THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

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# This Issue in the Journal

**Is routine alcohol screening and brief intervention feasible in a New Zealand primary care environment?**
Heather Gifford, Sue Paton, Lynley Cvitanovic, John McMenamin, Chloe Newton

This paper reports on a demonstration project that tested the feasibility of alcohol screening and a brief intervention approach, consisting of advice and referrals, in general practice in a New Zealand region. The results suggest that good uptake of the intervention is possible and the paper concludes with a number of reasons why the intervention was successful in one primary care setting. The authors conclude that if the approach was more widely adopted, there is considerable scope for general practice nationally to address potentially harmful patient alcohol use.

**Chest tube drainage of pleural effusions—an audit of current practice and complications at Hutt Hospital**
Erica Epstein, Sisira Jayathissa, Stephen Dee

Chest drains are inserted for removal of fluid and air accumulated within chest cavity outside the lung and it is commonly performed by junior medical staff. We looked at our practice of chest drain insertions for fluid and found our complication rate to be similar to described elsewhere. Good training for junior staff, inserting chest drains with bed side ultrasound will improve safety from this procedure.

**Are two internal thoracic artery grafts as safe as one? Experience from Green Lane Hospital**
Arul Baradi, Paget F Milsom, Alan F Merry

In coronary artery surgery, it is thought that using bilateral internal thoracic artery grafts confer a long-term survival advantage for patients when compared to unilateral internal thoracic artery grafts. However, due to concern regarding perceived short-term risks associated with bilateral internal thoracic artery grafting, the majority of patients do not receive bilateral grafts. We conducted a retrospective study of 6592 patients undergoing coronary artery surgery at Green Lane / Auckland Hospitals between 1990 and 2004. After correcting for patient risk factors, we found no difference in the rate of perioperative complications between patients receiving surgery with either bilateral or unilateral internal thoracic artery grafts. This suggests that more patients can safely be offered bilateral internal thoracic artery grafting.

**An evaluation of a pictorial asthma medication plan for Pacific children**
John Kristiansen, Edlyn Hetutu, Moana Manukia, Timothy Jelleyman

Pacific children are over-represented in hospital admissions for asthma; education may improve outcomes. We developed www.pamp.co.nz for health professionals to use with Pacific families; it produces personalised asthma education materials in three Pacific languages with a pictorial format. A study of 48 families showed they were well used, and improved medicines knowledge and symptom recognition. Our approach may help other ethnicities. This is the first study about asthma education resources in Pacific children.

**Unusually virulent coagulase-negative *Staphylococcus lugdunensis* is frequently associated with infective endocarditis: a Waikato series of patients**
Michael Liang, Chris Mansell, Clyde Wade, Raewyn Fisher, Gerard Devlin

*Staphylococcus lugdunensis* is frequently associated with infective endocarditis and it is as aggressive as *Staphylococcus aureus* endocarditis. *Stayphylococcus lugdunensis* can be mistaken as less virulent coagulase-negative *Staphylococcus*. Assessment for endocarditis should be considered if S. *lugdunensis* bacteraemia is present, i.e. echocardiography is recommended. Investigation for suspected endocarditis should include at least three sets of blood cultures, to distinguish contamination or transient bacteraemia from the continuous bacteraemia of endocarditis.

**Did an acute medical assessment unit improve the initial assessment and treatment of community acquired pneumonia: a retrospective audit**
David G Tripp

The Medical Assessment and Planning Unit at Wellington Hospital was opened in November 2009. It aimed to be a "one-stop-shop" for people needing acute medical assessment referred from GPs, and also people presenting to the Wellington Emergency Department (ED) who needed further review. This study reviewed patients presenting with pneumonia before and after this change to see how the new system was working in this group of patients. The new system seems to be working well, in that weller patients are going to the MAPU, and avoiding time in the ED first. Some opportunities to improve the timeliness of the new processes, and to be more comprehensive in our assessment, were identified, and are now the subject of ongoing development work.

**Old Man's Friend? Resuscitation decisions in patients hospitalised with pneumonia**
David G Tripp

When someone is admitted to hospital that is at risk of dying, it is worthwhile to discuss with the patient and their family how they would like to be cared for should their condition deteriorate. These discussions often include whether they would like cardiopulmonary resuscitation (CPR) in hospital should their heart stop. Increasingly, however, there is a move to make these discussions broader—talking with elderly people about what they do and do not want done for them in their last years. This study reviewed 155 patients admitted to hospital with pneumonia. This was once

called “the old man’s friend”—pneumonia was a common cause of death in the frail or elderly, and a relatively quick and painless way to die. However, many other people with pneumonia are well and make a full recovery. This study aimed to see if it was possible to differentiate between those at high and low risk of dying, and then see if those at high risk of dying were included in discussions about end-of-life care.

The study found that simple criteria could highlight those at greatest risk. In particular, half of those over 80 had died within one year—some while in hospital, but most in the months after they returned home. Despite this, few had documented discussions about the care they would like at the end of their lives. This represents a missed opportunity. Such admissions have the potential to be a good opportunity to have difficult but important conversations about a patient’s wishes for end-of-life care.

**Implementing and sustaining a hand hygiene culture change programme at Auckland District Health Board**

Sally A Roberts, Christine Sieczkowski, Taima Campbell, Greg Balla, Andrew Keenan; on behalf of the Auckland District Health Board Hand Hygiene Steering and Working Groups

At Auckland District Health Board (ADHB) we have implemented a programme to improve hand hygiene practices by all healthcare workers. The programme included making the alcohol-based hand gel accessible at the bed side, educating staff about when to perform hand hygiene based on the WHO ‘5 moments for hand hygiene’ programme, and measuring improvement over time. Over the 3-year period we have seen an improvement in hand hygiene practices and at the same time we have seen fewer patients with serious bloodstream infections caused by *Staphylococcus aureus.* Commitment at the most senior level within ADHB has been crucial to bring about this change.

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# Will brief interventions in primary care change the heavy drinking culture in New Zealand?

J Douglas Sellman, Jennie L Connor, Geoffrey M Robinson

The state of alcohol in New Zealand has recently been examined by the Law Commission in the most comprehensive review ever conducted. The findings were an engrained normalised heavy drinking culture, causing enormous harm to individuals, families and society as a whole, and being driven by the "unbridled commercialisation of alcohol".[1]

The Law Commission's strongest recommendations were consistent with the best international evidence available, assembled in a World Health Organization (WHO)-sponsored publication "Alcohol: No Ordinary Commodity".[2] These measures have been publicised as the 5+ Solution by a national alcohol advocacy group, Alcohol Action NZ[3] as follows:

1. Raise alcohol prices.
2. Raise the purchase age.
3. Reduce alcohol accessibility.
4. Reduce advertising and sponsorship.
5. Increase drink-driving countermeasures.

PLUS: Increase treatment opportunities for heavy drinkers.

These principles were endorsed by an authoritative *Lancet* review of effective alcohol policy[4] and reiterated in a second edition of the WHO publication.[5]

The evidence for reducing population-based alcohol-related harm through treatment of individuals with alcohol problems (the final principle of the 5+ Solution) is primarily associated with wide availability of brief interventions for heavy drinkers, rather than specialist treatment of people with alcohol addiction. This is why the Gifford and colleagues' Whanganui research—in this issue of the *NZMJ*[6]—on the feasibility of conducting such interventions in primary care is important.

Brief alcohol interventions have been shown to have modest efficacy in research trials in primary care.[7] When the results of 21 randomised controlled trials investigating over 7000 patients were combined, patients on average reduced their drinking by about 6 standard drinks per week.

If there was a reduction of about 6 standard drinks on average across all drinkers in the population, there would be a significant impact on alcohol-related harm in New Zealand. The critical question therefore is whether these brief interventions can be effectively undertaken in primary care settings in a routine ongoing manner, like taking a patient's blood pressure.

The Whanganui research is pioneering work which does not reflect routine primary care practice at the current time. The study provided financial compensations and enjoyed the dedicated ongoing support and encouragement of the Alcohol Advisory Council of New Zealand throughout. Further, the study was resourced with excellent information technology support providing electronic reminders to undertake alcohol screening and facilitated recording of results. Finally, the research was fortunate to have a medical champion with a long-record of specific interest and leadership.

Despite these special conditions, the study was still only able to screen 43% of all patients enrolled with the clinics involved over a 10-month period, dropping to 36% of Māori. Although these results are nevertheless impressive given the state of alcohol in New Zealand, only 1 of the 15 clinics achieved over 70% screening. It is going to take perhaps a 90% screening rate across 90% of primary care practices to really begin to impact on the heavy drinking culture in New Zealand as a whole.

The Whanganui research results are arguably the best that can be achieved at the current time and provide an excellent model to follow and try to improve. But it is a major challenge to screen for a condition in clinical practice that is essentially a normative social behaviour being condoned by a government unwilling to lead any substantial change.

At least 25% of New Zealand drinkers over the age of 15 have an Alcohol Use Disorders Identification Test (AUDIT) score of 8 or more indicating heavy drinking,[8] which approximates to 700,000 heavy-drinking citizens. These are the group particularly targeted by the alcohol industry and daily shepherded along through $300,000+ of alcohol advertising and sponsorship (personal correspondence, Prof Sally Casswell, Massey University, 2010). Over half of alcohol industry profit is derived from these heavy drinkers.[9]

The Government continues to allow unrelenting promotion of alcohol as a normalised and glamorised product (like tobacco was in the past) and ultra-cheap alcohol for sale, sold virtually everywhere, anytime. It also continues to turn a blind eye to heavy drinkers continuing to drive their private motor vehicles in a drunken state while still under the legal drink-driving limit. Under these conditions, doctors and nurses are inevitably going to find it hard to swim against the tide and undertake effective clinical practice in the area of heavy drinking.

The Government has congratulated itself on incorporating 130 of the 153 final recommendations of the Law Commission into the Alcohol Reform Bill, which was the work of the Hon Simon Power, Minister of Justice in the previous government, and now being carried on by Hon Judith Collins in the same role. But this governmental response is conspicuous by the absence of all the major evidence-based measures that could make a real difference in influencing the excessive commercialisation of alcohol—effective regulation of marketing, pricing, trading hours and adult drink-driving limits—and therefore the nation's heavy drinking culture.

Screening for cigarette smoking in New Zealand's health care settings is now as routine as measuring patients' blood pressure. However, this has only come about following bold legislative moves which dismantled all tobacco promotion,

progressively increased the price of cigarettes, and began to place barriers up to the accessibility of tobacco for sale.

Screening for heavy drinking in New Zealand's health care settings remains somewhat out of step with social mores. This results in an inevitable degree of ambivalence on the part of primary health care practitioners to undertake this work, when with limited time they are also expected to routinely screen for (the more socially acceptable) breast and cervical cancers, immunisation status, cardiovascular risk factors, diabetes and smoking.[10]

As long as the Government refuses to lead a legislative public health programme to change the free-market commercial environment, brief alcohol interventions in primary care are unlikely to flourish, but will continue to be dependent on clinical champions and special incentives. Under these conditions the nation's heavy drinking culture is not going to change through brief interventions in primary care.

However, the latest Health Sponsorship Council survey[11] revealed high levels of public support for bold new alcohol policies in the areas of advertising and sponsorship, pricing, purchase age, liquor outlet density and trading hours. These findings suggest that the necessary legislative changes are now likely in the not too distant future. Then routine brief interventions in primary care will be widely undertaken and be an integral part of changing the heavy drinking culture.

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# Are two internal thoracic artery grafts as safe as one?

David Taggart

In the current issue of the *Journal*, Baradi and colleagues report a retrospective study of short-term outcomes in two groups, each of 637 patients, undergoing either BITA or SITA CABG matched for age, gender, body surface area, diabetes and hypertension.[1] They report no significant difference in the composite primary endpoint, nor of any of its individual components, between patients receiving BITA or SITA. They consequently imply that the use of BITA is as safe as SITA and recommend there should be increased utilisation of BITA in selected patients.

This issue is very important. Significant new evidence has emerged recently of the superiority of CABG over PCI for most patients with multi-vessel coronary artery disease.[2,3] While the benefits of a SITA graft were firmly established over a quarter of a century ago, more than 10 years ago strong evidence emerged of the potential survival benefits of BITA grafts.[4] The proven superiority of the long-term patency of BITA grafts in comparison to vein grafts when placed to the left sided coronary vessels is the likely explanation. Furthermore while the use of BITA grafts has additional survival benefit for younger patients it allows, with composite grafting techniques, the development of a truly off pump no touch aortic technique in those at higher risk of stroke.

Yet, in a survey of UK Cardiac Surgeons, although the majority believed that there were potential benefits for most CABG patients with two BITA grafts,[5] in reality they were used in only a relatively small number of patients. A decade later currently fewer than 10% of patients in Europe and 5% in the USA receive BITA grafts.

Consequently the ART Trial, a prospective randomised trial of 3100 patients operated on by 67 surgeons in 7 different countries, was established to determine if there are long term benefits of BITA grafts and, if so, in what patient groups.[6] Crucially the one-year outcomes were published as “a safety endpoint” and showed that the use of BITA grafts did not increase the risk of death, myocardial infarction or stroke in comparison to a single ITA graft. From the surgical perspective harvesting a second ITA graft added 23 minutes to operation time and an extra hour and half of ventilation in patients who were ventilated for around 12 hours.

The one crucial difference was an increase in the risk of sternal wound reconstruction from 0.6% in the SITA group to 1.9% in the BITA group (translating in to a number needed to harm of around 78 patients with each BITA operation). Current analysis of the ART data will identify which patients were at most risk of sternal dehiscence and this is almost certainly likely to be in obese diabetic patients. However even this risk can be reduced with more selective use of BITA and a skeletonisation harvest technique.

