleague of Barbara Brookes at the University of Otago and has been a co-author.

**Author information:**
Charlotte Paul, Emeritus Professor, Department of Preventive and Social Medicine, University of Otago, Dunedin.

**Corresponding author:**
Dr Charlotte Paul, Emeritus Professor, Department of Preventive and Social Medicine, University of Otago, Frederick St, Dunedin 9016.
charlotte.paul@otago.ac.nz

**URL:**
OBITUARY

Ronald James Kay Grieve
11 August 1937–4 March 2017

Dr Ronald James Kay Grieve passed away after complications of chemotherapy for bowel cancer.

Ron was born in Wellington. He attended Wellesley College in Days Bay as a boarder from seven to 13 years of age, where he rose to Head Boy and Dux, winning medals for the 100 yard sprint, and was Captain of the school’s first XV. He would always talk about his happy years there. Ron went on to Nelson College boarding until he was 18. Again, he became Head boy, Dux of the College and captain of the first XV! Ron won several medals and cups for the 100 yard sprint. Ron had a final year in Victoria University, obtaining a good scholarship and excelling in english literature, prior to going down to Otago.

Ron qualified in 1962, from Otago Medical School. He came to live in Auckland, where he married his first wife, Sally. After doing various locums, he settled in Glenfield, where he set up his own solo practice, and was on his own for the first 12 years. During this time, he met and married Irene, and adopted her three girls as his own. This period was extremely taxing for him and his family, as there was no hospital set up as yet, nor any after-hours services, and he was “it” 24/7. A partner joined the practice and remained with him for 28 years, and after he retired, Ron was mainly on his own again. Ron got involved with home births, along with the midwife icon at the time, Joan Donnelly. He must have delivered 200 home-birth babies.

Ron also developed a special interest in addiction problems, becoming a senior member of AA. He also tutored final year medical students, instructing them how to handle these problems effectively. He also helped to run a doctors’ support group for doctors that needed assistance.

Apart from his profession and family, his great loves were opera and classical concerts. He leaves his wife of 50 years, Irene, four children and five grandchildren.

Author information:
Irene Grieve, Glenfield, Auckland.

URL:
Dr Judith (Judi) Dawn Donnell

11 May 1956–31 January 2017

It is with great pride and sadness that I write this account of the career of my mother Judi. General practitioner, sports doctor, business owner and manager, company director, church elder, triathlete, amazing mother and friend, who died 31 January 2017 after a short and traumatic illness from mesothelioma.

Judi had been a general practitioner for 30 years and, with her business partner Dr Mike Williams, developed the Hinemoa House Family Health Centre in Rotorua. Judi graduated from Auckland Medical School in 1980, became a house surgeon, gained her Diploma of Obstetrics in 1982 and then became Paediatrics Registrar at Rotorua Hospital. She subsequently worked in general practice for a year in Rotorua before moving, with her husband Russell, to practice in England while Russell completed his PhD. While in England, she completed the UK General Practice Training Scheme and practised in two different clinics in Leicestershire.

Returning to Rotorua in 1987, she went into partnership with Dr David Rowe and then later with Dr Mike Williams. Judi was extremely proud of this practice and her colleagues who were like family to her. They were in the midst of merging with another practice to create Ruatahi Medical Centre when her illness struck.

Judi was a board member of the Rotorua Area Primary Health Organisation and also provided community health support to Western Heights High School in Rotorua.

Her love of sport saw her complete a Diploma in Sports Medicine in 1999, and become the first woman doctor of the Bay.
of Plenty Rugby Team, the Steamers. She was with them for four years—two years while they were in the Second Division and two years in the First Division. Her family became very used to seeing her on television as she worked with the team as they travelled around the country. Trying to help rugby players who were typically 0.5m taller than her was always a source of amusement, but they loved her and she them. Along the way she became very knowledgeable about rugby, a side benefit greatly appreciated by Russell. She also served as match doctor for the Chiefs and provided medical cover for many other sports teams when they were playing in Rotorua.

Judi was a keen and accomplished sportswoman. She challenged herself in the water, running, road biking and mountain biking. She ran marathons, twice completed the 160km round Taupō bike ride, competed in the cycle Tour of Northland and many triathlons where she was very competitive in her age group.

Judi was also very committed to her church activities. She was both an Elder in her church and also served as a board member on the Rotorua District Presbyterian Council.

A keen and enthusiastic cook, Judi loved experimenting with new cuisine and trying out the results on her family and wonderful friends with whom she enjoyed spending time.

She will be much missed by her immediate family—her husband Russell, her daughter Rebecca, her son Sam, her mother Mardi and her sisters Liz, Deborah, Robin and Cate. Her encouragement, warm support and ‘go for it’ attitude will be missed by all her friends, her colleagues, her patients and fellow athletes.
David and his identical twin brother Hamish were born 8 December 1927 to James Lawrence Hay and Davidina Mertel Hay (née Gunn). They had two older sisters, Helen then aged eight and Laurie, three. Both parents had been born in New Zealand in 1888 and were strict Presbyterians. Hay’s Ltd was soon to start as a drapery store in 1929, and Davine had trained in nursing at Christchurch Hospital.