Considering its proven angiographic superiority, the very low rates of BITA use is an indictment of the practice of contemporary CABG. For those who argue that there is

no evidence from RCTs to support BITA use the same is true for the use of a SITA graft.

Use of BITA grafts should be in the routine surgical armamentarium of all cardiac surgeons.

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# Avoidable complications following chest tube insertion

David Shaw, Frank A Frizelle

Epstein, Jayathissa and Dee report (in this issue of the *Journal*) on their review of small-bore chest tube insertion practices for drainage of pleural fluid at Hutt Valley District Health Board (HVDHB). They report a surprising number of complications and conclude that specialist societies need to take a leadership in providing guidance on chest drain insertions to secondary and tertiary hospitals in Australia and New Zealand. This appears to abdicate the responsible of education away from the teachers of our resident staff.

The ability to place a safe chest tube should be in the repertoire of all doctors of registrar or greater positions. Unfortunately, bad techniques are often passed down to generations of resident medical officers (RMOs) based on a teaching principle of "see one, do one, teach one".

On of the authors (DS) of this editorial, a cardiothoracic surgeon, has been involved with/made aware of/consulted on complications inclusive of cardiac insertion, lung parenchyma insertion, liver insertion, IVC insertion (via liver), splenic insertion, damage to intercostal vessels, pulmonary artery, auxiliary vein, portal vein, bowel, and so on. Informal analysis of these errors has led us to the conclusion that they are almost universally avoidable and a product of inexperience and ignorance on the part of the operator with regard to anatomy, physiology, and dealing with complications.

The objective is simple. A hollow tube is to be placed within the pleural cavity through the chest wall without damaging contents of the chest cavity or chest wall and if damage occurs it is noted and managed appropriately. In order to do this, a very basic understanding of anatomy, physiology and human factors is required.

Kindergarten anatomy for chest tube insertion:

- The chest cavity is smaller than you think, if standing, the top of the diaphragm is approximately level with the nipple. No chest tube should be placed below this level without careful thought.
- The apex of the lung is a couple of centimetres above the mid point of the clavicle. Many individuals erroneously think that the lungs occupy the middle of the rib cage. This is wrong. Patients with marked lung collapse, like those on the ventilators in ICU, may have the diaphragm considerably above the level of the nipple line.
- The intercostal blood vessels only became under-cover of the inferior border of the rib at approximately the posterior auxiliary line. More proximally they are within the intercostal space and very easy to lacerate on instrumentation. Unfortunately this territory is frequently the sight of "x marks the spot" place by an ultrasonographer. Fluid in this territory, in the majority of cases, can be accessed by a laterally placed tube directed to the paravertable gutter.

Fortunately the majority of structures one wishes to avoid are located medically hence the thoracic surgical axiom "go high, go laterally".

The plane of the manubrial sternal angle denotes the bifurcation of the pulmonary artery, inside arch of aorta, and so forth. Classic teaching of mid clavicular lines/second interspace for emergency chest tube placement is, in the opinion of the authors, inherently dangerous. Tales of pulmonary artery injury etc nearly always associated with this site. It should only be used by experienced personnel when lateral access is not an option.

The surgical teaching, that the safest way to place a tube in the chest is to place a finger in first, still holds. There is an illusion that the ease of a Seldinger technique makes it inherently safer. This is wrong. Unfortunately there is a generation of RMOs ignorant in the skills to place a tube in the classic manner. This had led to the inappropriate approach of "only one screwdriver for all screws".

While it is not the intention of this editorial to provide detailed instructions of the technique of inserting a classic chest drain please bear in mind the following:

- The skin and pleura are the most sensitive. Target local anaesthetic to these areas (local anaesthetic with a vasocontractor can reduce bleeding). To anaesthetise the pleura, place half of the local anaesthetic as an intercostal nerve block, i.e. tap down the rib with tip of the needle, at the inferior margin, slide in approximately 1mm or 2mm to place the local anaesthetic. **Let the local anaesthetic infiltrate.** A dentist would not start immediately after a nerve block, neither should you. Use this time for setting up the rest of the procedure.
- Make the hole adequate. Skin incision should be approximately 3cm long, dependent upon the size of the operator's finger. To safely enter the chest, grasp a "Roberts" type clamp a few centimetres from its tip, in a manner similar to a one handed hold on a golf club. With the grasp fingers resting on the skin, roll the tip of the instrument over the top of the rib. A pop can be felt as it is enters the pleura. Opening the jaws along the axis of the rib will bluntly dissect safe entry into the chest.
- A finger is then inserted into the chest to sweep away minor adhesions if necessary, to ensure the tube will be in the pleura (to the uninitiated it can be difficult to recognise if a finger is placed into lung parenchyma. A finger in the parenchyma of adherent lung may meet no more resistance than a finger swept through the centre of a pavlova).
- This tube is guided into place **gently** with the aid of a finger or the side can be grasped by a Roberts forcep as a temporary stiffener. **Do not** use centre stylets as they are dangerous (be aware that drains with centred trocars are sometimes found less enlightened smaller hospitals).

A thoracic drain connected to an underwater seal system is simply a manometer within the chest. With inspiration there is negative intrathoracic pressure that not only draws in air for breathing but will "suck" the "water" up the tube. The water goes down during inspiration then the tube is not measuring intra thoracic pressure, it is

most likely in the abdominal cavity and thus an urgent general surgical opinion should be sought.

While good technique and an understanding of relevant anatomy/physiology will not guarantee the freedom from complications, a poor technique applied without understanding will guarantee avoidable complications.

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# Submitting articles to the New Zealand Medical Journal via Manuscript Manager

Frank A Frizelle

Many people who read and write for the *Journal* will remember the days when one posted off 5 to 8 copies of one's manuscript to the editor of a journal, and waited to receive an acknowledgement that the article had been received. Then sit and wait many months for the editor's decision while the copies were posted out to reviewers and the subsequent editorial decisions made.

In those days, researchers often had to book time at the university computer to get their results analysed and spend their time waiting punching out data cards. It doesn't seem that long ago when in 1982 the first computer arrived in the department I was researching in. It was an Apple and it was in the days when floppy disks were floppy. It had been ordered by the Professor at the time, however after it arrived it remained packed for 2 months as no-one really felt they needed it. I unpacked it to see if I could write my thesis on it, unfortunately it turned out easier to pay someone to type it.

In the last 30 years the advent of computers and the Internet have led to changes associated with journal publishing that seem incredible. In mid-2002 the *NZMJ* was one of the earlier journals to change to an electronic format. At the time many thought that the *Journal* might disappear. It hasn't and continues to attract excellent submissions relevant to the New Zealand healthcare environment. At the time the *Journal* went electronic there was little in the way of software support for electronic journals, however over the last 10 years these have developed, albeit until recently financially outside the reach of a small journal like the *NZMJ*.

The *NZMJ* is finally in a position to be able to acquire such software. We have spent many months accessing and evaluating the available products and finally have settled on Manuscript Manager (by Ektimo ApS in Denmark) which is we feel the best available software system for our budget.

From today, submissions (unsolicited editorials, original research, reviews, viewpoints, clinical correspondence [case reports and medical images], and letters to the editor) should be submitted via the Manuscript Manager website. This is a very similar process most other journals (both print and electronic) are now following.

Obituaries and book reviews as well as approved notices and meeting proceedings can still be sent to nzmj@cdhb.govt.nz

Articles already under review will be processed through to decision as before, but from 11 May 2012 please submit all articles to www.manuscriptmanager.com/nzmj. Online submission consists of 5 steps:

- **Step 1:** Log in or create a new user account (by inserting a unique email address and password) and enter personal details.
- **Step 2:** Enter the manuscript details, title, authors, abstract and other necessary material.
- **Step 3:** Upload manuscript file(s).
- **Step 4:** Enter covering letter to the Editor and response to reviewers if resubmitting.
- **Step 5:** Check submission details and send.

Past and prospective reviewers will be sent an email inviting them to log on and add their fields of expertise and amend contact details if necessary.

With any new technology or system there will be a period required for adjustment but we trust submitting via Manuscript Manager will become advantageous for authors, reviewers, and editorial staff.

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# Is routine alcohol screening and brief intervention feasible in a New Zealand primary care environment?

Heather Gifford, Sue Paton, Lynley Cvitanovic, John McMenamin, Chloe Newton

**Abstract**

**Aim** To test the feasibility of a systemised ABC alcohol screening and brief intervention (SBI) approach in general practice in a New Zealand region.

**Method** Data were collected on patients over 15 years who had their alcohol status recorded using the AUDIT tool. A concurrent independent process evaluation was conducted to assess effectiveness of ABC alcohol SBI related training and implementation of intervention.

**Results** In an 8-month period, general practices in the Whanganui region documented alcohol consumption of 43% of their patients. Of the 43% of patients screened 24% were drinking contrary to ALAC's low risk drinking advice. Of these, 36% received brief advice or referral.

Success of the approach can be attributed to the use of the Patient Dashboard reminder software and linked alcohol recording form. Other success factors included the use of a clinical champion and project leader, education and training, funding for extra GP and nurse assessment time and linking of the ABC alcohol SBI approach to existing services.

**Conclusion** Primary care in Whanganui has demonstrated the capacity to routinely query patient alcohol use and offer brief advice. If the approach was more widely adopted, there is considerable scope for general practice nationally to address potentially harmful patient alcohol use.

Alcohol is the most commonly used recreational drug in New Zealand, with 85% of adults (aged 16–64 years) having had an alcoholic drink in the past year. The prevalence of risky drinking is high with alcohol-related harm continuing to be a social and health issue in New Zealand.[1] Brief intervention, in a primary health care setting, has been shown to be an effective way of motivating patients to reduce their risk of harmful drinking.[2–4]

To test this concept in a primary health care setting in New Zealand a systemised ABC alcohol screening and brief intervention (SBI) demonstration project was implemented, in general medical practices in the Whanganui region, from May 2010 to January 2011. The aim of the demonstration project was to test the applicability of an ABC SBI approach, with a focus on reducing alcohol related harm.

The ABC model was derived from experience with smoking cessation in primary care and involved (A) **a**sking about alcohol use, (B) offering **b**rief advice to those drinking in ways inconsistent with Alcohol Advisory Council of New Zealand (ALAC) low risk drinking advice, and (C) where appropriate providing, or referring for, **c**ounselling[5].

The demonstration project was developed by the Whanganui Regional Primary Health Organisation (WRPHO), the umbrella for participating Whanganui general practices, in partnership with Te Kaunihera Whakatupato Waipiro o Aotearoa / ALAC.

Whakauae Research for Māori Health and Development (WRMHD) was commissioned by ALAC to undertake a process evaluation of the demonstration project. All partners in the project sought to determine whether a systemised ABC alcohol SBI intervention could be implemented effectively within a New Zealand primary health care setting. The information gathered was to potentially be used to inform wider implementation of ABC SBI style intervention services for alcohol harm reduction in other New Zealand primary care settings.

This paper provides a brief description of the ABC alcohol SBI intervention and presents key results from two data sources; PMS (Medtech)—data collected from 14 practices participating in the demonstration project—and qualitative data collected by WRMHD evaluation researchers.

## Methods

The demonstration project aimed to facilitate a change, within the WRPHO test site, in the way that alcohol was being addressed at primary health care level. Components of the intervention included systematising the recording of alcohol consumption, increasing patient knowledge of low risk drinking, and creating simple pathways by which to address potentially harmful alcohol consumption:

**A (Ask)—**patients attending clinical appointments at 14 WRPHO general practices and at the Whanganui Accident and Medical Clinic were asked by their GP, or practice nurse, about their drinking initially using the three-question AUDIT C screening tool.[6] A score of 4 for men and 3 for woman would trigger the clinician to undertake the full standardised 10 question AUDIT screening tool[7].

AUDIT, the Alcohol Use Disorders Identification Test, was developed by the World Health Organization as a tool to identify persons with hazardous and harmful patterns of alcohol consumption; the tool was developed and evaluated over a period of two decades, and it has been found to provide an accurate measure of risk across gender, age and cultures. The AUDIT was administered during routine consultations or during planned medicals and heath checks. Alcohol use was recorded in a structured format using a clinical recording template (Medtech advanced form) which automatically updated classification with reference to ALAC's low risk drinking advice, recorded readiness to change in the clinical progress notes and linked to a referral process;

**B (Brief Advice)—**patients identified as drinking contrary to low risk drinking advice were offered brief feedback about this along with low risk drinking information; and,

**C (Counselling)—**clinicians had the option of providing further assessment of a patient's drinking using a structured 10-point electronic questionnaire (available as part of the clinical recording template and also linked to the ALAC website). The questionnaire classifies at-risk, problem or dependent drinking which is then linked to advice and other educational resources. Subsequent management included the provision of further clinical appointments within the practice, or referral to an alcohol counsellor, to the Alcohol Drug Helpline or to specialist alcohol and other drug services, including a local kaupapa Māori mental health services provider.

Clinicians included asking about alcohol use as part of routine nursing or medical checks and as opportunities arose during consultations. A subsidy payment was available for assessment of patients whose reported alcohol use necessitated completion of the 10-question AUDIT tool. A further subsidy payment was available for providing subsequent alcohol counselling within the practice. Intervention training participation was part of a service level agreement between the WRPHO and individual practices; clinicians were provided with specific training to equip them to screen patients for alcohol consumption and provide brief advice as part of the ABC alcohol SBI intervention.

Training included the purpose of screening, administration of ABC screening, completion of the advanced clinical form, communication skills /motivational interviewing and the use of brief

intervention skills. Three training options were available; professional development workshops delivered by outside consultants, locally facilitated inter-professional education meeting sessions and small group/peer learning support in the practice setting.

The Patient Dashboard clinical reminder system,[8] which WRPHO practices use to monitor and record key individual patient health data, provided the technical platform support for implementation of the ABC alcohol SBI approach. The demonstration project involved the development of a clinical alcohol recording template (Medtech advanced form) accessed through the Patient Dashboard, allowing the recording of information obtained by A (asking), recording that B (brief advice) had been given and providing access to the AUDIT questionnaire, a comprehensive assessment guide, if required and to subsequent referral forms.

The WRPHO collected data which included the number of patients over 15 years who had their alcohol status recorded using the AUDIT tool, number of patients over 15 who had their alcohol status recorded and were drinking contrary to low risk drinking advice, and number of patients who were drinking contrary to low risk drinking advice and were given brief advice. Data was gathered using the claims database and a population health reporting tool (Dr Info).

Independent of the data being collected by the WRPHO a process evaluation was conducted to assess effectiveness of the training component, factors influencing provider participation, and factors influencing implementation of the project in particular relevance, ownership, impact on work and linkages with other providers with respect to referrals.

The evaluation used a primarily qualitative approach to data collection and analysis supplemented by the limited use of quantitative methods. Included in the evaluation were analysis of project documentation, a learning support / training survey, key informant interviews and key informant survey.

Document review focused on the demonstration project proposal, the project plan and progress implementation reports to ALAC prepared by the WRPHO. The project goal, objectives, planning and implementation processes relevant to the project were identified through this review.

Before developing the learning support/training survey tool, the evaluators met with the WRPHO's ABC alcohol SBI demonstration project co-ordinator and project champion to review design related options for maximising survey response rate. It was agreed that brevity and simplicity of the tool would be critical factors impacting on survey participation.

The monthly Whanganui Inter-Professional Education meeting for health professionals in primary care, hosted by the WRPHO, was selected as an appropriate avenue for administering the survey; 18 training surveys were completed and returned during one of these meetings. The co-ordinator also followed up with the WRPHO's two practice facilitators who then canvassed practices for further recruitment and completion of the training survey. Another two surveys were completed as a result of this making a total of 20. 12 GPs, six practice nurses and two others (one Plunket nurse and one unspecified) completed the learning support/training survey.

It was also intended to carry out ten to 12 key informant interviews, using a semi structured interview schedule, with a majority of these being with GPs and practice nurses. However, only eight interviews were secured within the evaluation timeframe with GPs and practice nurses being particularly difficult to access. As a result of this, it was decided to offer GPs the opportunity to instead complete open-ended, self-administered surveys designed around the content of the interview schedule. Five of these surveys were sent out to GPs who had previously indicated a particular interest in the evaluation work. Of these two were completed and returned. In total, six GPs and practice nurses were included amongst the key informants along with four alcohol and other drug personnel/demonstration project strategic players.

Data from all sources – documentation review, surveys and key informant interviews – were analysed using an inductive thematic analysis approach. Themes were reviewed and categorised by the research team and used to answer the research questions outlined previously. The results distilled from the various data sources were presented back to informants for comment and review, at which point they were further clarified.

## WRPHO results

In the 10 months, from 01 May 2010–28 February 2011, WRPHO practices 'Asked' and recorded the alcohol consumption of 43% of patients aged over fifteen years, with one practice recording alcohol status of 74% of their patients. 24% of patients whose consumption was recorded were drinking contrary to low risk drinking advice. Of these, 36% received brief advice or referral to a specialist service.

35 practitioners (17 GPs and 18 nurses), representing 35% of the WRPHO workforce, completed either an AUDIT or Full Assessment with a patient. 492 patients were administered the AUDIT and 48 full assessments were recorded.

Almost 40% of those administered the AUDIT were 45–64 years, with 30% being between 24 – 44 years. These results are broadly representative of demographics of general practice in the Whanganui region.

62% of those administered the AUDIT were European, 34% were Māori and 4% were of other ethnicities. Of those administered the AUDIT 69% were men. The substantially higher rate of administration to men requires further exploration to determine the role of gender in this context. Investigation of the composition of the AUDIT sample was not however, a focus of this study.

When an AUDIT is completed, referral outcomes are automatically recorded in the clinical notes if the referral option is activated. The chart below (Table 1) uses the World Health Organisation (WHO) zones and recommended intervention,[9] and compares this with the scores of the 492 AUDITs recorded.

### Table 1. WHO Audit Tool

| RISK LEVEL (WHO) | Recommended Intervention | AUDIT Score | Number within Zone | Percent of results |
|---|---|---|---|---|
| Zone 1 | Alcohol education | 0–7 | 129 | 26% |
| Zone 2 | Simple advice | 8–15 | 266 | 54% |
| Zone 3 | Simple advice plus brief counselling and continued monitoring | 16–19 | 52 | 11% |
| Zone 4 | Referral to specialist for diagnostic evaluation and treatment | 20–40 | 45 | 9% |

It is of note that practitioner's referral behaviour, without prompt, closely mirrored the interventions recommended by WHO. 81% were not referred or declined referral, 11% were referred for further follow-up (advice plus monitoring) and 9% were referred for specialist counselling/ treatment.

Importantly the data indicates that 80% of drinking behaviours could be addressed in a single consult, with brief advice, or through education about the effects of alcohol.

Data collected by the WRPHO demonstrated lower rates of 'asking' for Māori compared to non-Māori. In Table 2 below this has been compared to GP service utilisation rates in the year 2009/2010. This data shows that Māori present less often that NZ European. This means there is less opportunity to screen or assess patients in

general practice. However, even when data is adjusted for presentation Māori were less likely to be 'asked' (53% compared to 60%). In addition to the lack of opportunity to screen it is possible that patients presenting less often may present with more serious medical complaints leaving less time for clinicians to carry out routine health screening. Of those Māori that were screened a higher number were identified as drinking contrary to low risk drinking advice (40%) when compared to non-Māori (21%). This is consistent with other data.[10]

**Table 2. Patient utilisation of Audit C**

| Ethnicity | % pop with alcohol recorded (AUDIT C) | % pop who have seen GP in year | Utilisation adjusted % of patients having alcohol recorded |
|---|---|---|---|
| NZ European/Pakeha | 46% | 77% | 60% |
| Maori | 36% | 67% | 53% |
| Other | 36% | 75% | 48% |

## Process evaluation results

This demonstration project achieved the intended outcomes (as described in the project plan) in the timeframe initially agreed. The plan was implemented with very little change required in practice. There were minor changes to the IT programme in response to clinical feedback and a more major change around training for the intervention. 100% uptake of the demonstration project by GP practices was noted in the evaluation.

Key motivators for participation ranged from responding to the perceived expectation that all practices would take part as members of the PHO, through to the much more commonly cited interest in influencing positive change around acknowledging and dealing with patient alcohol issues. Financial incentives, while considered by some to be a necessary component of the intervention, were not cited as being the critical motivator for participating clinicians. These incentives were however, considered necessary to secure additional clinical time to carry out the intervention. Without financial incentives, the time necessary to implement the intervention becomes a cost against the practice which needs to be met in some other way.

In relation to this, practice configuration appeared to play a role in ease of implementation; those practices that had a wellness focus and protected nurse time for health screening were able to implement all components of the intervention with ease. While this type of practice configuration was considered ideal for implementation, key informants generally took the view that the A, and even the B, phases of the ABC alcohol SBI intervention were able to be implemented without significant impact on existing workload. Previous exposure to brief intervention practice such as the ABC tobacco intervention, had prepared practices for this type of approach and helped facilitate both uptake and implementation. Practice infrastructure such as integrated IT support and familiarity with IT programmes including Medtech and Patient Dashboard allowed for quick uptake and reporting.

Patient participation in the intervention was also a key factor in uptake. Patients were considered more likely to be compliant with the A (ask) phase of the intervention than

with the B and C phases, as these were seen to be potentially more intrusive and more likely to elicit a defensive or negative response from the patient. Overall the opportunity to engage patients in a discussion about alcohol was reportedly well received and it appears from the demonstration project that this is acceptable practice from a patient perspective; however, it is desirable that this result is tested directly with patients. Doing so was however outside the scope of the evaluation.

Clinical leadership was a critical feature contributing to project success. Particular attributes of project leadership included extensive knowledge of the evidence in brief intervention in primary health care, passion and commitment to reducing alcohol harm, credibility as a leader and allocated time and funding set aside for working to embed the project within the wider PHO setting. The importance of clinical leadership, in all phases of the demonstration project, cannot be overestimated. In order to secure colleague 'buy-in', in the first instance, and maintain intervention momentum ongoing clinical leadership is non-negotiable.

A further positive development influenced by project implementation was improved referral processes to specialist alcohol and other drug (A&OD) services. One service indicated that the project had resulted in there being more useful information contained in referrals received from primary care practitioners. This allowed alcohol and other drug clinicians to progress their work with clients with less delay and to focus that work more appropriately from the outset. It was also noted that, since project implementation, referrals had been better targeted to the services being offered by the A&OD sector.

The most significant challenge to project implementation identified was the non-alignment of the formal component of the training to the needs of the project; the externally contracted professional development workshops were considered least useful and face to face training in the practice setting the most useful. Key issues identified were the importance of ensuring availability of skills based as opposed to theory based training. This included an emphasis on individual coaching as well as the opportunity for 'hands on' exposure to the use of both tools and methods in a supervised setting.

Implementing the interpersonal component of the intervention, in tandem with the IT component, was challenging for some primary care practitioners. Alcohol use patterns are influenced by social and cultural factors and can be an emotive issue for both practitioner and patient. Repositioning alcohol use patterns as a health consideration, which the intervention attempted to do, requires a shift in consciousness, for both practitioner and patient which may be fraught with difficulties. High risk alcohol use is normalised in many New Zealand social settings including those familiar to people from across all social demographics. Exploring patients' alcohol use patterns, particularly at the instigation of the practitioner, was not always easy for practitioners especially given that, in some instances, they may have been personally unfamiliar with low risk drinking practices and environments.

Additionally, implementing the B and C phases of the intervention particularly for those practitioners unfamiliar with the addictions field of practice and lacking the necessary skills and / or confidence in the use of motivational interviewing and basic counselling was identified as challenging.

## Discussion

In 10 months, WRPHO practices '**a**sked' and recorded the alcohol consumption of 43% of patients aged over 15, with one practice recording alcohol status of 74% of their patients. It was found that almost a quarter of these patients were drinking contrary to ALAC's low risk drinking advice. Of these, 36% received brief advice or referral to a specialist service. All these patients had the link between their health and their drinking brought to their attention.

Achieving this rate of screening in a relatively short timeframe demonstrates that the intervention is feasible and indicates that high levels of screening could be expected with interventions carried out over the longer term. The rates of screening and referral achieved in the demonstration project are higher than normal in general practice settings without focused interventions on screening for alcohol misuse. Rates for screening and intervention as low as 4–28% have been noted in other studies[10,11,12,13]

While lower rates of screening for Māori were demonstrated when compared with non-Māori over half of those presenting at general practice were screened. Encouraging better access to routine health screening for Māori patients will be a critical factor in reducing the high rates of problem drinking for Māori.

Māori have reported elsewhere wanting help on alcohol misuse but not receiving it.[14] Barriers included a range of psychosocial factors (e.g. fear and social pressure), and organisational barriers (e.g. not knowing where to go and lack of transport). Removing barriers and working in partnership with advocacy organisations and Māori providers may go some way to increasing screening rates for Māori.

The higher rates of male screening in this demonstration project requires further investigation and trends should be noted in any possible wider roll out of the intervention. Due to low numbers of Pacific people residing in Whanganui, we are unable to comment on the intervention for Tagata Pasifika populations.

This ABC alcohol SBI approach could be considered low intensity and demonstrates that, with support and resources, GPs and practice nurses can include alcohol use in the consultation agenda. The outcome from the WRPHO demonstration project suggests that primary care is well positioned to lead the way in motivating patients to consider, and reduce, the risk of alcohol related harm. Enhancing confidence and competence for practitioners with well targeted training in alcohol brief intervention is likely to increase the screening rates in general practice.

It is probable that the outcomes could be duplicated by other PHOs. The success of the project is primarily attributed to the use of the Dashboard reminder software and linked alcohol recording form. These tools are available as shareware with costs to other PHOs limited to licensing and local software adjustments. Other factors impacting on the successful implementation of the ABC alcohol SBI approach included the use of a clinical champion, the role of a project leader, the availability of education and training, funding for extra GP and nurse assessment time and the linking of the approach to other existing services.

In this demonstration project, a primary care region has demonstrated the capacity to routinely ask about patient alcohol use and offer brief advice. If the approach was

more widely available, there is considerable scope for general practice to address alcohol use throughout New Zealand.

**Competing interests:** None declared.

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# Chest tube drainage of pleural effusions—an audit of current practice and complications at Hutt Hospital

Erica Epstein, Sisira Jayathissa, Stephen Dee

**Abstract**

**Aims** The aims of the study were to review small-bore chest tube insertion practices for drainage of pleural fluid at Hutt Valley District Health Board (HVDHB), to assess complications, and compare the findings with international data.

**Methods** Retrospective analysis of clinical records was completed on all chest tube insertions for drainage of pleural fluid at HVDHB from December 2008 to November 2009. Descriptive statistics were used to present demographics and tube-associated complications. Comparison was made to available similar international data.