The twins started their early schooling at Fendalton School, followed by St Andrew’s College in 1940. Both brothers did well, academically passing the university entrance exam at the age of 14 years, David later sharing proxime accessit. David was Company Sergeant Major of the College Cadet Corps and Hamish was Flight Sergeant of the Air Training Corps. David won oratory and debating prizes and was Mikado in the College’s 1944 production.

In 1945, David attended Canterbury University College and gained entrance to medical school, proceeding to Dunedin and Knox College the following year. He was much involved in social and musical activities, and played rugby for Knox College and the University B team. His public health thesis, which recorded the results of a study of the relationship of maternal rubella to congenital deafness and other abnormalities, was one of only two from the class published in the New Zealand Medical Journal, the other being on the topic of poliomyelitis. David’s choice of topic may have related in part to his own experience of partial deafness, the result of middle ear infection as an infant, which resulted in a radical mastoidectomy when he was five years old.

In 1950, David returned to Christchurch as a final year student, followed by a year there as a house surgeon. A second year in Christchurch was a consideration, but instead he headed to England for postgraduate study, travelling as ships’ surgeon aboard the MV Norfolk. He worked as a house surgeon at the Royal South Hants Hospital in Southampton, then the Hammer-smith and Brompton Hospitals, passing the London Membership examination at his first attempt. This success led to his appointment as house physician to Paul Wood and Guy Scadding, the former inspiring him towards a career in cardiology. As resident medical
officer at the National Heart Hospital for a year, David continued to work with Paul Wood and Aubrey Leathem.

In late 1955, David returned to New Zealand to take up a position as research officer in Professor Horace Smirk's Hypertension Unit in Dunedin. In 1956, he took on a senior registrar position at Dunedin Hospital and the next year returned to Christchurch as senior registrar, the second such position beside that of Don Beaven. David enjoyed teaching, and in tutorials with the final year students met Jocelyn Bell to whom he was later married in 1958. Jocelyn pursued a career path through general practice to the Student Health Service, and their two daughters Nicola and Natasha presently continue their careers in medicine and journalism respectively.

After two years as senior registrar, during which time he completed an MD and published on the topic of staphylococcal sepsis, David was appointed to the visiting staff as assistant physician combined with time in private practice. In 1964, he was appointed as cardiologist to develop a new Department of Cardiology at Princess Margaret Hospital, where Respiratory Medicine and the Medical Unit were already situated. Over time, a coronary care unit and investigational facilities were developed and enlarged, and further appointments made. David travelled widely and took a particular interest in pre-hospital coronary care, as exemplified in Seattle, and also in cardiac rehabilitation. From 1969–78, he was Head of the Department of Cardiology and then Chairman of Medical Services and Head of the Department of Medicine from 1978–84. He was a clinical reader in the Christchurch Clinical School, University of Otago. He held numerous leadership roles for the College of Physicians, Cardiac Society, New Zealand Medical Association and Canterbury Hospital Board.

The National Heart Foundation was founded in 1968. David was one of a small group of medical and lay people who had the vision and generosity of spirit to establish the Foundation on a firm footing, leading to its formal incorporation following the inaugural Council meeting at Wellington Hospital on 1 April 1968. He was a foundation Member of Council and also of the Scientific Committee, the first meeting of which was held in the Hay's home in Christchurch, chaired by Sir Edward Sayers, then Dean of the Otago Medical School.

As inaugural medical director of the Heart Foundation from 1977–92, David's style was inimitable and quietly distinctive. He was extremely thoughtful and detailed in his approach. During the period of his leadership of the Foundation, coronary heart disease death rates, which were extremely high and had peaked in the 1960s, fell steadily by more than 50%. The reasons for this decline were much debated at the time, with a number of factors related to prevention and treatment contributing. In retrospect, it became clear that the most important factor was the reduction in smoking rates.

Tobacco control was David's passion, and his leadership in this arena with all its complexity must have allowed him great personal satisfaction. His advocacy was relentless and most effective. He received international recognition for his work in tobacco control with a WHO Medal awarded in 1995.

David was a compassionate and caring physician, and an outstanding leader and representative of a generation, which made a massive contribution to the present wellbeing of our country. His lifetime contributions to healthcare were recognised by the award of CBE in 1981, and he was honoured as Knight Bachelor in 1991.

“Why do we have to listen to our hearts?” the boy asked when they had made camp that day.

Because, wherever your heart is, that is where you’ll find your treasure.”