**Results** Small-bore tubes comprised 59/65 (91%) chest tube insertions and 23/25 (92%) complications. Available comparative data was limited. Ultrasound was used in 36% of insertions. Nearly half of chest drains placed for empyema required subsequent cardiothoracic surgical intervention.

**Conclusions** Chest drain complication rates at HVDHB were comparable to those seen internationally. Referral rates to cardiothoracic surgery for empyema were within described ranges. The importance of procedural training for junior medical staff, optimising safety of drain insertions with ultrasound guidance, and clear clinical governance for chest tube insertions are important in minimising harm from this procedure. Specialist societies need to take a leadership in providing guidance on chest drain insertions to secondary and tertiary hospitals in Australia and New Zealand.

Chest drains are used to manage a range of pleural diseases including empyema, malignant effusion, pneumothorax and trauma.[1] The optimal location for drain insertion as described by the British Thoracic Society (BTS) is the 'Safe Triangle'. This is an area bordered anteriorly by the lateral border of pectoralis major, posteriorly by the lateral border of latissimus dorsi, with an apex in the base of the axilla and a base on the line of the fifth intercostal space[1]; minimising the risk to the internal mammary artery, muscle, breast tissue and organs.[2]

Potential complications of chest drain insertion include puncture of major organs such as the heart, lungs, liver or spleen, bowel as well as bleeding due to arterial or other major vascular structure perforation. Other important complications include pleural infection, inter-costal neuralgia, re-expansion pulmonary oedema, pneumothorax and subcutaneous emphysema.[3]

Chest drain insertion is a common procedure carried out in general wards by relatively junior medical staff,[3] with limited knowledge of anatomy and physiology. Several studies since 2005 have documented the lack of adequate training and confidence in chest drain procedures for junior doctors.[4–6]

International interest in small-bore chest drain complications has intensified following a British National Patient Safety Association (NPSA) Rapid Response Report in 2008 addressing chest drain related patient safety incidents. Twelve deaths and 15 cases of serious harm between January 2005 and March 2008 were described.[3]

Recommendations for the National Health Service included emphasis on clinical governance, technical training, and particular endorsement was given for the use of ultrasound guidance for chest drain insertion. The BTS also reviewed their Pleural Disease Guidelines (originally published in 2003 and since updated in 2010) and a pilot audit of 50 Trusts across the UK was completed in July 2009 to review progress.

The audit revealed improved approaches to chest drain insertion safety such as improved access to bedside ultrasound, timing of insertions (less 'out of hours'), and earlier specialist involvement. Consent practices were found to be inadequate and local auditing was encouraged. In addition, further national auditing was planned for 2010.[7] The BTS has since published on their website an audit tool to review chest drain insertions in the NHS.[8]

Prior to 2009, there was relatively little published information on complications related to small-bore catheter use for pleural effusion. A large number of studies cited complications of large-bore drains using blunt-dissection insertion techniques for trauma patients and treatment of pneumothorax, but these studies are not directly applicable to medical patients. An unpublished meta-analysis of complications associated with Seldinger chest drain insertion (serial dilation over a guide wire), involving a review of 12 studies from 1987 to 2008 with a total of 1381 patients[9–19] presented at the Royal College of Physicians (London) update in respiratory medicine for general physicians in 2008, has been used for comparison of complication data in this audit.

The BTS recently updated it's Pleural Diseases Guidelines, and within this evaluated both large-bore and small-bore chest drain complications separately.[1] Studies reviewed differ in insertion indications, definitions of complications, tube size, expertise of operators and rates of image guidance. We were not able to identify published studies looking at complications of small-bore chest tubes in Australia or New Zealand.

HVDHB is a secondary level care New Zealand hospital, serving a population of 140,000 with 54 general medical inpatient beds. It has no specialist respiratory inpatient service and all medical patients requiring chest drains are managed by the general medical service.

Pleural procedures at Hutt Valley District Health Board (HVDHB) were reviewed in late 2008 following an incident of inadvertent perforation of the myocardium with a small-bore chest drain placed for pleural effusion.[20] This has been reported to the Ministry of Health as a sentinel event.

Actions taken included the review and rewriting of procedural protocols and the introduction of a compulsory training session provided by an outpatient based respiratory physician for those inserting chest drains, as well as the availability of digital images in the procedure room, a move towards routine image guided chest drains, and the undertaking of this audit.

The primary objectives of the audit were to review HVDHB chest drain practices including use of ultrasound in drain insertion, to assess the complications, and to compare findings with national and international data. The secondary objective was to address anecdotal report of a high incidence of medically managed patients with small-bore chest tubes for empyema requiring cardiothoracic surgery.

## Methods

We conducted a computer search using ICD10 codes for pleural effusion, tuberculous pleurisy, pyothorax, chylous effusion, haemothorax, unspecified pleural condition, and diagnostic and therapeutic thoracentesis for a 12-month period from December 2008 to November 2009 inclusive. This search identified 140 records. Pleural fluid drainage using techniques other than chest drain insertion, and chest drains placed for pneumothorax were excluded, resulting in 65 chest drain insertions.

We obtained data from hospital electronic records and paper-based clinical notes retrospectively. Diagnostic categories were simple parapneumonic effusion, empyema, malignant effusion, heart failure related effusion, exudates not otherwise specified and other/unknown. Laboratory data was also reviewed to clarify the diagnosis. Empyema was defined according to BTS guidelines.

We recorded drain types according to the following categories: Unknown, French gauge 6–30, or pigtail catheter. Small-bore tubes were defined as <24 French gauge. We documented the location and success of placement with or without ultrasound guidance as well as number of drain insertion attempts, number of drains inserted per patient, days of drain site use, and drain flushing practices. Complications including pneumothorax, malpositioning, vascular injury, injury to diaphragm, liver, spleen or lung, and death, were recorded.

We noted referrals to a respiratory physician or cardiothoracic service and the timing of review and transfer. Transfer outcomes were assessed by accessing electronic records from the receiving hospital.

The BTS Pleural Diseases 2003 guidelines[2,21,22] available at the time of study, and 2008 NPSA Rapid Response Report served as the basis for guidance of best practice for this audit, as there were no guidelines published by the Thoracic Society of Australia and New Zealand.

Data were entered into a Microsoft Excel spreadsheet. Descriptive statistics were used to present demographics and complications associated with chest drain insertions. Complications were compared with the data from the unpublished meta-analysis and Pilot Audit from the NPSA.

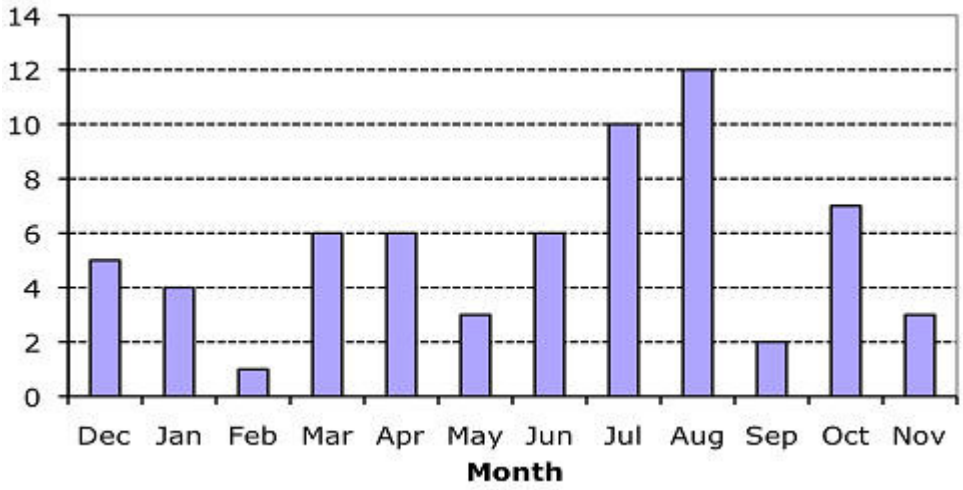
According to National Health And Disability Ethics Committee Guidelines, this study is considered as an audit primarily carried out for quality improvement activity by the employees of the HVDHB and hence did not require formal ethical approval.

## Results

Forty-nine patients receiving chest tube insertion for intrapleural fluid were identified in the 12-month period. Thirty-five patients received one tube only, 12 received two tubes, and 2 patients had three tubes placed, with a total of 65 insertions. Two sets of paper-based clinical records were unavailable for review, though electronic records were accessed in all cases.

Age range at admission was 23 to 89, median age 68 years; 69% were male. More chest tube insertions were carried out during the winter months 37/65 (56.9%) (Figure 1.)

**Figure 1. Number of chest drains per month (Dec 2008–Nov 2009)**




Median length of stay for patients with chest tubes was 10 days, with a range of one to 45 days. 52/65 (80%) chest drains were inserted by the general medical service, 6/65 (9%) by surgical or intensive care services, 5/65 (8%) by the Cardiology Service and 2/65 (3%) Older Persons Rehabilitation Service. These comprised six large-bore drains (9%), 37 small and 22 of undocumented size.

The undocumented drain sizes are very likely to have been small-bore tubes, as medical services managed all events with undocumented tube size and large-bore drains have not been stocked or utilised by medical teams at HVDHB. Therefore for the purpose of this study all undetermined tube sizes have been considered as small-bore, giving a total of 59/65 (91%).

Diagnosis, number of insertions and number of patients are shown in Table 1.

**Table 1. Chest drain insertion numbers according to diagnostic categories**

| Diagnosis | Number of insertions | Percentage of total insertions | Number of patients |
|---|---|---|---|
| Simple parapneumonic | 8 | 12.3 | 7 |
| Empyema | 27 | 41.5 | 16 |
| Malignancy | 6 | 9.2 | 5 |
| Heart failure related | 5 | 7.6 | 5 |
| Exudate not otherwise specified | 10 | 16.3 | 7 |
| Unknown | 4 | 6.1 | 4 |
| Transudate of unknown cause | 1 | 1.5 | 1 |
| Dressler's syndrome | 1 | 1.5 | 1 |
| Tuberculosis-associated effusion | 1 | 1.5 | 1 |
| Intraoperative diaphragm perforation requiring chest drain | 1 | 1.5 | 1 |
| Intrapleural total parenteral nutrition drainage | 1 | 1.5 | 1 |
| **Total** | **65** | **100%** | **49** |

Of patients requiring two or more drains, 8/14 (57%) had a diagnosis of empyema. Real time ultrasound or marking the site for best insertion was carried out in 21/59 (36%) of chest drain procedures. No information was available on ultrasound use in six cases. No patients had Doppler analysis for detection and avoidance of vascular structures.

**Table 2. The distribution of drain site location. Site location was not documented in 47.7% of insertions**

| Location | Number (N=65) | Percentage (%) |
|---|---|---|
| Not documented | 31 | 47.7 |
| Image guidance into locule | 6 | 9.2 |
| Left 'Safe Triangle' | 5 | 7.7 |
| Right 'Safe Triangle' | 8 | 12.3 |
| Posterior | 15 | 23 |

From HVDHB data, 25 complications within the listed categories were identified from 65 chest tube insertions. 23/25 (92%) complications occurred in those with small-bore, (including five probable small-bore tubes—i.e. 23 complications of 59 small chest-drain insertions), and 2 large-bore drains had complications (of 6 inserted). There were no deaths. Comparative complications between our cohort and available studies are summarised in Table 3.

**Table 3. HVDHB complication rate compared to Seldinger chest drain meta-analysis[9–19] data and NPSA Pilot Pleural Procedures audit**

| Complication | HVHDHB complication number and percentage occurrence | Meta-analysis patient number with non-weighted average frequency | NPSA Pilot pleural procedures audit 2009 |
|---|---|---|---|
| Total events | 65 (100%) | 1381(100%) | 68 (100%) |
| Pneumothorax | 14 (21.5) † | * | * |
| Malpositioning | 1(1.5) ‡ | 671 (1.2) | * |
| Lung injury | 1(1.5) § | * | 0 |
| Vascular injury | 1(1.5) ¶ | * | 0 |
| Symptomatic re-expansion pulmonary oedema | 1(1.5) | 320 (0.9) | 1(1.5) |
| Vasovagal reaction | 1(1.5) | 42 (1.9) | * |
| Drain site skin infection | 1(1.5) | 178 (0.4) | * |
| Subsequent empyema | 0 | 1701(1.8) | 2(2.9) |
| Drain blockage or accidental removal | 5(7) | 456 (14) | 6(5) |
| Total complication events | 25(38.5) | * | * |

† 1/14 pneumothoraces required transfer for cardiothoracic surgery; ‡ Chest tube placed above an effusion requiring reinsertion; § Occurred during CT-guided drain placement for loculated empyema, resulting in persistent pneumothorax, extensive surgical emphysema and respiratory failure. Cardiothoracic surgery and lengthy intensive care stay followed. ¶ Myocardial perforation requiring cardiothoracic surgery. The patient made a good clinical recovery; * Information not available.

Of 27 empyema-associated insertions, 26 comprised small-bore tubes (including 10 probable small-bore). In one event a large-bore drain was used. Ten patients with empyema required transfer for cardiothoracic surgery, comprising 13/27 (48%) of the empyema category drain insertions.

Audit data showed regular drain flushing in 40% of small-bore tubes, but rare use of suction. Regular flushing was not documented in one of five small-bore drain blockages.

In order to review HVDHB clinical governance of patients with chest drains, we documented referrals to HVDHB respiratory service, regional respiratory physicians, or cardiothoracic service. Referrals occurred in 29/65 (44.6%) instances. Most (76%) were referred within 5–7 days from diagnosis, which is within the BTS guidelines. There were two delayed referrals (14 and 31 days), though unfortunately clinical records for these were not available to identify the causes of delay.

All 15 patients accepted for further treatment by the cardiothoracic unit were transferred within 6 days of referral. Nine events were referred to HVDHB respiratory physicians, of which three were reviewed on the day of referral and one 2 days following. In five events no record of review was found, though three of these five patients were transferred for cardiothoracic surgery.

## Discussion

This study showed complication rates at HVDHB were comparable to international rates where available, although event numbers were small. Pneumothorax which was the most common documented complication in our audit was not included in the two comparative studies. All but one of the pneumothoraces in our study were small and did not require further intervention.

There were anecdotal reports of a high incidence of subsequent cardio thoracic surgery in medically managed patients with small-bore tubes for empyema at HVDHB. The rate of requirement for cardiothoracic surgery in patients with empyema is variable in the literature but HVDHB referral rate of 48% was within described ranges.

Although it is well recognised that patients with purulent fluid and/or loculations at presentation are more likely to require surgical drainage, there is not an appropriately powered study comparing surgical and medical treatments of empyema.[23]

A 2005 Cochrane review revealed only one small randomised trial, and suggested that firm conclusions were difficult, but video-assisted thoracoscopic surgery for large loculated empyemas was superior to chest tube drainage in terms of duration of chest tube in situ and length of hospital stay.[23] The majority of patients within our audit requiring surgery, 10/12 (83%), were those with empyema. 26/27 chest tube insertions for empyema were of small-bore category.

HVDHB utilised small-bore drains 24 French gauge or less inserted with Seldinger technique during the audit period. Now BTS describe small-bore drains as those less than 16 French gauge. Small-bore tubes are more comfortable for patients than larger

tubes, but there is no evidence that either is therapeutically superior (for diagnoses other than haemothorax), or safer.[2]

Some believe classical surgical insertion of chest tube is safer than Seldinger technique. There is limited data on the rate of adverse events for different insertion techniques. Use of the Seldinger technique is widespread but what proportion of chest drains are inserted by this method is uncertain though the NPSA quote a rate of 85–90%.[25] However, there remains a substantial body of opinion that considers large-bore tubes to be more effective for thick pus empyema based on clinical experience.[21,26,27] Some studies have shown failure rates in medical treatment for empyema of 19 to 55% (including use of intra-pleural streptokinase),[19,24] though utilised tube size varies within these studies. The 48% failure rate in this audit was within this range. Failure of medical treatment may be an expected outcome especially in those with loculated effusions at presentation.

This information raises the question whether patients presenting to HVDHB with empyema or complicated effusions would be best managed under the nearest cardiothoracic unit which is 20 km away, from the time of diagnosis.

Since our audit there have been recommendations[1] for routine use of real time image guidance for all chest drains placed for pleural fluid, and it is suggested this may become mandatory.[25] Latest BTS guidelines[1,8] state that use of ultrasound to mark a site suitable for later drain insertion is no longer recommended except in large effusions. Although real time ultrasound guidance is now recommended, BTS also state, “ultrasound may not reduce the incidence of laceration of the intercostal vessels because they are not visualised on ultrasound”. Ultrasound is available in the radiology department at HVDHB, but its rate of use for assisting chest drain placement is low (36%).

The NPSA Pilot Pleural Procedures Audit during July 2009, showed a combined rate (real time and remote) of ultrasound guidance usage of 34/68 (50%). No other published data were available to compare acceptable rates of use of ultrasound at the time of this study.

Lack of understanding of thoracic anatomy and relative assurance of ultrasound marking often applied by ultrasonographers may lead to injuries to the vital structures. Top of the diaphragm is usually at the level of the nipple and in cases of patients with lung disease the position of the diaphragm may be high. Intercostal arteries may become under the cover of ribs beyond posterior axillary line and insertions medially could potentially lacerate the intercostal arteries. Chest tube placement in mid clavicular line could cause injury to pulmonary artery.

The majority of structures one wishes to avoid are located medically hence the thoracic surgical axiom “go high, go laterally” need to be kept in mind while inserting chest drains.

Obtaining adequate training and skill for staff to conduct real-time ultrasound- poses difficulties in a secondary hospital with limited access to respiratory physicians and a stretched radiology service. The radiology department may not be able to manage increased demand for training or performing real time ultrasound and therefore general medical specialists may need to become proficient in pleural ultrasound.

More careful planning of the timing of necessary drain insertions may also aid in achieving safer procedures with adequate supervision and ultrasound guidance, however resources and training for pleural ultrasound are important considerations.

The implementation of clinical governance for the management of patients with chest drains at HVDHB requires review, particularly in view of the limited local respiratory and cardiothoracic services. Only 45% of our patients in total were referred to respiratory specialists, including 12/16 patients with empyema.

The BTS recommends that a respiratory physician or thoracic surgeon should be involved in the care of all patients requiring chest tube placement for pleural infection given the substantial associated mortality rate. Early respiratory specialist input is beneficial not only for their expertise in managing these patients but also their relationship with the cardiothoracic service, improving communication and expediting patient transfer for surgery if necessary.

Matters that may be contributing factors to serious insertion complications are those highlighted in recent studies that reveal a lack of understanding, "training, experience and confidence in junior doctors performing pleural procedures."[4–6] These factors are generalisable to junior doctors at HVDHB. Wong et al[5] highlighted the variable confidence and experience of junior medical staff, and the need for better training.

Griffiths et al[4] drew attention to the lack of understanding of guidelines on use of the 'safe triangle' and the need for training. They surveyed 55 junior doctors, finding 45% were unable to mark a hypothetical insertion position within the 'safe triangle'. In 47.7% of cases in our audit, location position was not documented (Table 2), though due to small complication numbers it was not possible to observe a meaningful trend in relationship between complication and insertion location.

Pleural procedures are widely performed across many specialties and although in some cases different procedural techniques may be appropriate, generalisable training sessions may be economic and useful. HVDHB has now introduced a compulsory training session delivered by a respiratory physician completed at the commencement of each new medical registrar intake. A simulation model is utilised in an approach previously shown to be effective in improving confidence and skill in chest drain insertion.[5,28] Physicians at HVDHB also may need to consider regular re-training, in order to provide supervision for their junior staff. One or two physicians assuming the responsibility of inserting chest drains under US guidance could be an option for smaller hospitals to ensure that they remain proficient with small number of procedures undertaken in such hospitals.

This audit has several limitations. They include the retrospective nature of data collection, unavailability of all relevant data on medical records and small sample size limiting subgroup analysis. However, the small number of chest drains performed during a year also highlights the need for clinical vigilance. Interpretation and statistical comparison of the data is restricted due to limited number of published studies on complications and variable definition of complications of small-bore chest drains placed for pleural fluid. In addition there was a potential for misclassification as we included all chest drains inserted by physicians as small-bore drains even though we couldn't find supporting documentation in some cases, but this unlikely to

be inaccurate as medical service don not routinely perform large-bore chest drain insertions.

In the absence of published studies on small-bore chest tube insertions in Australia and New Zealand this audit makes a significant contribution to understanding of complications of chest drain insertions in a secondary hospital. It also raises questions about appropriate management of empyema, improvement of clinical governance related to chest tube insertions and the feasibility of training in real time ultrasound, which are all important in reducing the unacceptably high rate of complications associated with chest drain insertions.

Recommendations arising from this study include the need for hospital wide training and the use of ultrasound guidance to enhance the safety of the procedure, as well as the implementation of uniform clinical governance for patients with chest drains and the need for improved procedural and care documentation. Consent practices and nursing education around drain management which were not examined in detail, need further review.

In conclusion we feel complication rates associated with small-bore chest drain insertions while in keeping with the literature are still unacceptably high at our hospital, especially given some are associated with serious morbidity. Documentations of the procedure and care were suboptimal.

Further studies are required to define acceptable complication rates after implementing guidelines to improve safe chest drain insertion. Moreover, Thoracic Society of Australia and New Zealand in collaboration with Internal Medicine Society need to develop appropriate guidelines for safe chest drain insertions targeted at different types of hospitals throughout Australia and New Zealand according to the size of the hospital and variability of available specialist respiratory services.

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# Are two internal thoracic artery grafts as safe as one? Experience from Green Lane Hospital

Arul Baradi, Paget F Milsom, Alan F Merry

**Abstract**

**Aim** To compare short-term mortality and major morbidity between patients undergoing elective primary isolated CABG with bilateral internal thoracic artery (BITA) or single internal thoracic artery (SITA) grafts at Green Lane Hospital (Auckland, New Zealand).

**Methods** We conducted a retrospective study of short-term outcomes in 5955 patients receiving SITA and 637 patients receiving BITA grafts between 1990 and 2004. Only patients undergoing elective primary isolated coronary artery surgery were included. The primary outcome was a composite end-point (early death, perioperative MI, reoperation for sternal wound complications or significantly prolonged hospital stay). Patients receiving BITA grafts were case-matched with patients receiving SITA grafts for confounding factors and comparison was made between perioperative outcomes in the two groups.

**Results** After case-matching, no statistically significant difference was found in the incidence of our primary endpoint between patients receiving BITA versus SITA grafts [odds ratio 0.84 (95% CI 0.59, 1.21)]. Furthermore, there was no difference in rates of reoperation for sternal wound complications between the two groups [odds ratio 1.00 (95% CI 0.29, 3.44)].

**Conclusions** Given the potential long-term clinical advantages of BITA grafting, our results support the increased use of BITA grafts in selected patients.

The value of coronary artery bypass graft (CABG) surgery in the treatment of coronary artery disease has been well established over the last 50 years, but few randomised trials have been conducted concerning any of the variations in this type of surgery.[1] The currently accepted standard (using a single internal thoracic artery graft for the left anterior descending artery with supplemental vein grafts for bypassing lesions in other vessels) is based on evidence derived from large observational studies rather than randomised controlled trials.[2,3] While this strategy provides excellent short to medium-term results, its long-term success is limited by progressive vein graft failure.[3]

There have been no randomised trials comparing SITA to BITA grafts. However, several large observational studies have compared the two techniques. Lytle et al conducted a retrospective, non-randomised, long-term (mean follow-up interval of 10 postoperative years) study of patients undergoing elective primary isolated coronary artery bypass surgery who received either single (8123 patients) or bilateral ITA grafts (2001 patients), with or without additional vein grafts.[1]

Various statistical methods (including propensity matching) were used to address the issues of patient selection and heterogeneity. The study showed better survival (84% vs 79% at 10 years, p <0.001) and reoperation rates (1% vs 3%, p <0.01) for BITA grafting. Kurlansky et al have recently published their retrospective 30-year follow-up experience with 4584 patients receiving BITA (2215 patients) or SITA (2369 patients) grafts.[4] They demonstrated a long-term survival benefit in propensity matched groups receiving BITA grafts (p=0.001).

Early studies regarding the safety of BITA grafting suggested an increased perioperative risk in patients offered BITA grafts.[5] The major concern was the risk of sternal wound infection, particularly in obese, diabetic females of advanced age.[5-7] More recent studies have disputed this, suggesting no increased risk with BITA grafting in diabetic patients.[8] However, many surgeons continue to reserve BITA grafting for patients with low surgical risk. According to the Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database, only 4% of CABG operations in the USA involve BITA grafts.[9]

The objective of this study on primary isolated coronary artery bypass surgery was to compare short-term mortality and major morbidity between patients undergoing primary CABG with BITA or SITA grafts at our institution.

## Methods

This was a retrospective observational study. Ethics approval was provided by the Northern Ethics Regional Committee.

### Table 1. Outcomes assessed and included in our composite endpoint

| | |
|---|---|
| Early death (30-day mortality) | Mortality within 30 days of operation, either in hospital or after discharge |
| Perioperative myocardial infarction | AST ≥100 mmol/L on first day post-op[10] |
| Reoperation for sternal wound complications | Reoperation in same admission for sternal wound complications (mediastinitis or dehiscence) |
| Significantly prolonged hospital stay | Hospital stay longer than the mean by at least two standard deviations |

We identified all 8004 patients who underwent coronary artery bypass graft surgery involving either single or bilateral internal thoracic artery grafts (with or without additional vein / radial artery grafts) by the Green Lane Cardiothoracic Surgical Unit between 1990 and 2004. 1412 patients who had emergency surgery, concurrent valvular surgery or redo-cardiac surgery were excluded from the study. We made no distinction in our analyses between patients who received pedicled or skeletonized grafts.

Data were collected from the Green Lane Cardiothoracic Surgical Database (which records patient information based on hospital records, catheterization, echocardiography and operative reports, including follow up information following discharge regarding mortality and readmission to hospital within the first 30 days of operation).

Patients receiving BITA grafts (637 patients) were case-matched with patients of similar surgical risk receiving SITA grafts (total 5955 patients). Patients were matched for major risk factors known to significantly affect surgical risk and the risk of mediastinitis[11] in particular (see Table 2). To avoid confounding due to operator selection bias, experience of the operating surgeon was also matched. Conditional logistic regression models were used to estimate the odds ratios for different outcome measures between patients receiving BITA grafts relative to patients receiving SITA grafts.