Paulo Coelho, The Alchemist

This quotation is the frontispiece in David's autobiography entitled Heart Sounds, a life at the forefront of health care (Steele Roberts Ltd, 2005). The memoir is concise, amusing, informative and eminently readable. It is a quintessential Christchurch and Canterbury tale of the times. It spans the birth and development of modern clinical cardiology as it grew from a bedside art to high technology.

Author information:
Norman Sharpe, Medical Director, Heart Foundation 2003–2014, Auckland.

URL:
Treatment strategies for women with WHO group II anovulation

This report concerns a meta-analysis of trials on the topic of what is the most effective first line treatment for women with World Health Organization group II anovulation wishing to conceive.

The data includes randomised controlled trials comparing eight ovulation induction treatments in these women. These treatments included clomiphene, letrozole, metformin, clomiphene and metformin combined, tamoxifen, gonadotrophins, laparoscopic ovarian drilling and placebo or no treatment. Pregnancy, defined preferably as clinical pregnancy, was chosen as the primary outcome.

Fifty-seven trials reporting on 8,082 women were included. All treatments were superior to placebo or no treatment in terms of pregnancy. The researchers concluded that letrozole and the combination of clomiphene and metformin are superior to clomiphene alone in terms of pregnancy.

BMJ 2017; 356:j138

Thromboprophylaxis after knee arthroscopy and lower-leg casting

The use of pharmacologic thromboprophylaxis after most orthopaedic interventions is well established, because it strongly reduces the risk of thrombosis while only slightly increasing the risk of bleeding. However, whether such treatment is beneficial after arthroscopy or lower-leg casting is disputed.

Two randomised trials conducted in the Netherlands examine this proposition. Patients were assigned to receive either low-molecular-weight heparin for eight days after arthroscopy or during the full period of casting or no anticoagulant therapy.

The incidence of venous thromboembolism was low in both trials and its incidence was uninfluenced by the use of anticoagulation.


Obesity and hypertension in Australian young people

This study aimed to characterise the prevalence of obesity and systolic hypertension in young people aged 15–24 years across Australia.

Data was obtained from the Australian Health Survey. Over 2,000 young people were involved. In males, the prevalence of obesity increased from 8% to 15% through the ages of 15–24 years. The prevalence of overweight and obesity were both 14% for females across all age groups. The prevalence of hypertension was low (4% males and 3% females) but the prevalence of high normal blood pressure was substantial (males 28% and females 14%).

In their summary, the authors noted that overweight, obesity and high normal blood pressure were highly prevalent among Australian young people. Low levels of physical activity were identified as a risk factor for obesity for both male and females.

Internal Medicine Journal 2017; 47:162–169

URL:
Obituaries
April 1917

DR. W. H. HOSKING, MASTERTON.

The death has occurred at his residence in Masterton of Dr. William H Hosking, M.R.C.S., aged 75 years. The late Dr. Hosking has had a memorable career in New Zealand, playing an important part in the colonising days of various districts. He was born at Cornwall, England, and educated at Falmouth and Taunton. He studied at the Charing Cross Hospital Medical School, where he obtained his English qualifications. In 1863 he came to New Zealand in the ship New Great Britain. He practised for a time at the Bluff, and made regular visits to Stewart Island in whaling vessels.

A few years later he journeyed in a whaling boat around the Sounds to Hokitika. He was in charge of a public institution in that township for a time, and afterwards went to the Ross goldfields, where he was surgeon to the Ross Hospital for a period. While in Hokitika he married his first wife (Miss Archer), who died in 1890. He went to Masterton in 1875, after completing one of his several trips to the Old Country, and has resided there ever since. He was appointed to the charge of the Masterton Hospital at the time of its establishment, and retained the position until a few years ago, when he retired in favour of his son (Dr. Archer Hosking).

In recent years the late Dr. Hosking had devoted himself to researches into the hidden mysteries of electricity and radiography, and became so infatuated with the latter that he expended large sums of money in importing radium, and he received patients for the treatment of cancer from all parts of the Dominion. He was very enthusiastic over the introduction of the antiseptic treatment some years ago, and he was one of the first in New Zealand to introduce the X-rays apparatus. In the year 1900 he accompanied the 4th Reinforcements to South Africa, holding the rank of major. He had been for many years a Justice of the Peace.

The deceased was married a second time to Miss Alice Vallance. He leaves a widow, four sons, and one daughter. The sons by his first wife are Dr. Archer Hosking, Mr. F. A. Hosking (Bay of Plenty), and Dr. Rupert Hosking (Cook Islands). His second family are Mr. Douglas Hosking (at present on active service in Egypt) and Miss Christina Hosking.

CAPTAIN JOHN MACDIARMID, N.Z.M.C.

Captain J. MacDiarmid died in Wellington on March 18th as the result of appendicitis and general peritonitis. He had been in practice at Huntly, but for some time past was a medical officer at Featherston Camp. He was buried with military honours at Karori. Captain MacDiarmid graduated at Edinburgh University in 1907.

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