**Table 2. Matching criteria**

| Variable | Definition |
|---|---|
| Demographics | |
| Gender | |
| Age | <65 vs >65 |
| Body surface area ($m^2$) | <1.81, 1.81-1.99, >1.99 |
| Comorbidities | |
| Diabetes mellitus | Diabetes treated with oral hypoglycaemics / insulin OR recorded diagnosis of diabetes in patient's notes |
| Hypertension | Hypertension requiring treatment OR recorded diagnosis of hypertension in patient's notes |
| Cardiac morbidity | |
| Recent MI | Infarction within 6 weeks of operation |
| Symptomatic CHF | NYHA class III or IV |
| Surgeon | |
| Surgeon's experience | Less experienced BITA surgeons: case mix including < 10% BITA grafts |

## Results

We found 6592 patients who met our inclusion criteria, 637 with BITA grafts and 5955 with SITA grafts. After case-matching, the groups for further analysis were well balanced (Table 3):

**Table 3. Baseline data**

| Patient characteristics | BITA (N=637) | SITA (N=637) |
|---|---|---|
| Age, mean (SD) | 56 (10.1) | 59 (8.7) |
| Male, n (%) | 528 (83) | 528 (83) |
| Body surface area, mean (SD) | 1.93 (0.188) | 1.93 (0.192) |
| Diabetes, n (%) | 181 (28) | 181 (28) |
| Hypertension, n (%) | 276 (43) | 301 (47) |
| Myocardial infarction within 6 weeks of operation, n (%) | 524 (82) | 524 (82) |
| NYHA class III or IV, n (%) | 36 (6) | 33 (5) |

There was no significant difference in our composite primary endpoint between patients receiving BITA grafts and those receiving SITA grafts [odds ratio 0.84 (95% CI 0.59, 1.21)], nor in any of the component outcomes (Table 4).

**Table 4. Outcome data**

| Outcomes | BITA n=637 N (%) | SITA n=637 N (%) | Odds Ratio (95% CI) |
|---|---|---|---|
| Early death (1) | 6 (0.9) | 9 (1.4) | 0.66 (0.24, 1.87)* |
| Perioperative MI (2) | 41 (6.4) | 52 (8.2) | 0.76 (0.50, 1.17)* |
| Reoperation for sternal wound complication (3) | 5 (0.8) | 5 (0.8) | 1.00 (0.29, 3.44)* |
| Significantly prolonged hospital stay (4) | 17 (2.7) | 12 (1.9) | 1.41 (0.67, 2.99)* |
| Adverse clinical event (1+2+3+4) | 62 (9.7) | 72 (11.3) | 0.84 (0.59, 1.21)* |

*all p-values > 0.1.

## Discussion

In our patients, there was no statistically significant difference in the risk of death or in specified major morbidities in the short-term between patients receiving BITA versus SITA grafts [odds ratio 0.84 (95% CI 0.59, 1.21)]. In particular, there was no difference in rates of reoperation for sternal wound complications [odds ratio 1.00 (0.29, 3.44)].

Our findings are consistent with published data regarding the perioperative risks of BITA grafting. The systemic review conducted by *Taggart et al.*[12] revealed an operative mortality with BITA grafting of 1%-2%, which was no higher than the operative mortality associated with SITA grafting.

Other studies have shown that risks of sternal wound complications are minimal in the absence of factors which increase the risk of sternal wound morbidity (diabetes, morbid obesity, female gender, respiratory impairment).[11,13-14]

Although our study did not distinguish between pedicled and skeletonized techniques of ITA harvesting, there is evidence that harvesting of the ITA using the skeletonized rather than pedicled technique further diminishes the risk of sternal wound complications.[15]

Our study's primary limitation is that it is retrospective, with the inherent potential for selection bias. This is also a limitation of previous research on the topic, including the large observational study conducted by Lytle et al.[1] No prospective randomized controlled trials comparing the clinical outcomes of BITA to SITA grafting have yet been published.

The Arterial Resvascularization Trial (ART) is a large randomized controlled trial designed to provide a definitive comparison of the two techniques that has recently completed recruitment of patients.[16] However, 10-year follow up data from this study will be available only in 2017 (the authors of the ART trial have stated an aim to publish preliminary 5-year data in 2012).

Evidence-based medicine implies making clinical decisions for each patient on the basis of the best evidence currently available, and until the results of ART become available surgical decisions regarding BITA versus SITA grafting will necessarily be informed by observational evidence alone.[17] Our data demonstrate that surgeons in

our unit have been able to utilise BITA grafts in selected patients without increased risk of perioperative adverse outcomes, including sternal wound complications. Given the suspected long-term clinical benefit of BITA grafting over SITA grafting, we would recommend increased utilization of BITA grafting in selected patients.

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# An evaluation of a pictorial asthma medication plan for Pacific children

John Kristiansen, Edlyn Hetutu, Moana Manukia, Timothy Jelleyman

**Abstract**

**Background** The burden of asthma falls disproportionately on children from New Zealand's Pacific communities. Guidelines recommend pictorial resources but these have not been evaluated in this population.

**Aims** Evaluate a *pictorial asthma medication plan* focusing on regular 'everyday' inhaler use and a *signs and symptoms sheet* for Pacific children; the primary outcome measure was continued use of resources after 6 months.

**Methods** Resources were provided to families with face-to-face education at a general practice or inpatient setting in West Auckland. A questionnaire about the resources was completed after 6 weeks, and an audit regarding use after 6 months.

**Results** Data from 48 children were analysed (Samoan, n=31); 45 English and 22 first language versions (Samoan, Tongan, Tuvaluan) were used; median time to questionnaire completion was 48 days. The *pictorial asthma medication plan* was acceptable to families, effective at reinforcing the importance of 'everyday' inhalers, and a reminder for regular use; the *signs and symptoms sheets* were informative and improved self-efficacy; 93% of families were using the resources after 6 months. An increase in 'everyday' inhaler use was observed after education.

**Conclusion** The resources were effective at improving inhaler knowledge and supporting symptom recognition. A 'less-is–more' approach, pictorial format, and first language availability are characteristics that may benefit other ethnicities.

Asthma has a considerable influence on the lives of many New Zealand children and their families. Uncontrolled disease can negatively impact day-to-day activities, such as school attendance and participation in sports, and may lead to acute attacks. These are not only frightening, but can also result in visits to general practice or accident and emergency facilities.[1]

The burden of disease falls disproportionately on children from Pacific communities. Pacific children, along with Māori, have a higher asthma prevalence and their acute symptoms are often more severe when compared with other ethnicities.[2] They are also overrepresented in preventable asthma-related hospital admissions.[3] This is a significant health inequity and an ongoing challenge for the health sector.

The exact reason for poor asthma outcomes in Pacific children is unclear. Evidence suggests that Pacific families lack an understanding about asthma medicines use and how to recognise the signs and symptoms of worsening asthma.[4] These factors are likely to contribute to poor asthma management and symptom control and may be mitigated with appropriate education.[3]

For all ethnicities, asthma education has traditionally relied upon the use of written asthma action plans, despite there being limited evidence of their effectiveness.[5] Utilisation rates of such plans may also be decreasing in New Zealand.[6]

Data about the use and utility of asthma education resources in Pacific children is lacking. The only published study that has evaluated asthma self-management plans in Pacific people was in a Tongan community-based programme.[7] Although older children were enrolled in this study, the overall emphasis was on adults and no specific conclusions were made with respect to the child participants.

The Paediatric Society of New Zealand's childhood asthma guidelines has recommendations around providing asthma education to Pacific families. They stress the importance of educating about 'everyday' asthma inhaler use (e.g. 'preventers', 'controllers'), ensuring language is not a barrier, and suggest that 'action plans with pictures of medicines rather than words may help'.[8,p41] No such asthma resource has been available to health workers in New Zealand. Furthermore, no studies have been published yet about the use of 'pictorial' asthma action plans in children - of any ethnicity. There is a single study that evaluated a pictorial asthma plan, but this was designed only for use in adults.[9]

Recently, the Pharmaceutical Management Agency (PHARMAC) launched *Space to Breathe*, an initiative that uses a personalised asthma action plan with images of the child's inhalers.[10] However, it has not been formally evaluated, the resources are predominately textual, and are unavailable in the first language for Pacific families. The 'one-size-fits-all' approach of the written asthma action plans that are commonly available in New Zealand could be a potential barrier to effective asthma self-management support in the Pacific community.

We have developed www.pamp.co.nz a web-based tool that health professionals can use to produce personalised pictorial asthma resources in English and three Pacific languages. The focus of the *Pacific Asthma Medication Plan*, or *PAMP*, is on the child's 'everyday' inhalers. Pre-printed information sheets about the signs and symptoms of asthma are also available in the first language. These resources are laminated together with fridge magnets attached for families to take home.

The objective of this study was to evaluate: the utilisation and acceptability of the resources, the effectiveness of the *PAMP* to reinforce the importance of the 'everyday' inhalers and to act as a reminder to use them regularly, changes in 'everyday' inhaler use patterns, and the effectiveness of the *asthma signs and symptoms sheets* to inform and improve self-efficacy. The primary outcome variable was continued use of the resources after 6 months.

## Methods

This was a quantitative, prospective study conducted at two sites from June 2009 to May 2010: West Fono Health Trust (a large Pacific Health primary care provider in West Auckland servicing 360 enrolled asthmatic children aged 2-16 years), and the Rangitira Unit, Waitakere Hospital (a 15-bed children's ward). Inclusion criteria were Pacific children aged 2-15 years prescribed 'preventer' or 'controller' asthma medications.

To generate a *PAMP* using the online tool, details were entered about the child (age, gender), prescribed asthma inhalers (one 'reliever' with variable fields for dose and frequency; up to two 'everyday' inhalers with variable fields for dose and a default frequency of twice a day), health professional (name, location, phone number), and expiry date of the plan. These were printed in colour

in the patient's choice of language/s (English, Samoan, Tongan or Tuvaluan), then laminated with a pre-printed *signs and symptoms sheet* (also in the chosen language/s) on the reverse, and fridge magnets attached (Figure 1).

**Figure 1. PAMP (English and Samoan) and asthma signs and symptoms sheet**


Participants were given the resources as part of the routine face-to-face asthma education provided during their visit; six weeks later they completed a structured questionnaire about the resources, either in person at West Fono Health Trust, or by phone. For the purposes of follow-up, patients visiting the Rangitira Unit were excluded if they were not enrolled at West Fono Health Trust. The dates of initial visit and follow-up, the family's ethnicity, and language versions of the resources provided were also recorded. Consultations were conducted in English by a registered health professional. The questionnaire answers were collated and statistical analysis carried out using SAS v9.1.3 software for Windows. An additional audit was conducted 6 months after study completion to see if the families were still using the resources.

Adult and child versions of the participant information sheet and consent form were pre-tested for comprehensibility using key informant interviews with six Pacific families; these were available in English only. These documents were tested at a focus group of West Fono Health Trust staff who also assisted with writing the asthma resources in the first language; the choice of languages was aligned with the demographics of the local population. Both groups provided feedback on the layout and design of the asthma resources. The clinical content was compiled by the Quality Use of Medicines Team at Waitemata District Health Board (DHB) and the asthma educators at West Fono Health Trust; this was endorsed by a consultant paediatrician, a paediatric clinical pharmacist, paediatric nursing staff, and Pacific Support Services at Waitakere Hospital.

Changes in 'everyday' inhaler use before and after receiving the asthma resources were investigated using repeated measure analysis to adjust for child to child variability; inhaler use was coded as: 'never' = 0; 'few times a week' = 3-5 (midpoint of 4 was used); 'most days' = 6-7 (midpoint of 6.5 was used).

The study had ethics approval from the Northern X Regional Ethics Committee, Auckland (NTX/08/09/088).

## Results

None of the study participants were recruited at the Rangitira Unit during the 11-month study period because there were no hospital admissions of West Fono Health

Trust enrolled children who met the inclusion criteria. A total of 52 children were recruited, but four children were excluded (two were from non-Pacific families; two had incomplete consent forms); the remaining 48 participants completed the structured questionnaire. Along with parental consent, five older children also gave their assent to participate. The primary visit and follow-up was performed by either of two registered practice nurses who had completed an accredited asthma education course; one nurse enrolled 45 of the participants.

Table 1 describes the patient demographics and utilisation of resources. There were similar numbers of boys and girls, with an average age of 6 years. Samoan made up the largest specific ethnicity (n = 31) in the whole group. The median time to initial follow-up was 48 days. A total of 67 sets of asthma resources were given to 48 families (45 English and 22 first language versions).

**Table 1. Patient demographics, distribution and utilisation of resources**

| | | | |
|---|---|---|---|
| Gender of children and age (median; range) | **All participants (n=48)** | **6 years (2-14)** | |
| | Female (n=23) | 7 years (3-14) | |
| | Male (n=25) | 6 years (2-13) | |
| Ethnicity; number of families | Samoan | 31 | |
| | Cook Island Maori | 4 | |
| | Niuean | 4 | |
| | Tongan | 3 | |
| | Fijian | 2 | |
| | Tuvaluan | 2 | |
| | Unspecified† | 2 | |
| Ethnicity; language version; no. of families who received the resources | Samoan | Samoan + English | 16 |
| | | English only | 13 |
| | | Samoan only | 2 |
| | Cook Island Maori | English only | 4 |
| | Niuean | English only | 4 |
| | Tongan | Tongan + English | 2 |
| | | Tongan only | 1 |
| | Fijian | English only | 2 |
| | Tuvaluan | Tuvaluan + English | 1 |
| | | English only | 1 |
| | Unspecified† | English only | 2 |
| No. of English + first language versions given to families | 67 versions to 48 families (English 45; first language 22) | | |
| Median time between first meeting and follow-up questionnaire | 48 days (range 37-119)* | | |

† Patients listed as 'Other Pacific'

* Includes five families that took longer than 60 days to follow-up

Table 2 details the questions and responses in the questionnaire. There were minor omissions in nine questionnaires; all available responses were included in the analysis. The questionnaires were completed by the child's parent or caregiver.

## Table 2. Questions and responses from structured questionnaire

| Questions† | Choices | No. of responses | % of responses |
|---|---|---|---|
| Q1. Are you still using the asthma medication plan? | Yes, we are still using the plan | 45/45# | 100 |
| | No, we are not using the plan | 0 | 0 |
| Q2. Where did you keep the asthma medication plan that we gave you? | Fridge | 45/47 | 96 |
| | Bedroom | 1/47 | 2 |
| | Drawer | 1/47 | 2 |
| Q3. Have you ever been given another type of asthma medication plan, or asthma action plan before? | No, this is the first time (go to Q5) | 39/45 | 87 |
| | Yes, we have been given one before | 6/45 | 13 |
| Q4. How does the asthma medication plan we gave you compare to ones you've used before? | Better* (from Q3) | 6/6 | 100 |
| | Same* | 0 | 0 |
| | Worse* | 0 | 0 |
| Q5. About the number of words used on the asthma medication plan, which of the following do you agree with? | About right | 46/47 | 98 |
| | Not enough words | 1/47 | 2 |
| | Too many words | 0 | 0 |
| Q6. About the number of pictures used on the asthma medication plan, which of the following do you agree with? | About right | 46/47 | 98 |
| | Too many pictures | 1/47 | 2 |
| | Not enough pictures | 0 | 0 |
| Q7. After we gave you the asthma medication plan, how often have you been using your everyday asthma inhalers, e.g. the brown Beclazone inhaler? | Most days | 32/47 | 68 |
| | Few times a week | 9/47 | 19 |
| | Never | 6/47 | 13 |
| Q8. Before we gave you the asthma medication plan, how often did you use your everyday asthma inhalers, e.g. the brown Beclazone inhaler? | Few times a week | 23/47 | 49 |
| | Most days | 15/47 | 32 |
| | Never | 9/47 | 19 |
| Q9. Which of the following options best fits with this statement? "The pictures of the everyday inhalers in the asthma medication plan were a reminder to use these inhalers." | Agree | 47/48 | 98 |
| | Disagree | 1/48 | 2 |
| | Don't agree, don't disagree | 0 | 0 |
| Q10. Was the asthma medication plan used by other people, like family members, teachers, and other caregivers who help to care for you/your child? | No, the asthma medication plan wasn't used by other people | 28/46 | 61 |
| | Yes, some other people used the asthma medication plan | 18/46 | 39 |
| Q11. Which of the following options best fits with this statement? "The information about the asthma warning signs informed us about what to watch out for." | Agree | 48/48 | 100 |
| | Disagree | 0 | 0 |
| | Don't agree, don't disagree | 0 | 0 |
| Q12. Which of the following options best fits with this statement? "The asthma medication plan informed us about how important it is to use the regular inhalers everyday." | Agree | 48/48 | 100 |
| | Disagree | 0 | 0 |
| | Don't agree, don't disagree | 0 | 0 |
| Q13. Which of the following options best fits with this statement? "The written information we were given has made us feel more confident about how to look after the asthma." | Agree | 48/48 | 100 |
| | Disagree | 0 | 0 |
| | Don't agree, don't disagree | 0 | 0 |
| Q14. Which of the following statements do you agree with? | We like the asthma medication plan* | 45/47 | 96 |

| | | | |
|---|---|---|---|
| | We thought the asthma medication plan was OK* | 2/47 | 4 |
| | We didn't like the asthma medication plan* | 0 | 0 |
| Q15. Will you keep using the asthma medication plan? | Yes, we will keep using it | 47/47 | 100 |
| | No, we won't keep using it | 0 | 0 |
| Q16. Why won't you keep using the asthma medication plan? | n/a – no negative responses in Q15 | | |

† The table contains all 16 questions used in the questionnaire

# Responses were missing for some questions; total is less than number of participants in some instances

* Responses were associated with a modified Likert-type scale using pictorial faces

Questionnaire responses indicated that all complete respondents were still using the *PAMP* (45/45) at the 6-week follow-up, with the majority kept on the fridge (45/47), and that for most it was the first plan they had used (39/45). All six who had previously had an action plan reported that the *PAMP* was better. Further positive responses indicated from most respondents that the number of words and pictures in the *PAMP* were 'about right'.

Participants agreed that the *PAMP* reinforced the importance of using the regular inhalers everyday (48/48), the inhaler images in the *PAMP* acted as a reminder (47/48), the *asthma signs and symptoms sheets* were informative (48/48), and the resources helped to improve confidence (48/48). None of the families reported that they didn't like the *PAMP*, all intended to continue using it, and some (18/46) had shared it with other people, e.g. the extended family (Table 2).

Questions 7 and 8 asked families about how often they used the 'everyday' inhalers; 47 of the 48 families responded. A statistically significant difference (p=0.014) in the trend of inhaler use was observed, between before and after receiving the asthma resources, after adjusting for the subject effect. There was an increase in the proportion of children receiving these inhalers 'most days', from 15/47 (32%) at recruitment to 32/47 (68%) after they received the education and resources; a proportional increase of 36% (Table 2). Of the 47 children, 12 children used their 'everyday' inhalers 'most days' at the beginning and continued to do so.

For the remaining 35 children, their use can be described as follows: *unchanged:* never→never (1), few times a week→few times a week (5); *decreased:* few times a week→never (2), most days→never (3); *increased:* few times a week→most days (16); never→most days (4), never→few times a week (4). Therefore, 24 of the 35 children (69%) increased the frequency of their 'everyday' inhaler use.

The majority of the *PAMPs* utilised Salamol® (a brand of salbutamol) and Flixotide® (fluticasone) and all were valid for a period of 6 months. The average reported time for staff to create each set of laminated resources was 10 minutes. An audit by West Fono Health Trust staff revealed that 6 months after the 6-week follow-up, 40/43 (93%) of families had the original asthma resources in their possession and were still referring to them.

## Discussion

Our evaluation demonstrated that the two asthma resources were fit for purpose. The majority of families found the design and layout acceptable, and agreed that the resources reinforced the importance of 'everyday' inhaler use and helped to improve self-efficacy around symptom recognition. The resources were well utilised by families, both at the 6-week follow-up and 6-month audit. Although subjective, 45 out of 47 families said they 'liked the plan' – an important measure nonetheless.

The *Pacific Asthma Medication Plan*, or *PAMP*, appears to have been an effective reminder for families to use the 'everyday' inhalers on a regular basis. We observed a statistically significant change in inhaler use (p=0.014); the proportion of children using their inhalers 'most days' increased from 32% at baseline to 68% after they received the education and resources. However, the extent to which the *PAMP* contributed to these improvements, versus the effects from face-to-face education (and other factors) is unknown. This also applies to the absence of asthma-related hospital admissions observed in the children during the study, although fewer inpatient stays was the initial rationale for developing the *PAMP*. Of concern were the five families that reported reduced regular inhaler use; the reasons for this were not recorded and would require further qualitative investigation.

For the purposes of this study, we developed and evaluated a new asthma resource, which departs from the traditional step-wise, symptom or peak flow-based format. The intention was to use a 'less-is-more' approach, mindful that about 50% of New Zealand adults have low literacy levels,[11] and that patients generally prefer, simple, visual plans.[12]

We found there was demand for each of the first language versions; 67 plans in four languages (45 English and 22 in the first language) were given to 48 families. Just over a third shared their plans with the extended family; the availability of 'translated' versions may have facilitated this. Additionally, three families chose the first language version only, which we suggest is evidence that current asthma resources may not be meeting the needs of patients with adequate first language skills, but low English literacy. Finally, only 13% of study families reported having been given an asthma action plan previously, which is low relative to earlier reports.[6]

To our knowledge this is the first evaluation of a pictorial asthma plan designed especially for children - of any ethnicity. Roberts *et al*, a group of British researchers, have published a report detailing the development and comprehensibility of an electronic pictorial asthma action plan, but this was only evaluated in Somali and Malaysian adults.[9] This group used 'guessability testing' to show the pictograms were understood, and 'translucency testing' to reveal agreement with the intended meaning of the images. In our study, the pictorial elements were images rather than pictograms and we used a less sophisticated, but more pragmatic study methodology.

The www.pamp.co.nz website is not the first 'electronic' asthma plan to be devised. The pictorial plan developed by Roberts *et al* required manual download of the programme onto practice computers;[13] others have based their formats on Microsoft Access®.[14] In our case, we chose to construct a web-based tool (using Microsoft .NET® framework) so it could be easily accessed and shared with health professionals across New Zealand.

There are a number of limitations regarding this study; the questionnaire was subjective in nature, the results were self-reported and subject to social desirability bias, and the study was confined to a single general practice. The 6-week follow-up period between visits may be perceived as too short, but we believe this was sufficient time for families to familiarise themselves with the resources. The strength of this research comes from the inclusive study methodology, focus on a targeted population, and the high level of consultation and engagement with the participant community and health workers. Despite the resources being tested solely in Pacific children, we believe the results are generalisable to other ethnicities; especially children or caregivers who may benefit from their simple and pictorial nature.

In our study we have described a successful nurse-led initiative in a single primary care practice. Further research could focus on the use and utility of the resources within other primary care settings (and secondary care), or by other professional groups. Roberts *et al* conducted a follow-up study to examine the applicability of their pictorial asthma tool in British general practices; they encountered barriers arising from time pressures, staff apathy and change avoidance.[13] Even though the *PAMP* is simple and quick to personalise, print and laminate, similar issues could be expected here. Other priority research areas could focus on evaluating these resources specifically in tamariki Māori.

The study findings are significant in the context of Pacific Health because they describe and validate the useful textual and pictorial characteristics of asthma resources that may assist with providing asthma education to this population. This could be a step towards reducing the significant asthma-related health inequalities observed in Pacific children. However, asthmatic children from other ethnicities may also benefit from this educational approach. In fact, the *PAMP* website has already been re-branded as a paediatric *Pictorial Asthma Medication Plan* for use by all ethnicities, and is currently being promoted as such to New Zealand health professionals.

**Competing interests:** None known.

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# Unusually virulent coagulase-negative *Staphylococcus lugdunensis* is frequently associated with infective endocarditis: a Waikato series of patients

Michael Liang, Chris Mansell, Clyde Wade, Raewyn Fisher, Gerard Devlin

**Abstract**

**Background** *Staphylococcus lugdunensis*, a species of coagulase-negative staphylococci is associated with a wide variety of infections ranging from mild skin and soft tissue infections to serious infections which include brain abscess, chronic osteomyelitis and infective endocarditis. The aim of this study was to review cases of *S. lugdunensis* bacteraemia isolated from a New Zealand tertiary institution and describe the clinical presentation, diagnosis and treatment of the patients.

**Methods** All blood cultures reported positive for *S. lugdunensis* from the Microbiology Laboratory, Waikato Hospital, New Zealand between March 2006 to April 2011 were reviewed.

**Results** A total of 11 cases of *S. lugdunensis* bacteraemia were identified during the 5-year period. Three (27%) cases were due to infective endocarditis with one delayed diagnosis due to the failure of recognize the coagulase-negative *Staphylococcus*. Transthoracic or transoesophageal echocardiography was performed in 6 (55%) of the patients. One patient with endocarditis required early surgery and the other two were managed successfully with intravenous antibiotics. There was no in hospital mortality in the patients with endocarditis. The remaining 8 cases included 1 (9%) necrotizing fasciitis, 1 (9%) immunocompromised nosocomial multiple organism sepsis, 1 (9%) deep tissue infection requiring 6 weeks of intravenous antibiotics, 2 (18.5%) superficial skin infection, 1 (9%) nosocomial post-pacemaker insertion infection and 2 (18.5%) had fever of unknown origin. All isolates were sensitive to Flucloxacillin and Vancomycin. Overall the survival rate of the acute presentation and treatment was 91% (10/11).

**Conclusion** Three of our 11 patients (27%) with *S. lugdunensis* bacteraemia were diagnosed with infective endocarditis. Evaluation for endocarditis is therefore advised in patients who have positive blood culture for this organism.

*Staphylococcus lugdunensis*, a species of coagulase-negative staphylococcus (CoNS), was first described by Freney et al in 1988.[1] This organism is a rare contaminant in culture and commonly found on human skin. In addition this pathogen is associated with a wide variety of infections ranging from mild skin and soft tissue infections to serious infections such as brain abscess, septicaemia, chronic osteomyelitis and infective endocarditis.[2–4]

Case reviews have demonstrated that *S. lugdunensis* infective endocarditis is associated with a high mortality and early operation is often advised.[4–7] A positive blood culture for this pathogen is frequently an indication of invasive infection.

We report a case series of *S. lugdunensis* bacteraemia and clinical management and outcomes from our institution.

## Methods

All blood cultures reported positive for *S. lugdunensis* at Waikato Hospital between March 2006 to April 2011 were retrospectively reviewed. Patient's presenting complaints, diagnosis, duration of antibiotics therapy and longer term outcomes were assessed. Microbiological data were retrieved from the laboratory database and antimicrobial susceptibility was recorded. All cases of infective endocarditis fulfilled the modified Duke's Criteria.[8]

## Results

Eleven consecutive cases of *S. lugdunensis* bacteraemia were identified from our microbiology laboratory. The cases are summarised in Table 1. Overall, 3 (27%) patients had infective endocarditis, 1 (9%) patient had deep tissue infection, 1 (9%) had necrotizing fasciitis, 1 (9%) patient had multiple organism sepsis, 2 (18.5%) had skin infection, 1 (9%) had post-pacemaker insertion bacteraemia, and 2 (18.5%) had a diagnosis of fever of unknown origin.

Transthoracic or transoesophageal echocardiography was performed in 6 (55%) of the patients. All isolates were susceptible to Flucloxacillin and Vancomycin. The majority of patients were successfully managed with Flucloxacillin alone. Cephalosporin (intravenous Cefazolin and oral Cefaclor) were used successfully in one case where the patient had penicillin allergy.

All but one (91%) patient survived the acute presentation of bacteraemia. Mortality occurred in the patient who had nosocomial sepsis following pelvic radiotherapy, this patient progressed rapidly to multiorgan failure on the background of terminal metastatic prostate carcinoma. During the median follow-up period of 10 months, the cumulative mortality was 45%.

### Case synopses

**Endocarditis—**Three cases (Case 4, 9, 11) of infective endocarditis related to *S. lugdunensis* were identified in our series. One patient had native aortic valve involvement, one had mechanical mitral valve involvement and the third case had native mitral valve vegetation identified on a long standing prolapsing mitral valve leaflet.

An 80-year-old woman (Case 4) who presented with fever, general malaise and rigors, subsequently had native aortic valve infective endocarditis associated with severe aortic regurgitation diagnosed. She was successfully managed with high dose intravenous Flucloxacillin for a total duration of 6 weeks. The presence of severe aortic regurgitation led to deterioration in cardiac function (ejection fraction). Surgical intervention was not recommended due to general frailty and co-morbidities. She died 9 months post admission due to cardiac failure.

**Table 1. Summary of the patients with *Staphylococcus lugdunensis* bacteraemia including their clinical diagnosis, treatment and outcomes. TTE (transthoracic echocardiography), TOE (transoesophageal echocardiography), IV (intravenous)**

| Case No. | Date of Blood Culture | Patient Information. | Presenting Complaint | Diagnosis | TTE/TOE | Sensitivity/MIC | Treatment | Outcome | Survival, days from diagnosis to follow-up | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21 Jul 2006 | 52yr, Female | Fever, left elbow carpet burn | Necrotizing fasciitis of left forearm | Nil | Flucloxacillin, Vancomycin | Surgical debridement of left forearm. Ceftriaxone 2g OD, Metronidazole 400mg IV TDS for 2 weeks. | Successful surgical and medical treatment. | Alive, 1745 | |
| 2 | 17 Jun 2007 | 71yr, Male | Painful left ankle, fever, confusion. | Left foot/ankle tenosynovitis | Both | Flucloxacillin, Vancomycin | IV Flucloxacillin 2g IV Q6hr for 1 week and discharged with 6g IV Flucloxacillin continuous infusion over 24hrs. Total duration 4 weeks. | Successful Medical Treatment | Death, 460 | Death due to neutropenic sepsis with underlying multiple myeloma. Patient had negative transoesophageal echocardiography |
| 3 | 9 Dec 2007 | 46yr, Male | 24hrs fever, malaise and rigor | Sepsis ? source | Nil | Flucloxacillin, Vancomycin | IV Ceftriaxone 1g OD and Flucloxacillin 1g Q6hr for 2 days. Fever settled within 48hrs. Changed to oral Cefuroxime 500mg bd for 1 week. | Successful medical treatment | Alive, 1239 | Source of infection was unclear. |
| 4 | 28 Dec 2007 | 80yr, Female | Fever, rigors and general malaise | Native aortic valve endocarditis | Both | Flucloxacillin, Vancomycin. MIC Penicillin; 0.064ug/mL. | IV Flucloxacillin 2g IV Q6hr for 2 weeks and discharged with 6g IV Flucloxacillin continuous infusion over 24hrs. Total duration 6 weeks. | Successful immediate medical treatment. Severe AR with CHF. | Death, 287 | Cause of Death: Cardiac Failure. |
| 5 | 23 Jan 2008 | 84yr, Female | Rigors. Previous St Jude mitral valve replacement. Penicillin Allergy | Cellulitis of left leg | TTE | Cotrimoxazole, Flucloxacillin, Vancomycin | IV Cefazolin 1g TDS for 4 days then Cefaclor 250mg tds for 10 days. | Successful medical treatment | Alive, 1194 | Echocardiography did not reveal obvious abnormality. |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 23 Mar 2008 | 26yr, Female | Fever during acute myeloid leukaemia chemotherapy | Neutropenic sepsis with multiple organism infection | TTE | Cotrimoxazole, Flucloxacillin, Vancomycin, Erythromycin | Voriconazole, Meropenem, Teicoplanin, Amikacine for 2 weeks. | Successful inpatient treatment. | Death, 98 | Cause of Death: acute myeloid leukaemia. Nosocomial infection |
| 7 | 25 Mar 2008 | 70yr, Female | Post pacemaker insertion transient fever | Pacemaker wound infection | Nil | Cotrimoxazole, Flucloxacillin, Vancomycin | Amoxycillin-Clavulanate 625mg po tds 1 week. | Successful medical treatment | Alive, 1132 | Nosocomial infection |
| 8 | 19 Aug 2009 | 77yr Male | Post radiotherapy fever for prostate cancer | Fever of unknown origin | Nil | Cotrimoxazole, Flucloxacillin, Vancomycin | Amoxycillin-Clavulanate 625mg po tds | Failed medical treatment, patient progressed to multi-organ failure for comfort care. | Death, 2 | Nosocomial infection |
| 9 | 20 Dec 2009 | 70yr, Male | Fever, shortness of breath. Previous St Jude mitral valve replacement | St Jude mitral valve endocarditis | Both | Cotrimoxazole, Flucloxacillin, Vancomycin | Flucloxacillin 2g q6hrly IV for 6 weeks. Rifampicin 300mg tds po 6 weeks. Gentamycin 4mg/kg in 3 divided IV doses for 2 weeks. | Successful medical treatment | Death, 115 | Cause of Death: extensive subarachnoid haemorrhage |
| 10 | 22 Oct 2010 | 39yr, Male | High fever, malaise | Skin infection from minor scratch | Nil | Cotrimoxazole, Flucloxacillin, Vancomycin | Ceftriaxone IV 1g OD and Flucloxacillin IV 2g q6hrly for 3 days then oral Flucloxacillin 500mg po tds for 1 week. | Successful medical treatment | Alive, 161 | |
| 11 | 13 Mar 2011 | 56yr, Male | 4 weeks of fever, malaise, recent transient ischaemic attach. Mitral valve prolapse | Mitral valve endocarditis | Both | Flucloxacillin, Vancomycin | Flucloxacillin IV 2g q4hrly. Mitral valve surgery and St Jude mitral valve replacement on Day 3 post diagnosis due to ongoing fever and severe mitral regurgitation. 6 weeks of IV Flucloxacillin (6g over 24hrs) | Successful surgical treatment for severe mitral valve endocarditis | Alive, 49 | Post-surgery right middle and lower lobe pneumonia. |

A second case of endocarditis case was diagnosed in a 70-year-old man (Case 9) with a previous St Jude mitral valve replacement who presented with several days of fever. He was aggressively managed with intravenous Flucloxacillin (6 weeks), Gentamicin (2 weeks) and oral Rifampicin (6 weeks). He had good response to the medical treatment and transoesophageal echocardiography did not demonstrate significant valvular or para-valvular dysfunction. This patient died 4 months later due to an unrelated subarachnoid haemorrhage; computed tomography of the head did not show features to suggest mycotic aneurysm.

The final case of infective endocarditis was in a 56-year-old man (Case 11) with known mitral valve prolapse, associated with moderate mitral regurgitation under regular cardiology follow-up. He presented to the hospital 2 weeks prior with recent onset of fever and malaise which settled spontaneously. On that admission there was documented left hemiplegia, which resolved completely within several hours. A computed tomography scan of the brain did not reveal any acute lesions. A diagnosis of transient ischaemic attack (TIA) was made. On that particular admission, only a single blood culture was taken, and it grew a CoNS, which was not further identified at that time. Thus, based on the resolution of fever, it was believed that CoNS was a contaminant.

He subsequently returned to hospital with intermittent fever, rigors and abdominal pain; the working diagnosis communicated to the laboratory was suspected appendicitis or diverticulitis. This time, the first blood culture set grew two CoNS, one of which was identified as *S. lugdunensis*. A third set, taken 2 days later, grew only the *S. lugdunensis*. An urgent transthoracic echocardiography revealed a vegetation on the anterior mitral leaflet associated with severe mitral regurgitation which was confirmed on transoesophageal echocardiography. This patient underwent urgent mitral valve replacement surgery and a 6 week course of intravenous Flucloxacillin.

**Other infections—**A number of other infections including deep tissue infection, necrotising fasciitis, severe nosocomial systemic sepsis, superficial skin infection, post-pacemaker implantation bacteraemia, and fever of unknown origin have also been associated with *S. lugdunensis*.

The patient characteristics, diagnosis, antibiotics regime, duration, echocardiographic investigations and outcomes were summarized in Table 1. Flucloxacillin, Vancomycin, Amoxycillin-Clavulanate, second and third-generation of Cephalosporin monotherapy or combination had been used in treatment. Two of these eight patients died in the follow-up with associated comorbidities that resulted immunosuppression (Case 2 & 6, Table 1). One patient with end stage prostate cancer died in hospital due to nosocomial infection which progressed to multiorgan failure (Case 8, Table 1).

## Discussion

*S. lugdunensis* infection, unlike sepsis due to other species of CoNS, is frequently aggressive and life threatening in nature.[9] In our single centre report of 11 patients with *S. lugdunensis* bacteraemia presenting over a 5-years period, this organism was associated with serious clinical infection in almost half of the cases. This observation is similar to other published experience, where *S. lugdunensis* is reported as a virulent

pathogen, causing invasive infection similar to *Staphyloccocus aureus*, particularly in the setting of infective endocarditis.[4,10-12]

In our series, 3 (27%) cases of *S. lugdunensis* bacteraemia were due to infective endocarditis which merits further discussion. The incidence of endocarditis in patients with *S. lugdunensis* bacteraemia is not well established. It is reported as high as 46% by Zinkernagel et al.[11] Other studies report a much lower incidence of infective endocarditis with *S. lugdunensis* bacteremia from 0 -7%.[12–14] Of note, in the presence of multiple positive blood cultures, systemic inflammatory response syndrome, sepsis or septic shock, the incidence of endocarditis was considerably higher in most series; 1 (17%) of 6 by Ebright et al and 4 (27%) of 15 by Choi et al.[12,14] In our series, both native and prosthetic valves proved susceptible to infection which is in concordance with other series. In addition, pacemaker lead infection, as described in our series, can result in infective endocarditis, which was not clinically suspected in our patient, although no echocardiography was undertaken.

Our series revealed that only 6 (55%) patients had echocardiogram performed with 4 (66%) of this cohort also undergoing transoesophageal echocardiography. The 2009 European Society of Cardiology (ESC) guidelines on the prevention, diagnosis and treatment of infective endocarditis recommends echocardiography in cases where infective endocarditis were highly suspected and/or in patients with *S. aureus* bacteriaemia.[15] Recommendation of echocardiography in patients with *S. lugdunenesis* bacteraemia, however, is not clear. Due to its aggressive nature and high association with infective endocarditis and devastating effects once intracardiac infection is established, we support, as a minimum, routine transthoracic echocardiography in this group of patients.

*S. lugdunensis* endocarditis is associated with a high mortality rate with frequent surgical intervention considered necessary. Anguera et al, in a series of 912 consecutive endocarditis, reported the overall mortality of *S. lugdunensis*, *S. aureus* and *Staphylococcus epidermidis* as 50%, 14.5% and 20% respectively; surgery was performed in 70%, 36.9% and 60% respectively. Although *S. lugdunensis* accounts for 1.1% cases of endocarditis in this series, the high mortality rate highlights the aggressive nature of this particular CoNS in the setting of endocarditis.[4] Liu et al, in their recent review of 67 cases of *S. lugdunensis* infective endocarditis from 1988 to 2008, documented that 82.5% of cases were left-sided valvular endocarditis, 78.7% occurred in native valves, with surgery performed in 66.7% of cases and a mortality rate of 38.8%.[5]

Unlike most of the CoNS, *S. lugdunensis* appears susceptible to a wide range of antibiotics including Penicillin, Cefazolin, Linezolid, Moxifloxacin, Nafcillin, Quinupristin-Dalfopristin, Rifampicin, Tetracycline, Trimethoprim-Sulfamethoxazole, and Vancomycin, using standard *in vitro* methods.[16] However, Linezolid and Vancomycin were not bactericidal. In a biofilm model, the activity of most antibiotics was severely reduced and Nafcillin (a congener of the Flucloxacillin used in our case series) increased the production of biofilm.[16]

The 2009 European Society of Cardiology guidelines on the prevention, diagnosis and treatment of infective endocarditis has acknowledged the aggressive nature of *S. lugdunensis* and the recommended treatment is the same for *Staphylococcus* species which involves 4–6 weeks of Flucloxacillin (or Oxacillin) with 3–5 days of

Gentamicin for native valve infection. For patients with prosthetic valve infection or Methicillin-resistant strains, addition of Rifampicin or the use of Vancomycin may be considered.[15] All isolates in our series were susceptible to Flucloxacillin and Vancomycin. Oral treatment with Cephalosporin (Cefuroxime & Cefaclor) in simple soft-tissue infection appeared to be effective in our case series. The high rate of susceptibility to beta-lactams in our series is in concordance with available data.[4,10,11] Multiple antibiotics resistance is rare in the literature and was not observed in our study.

One of the described cases of infective endocarditis had CoNS identified on the admission blood culture which was initially considered to be a contaminant. As a consequence, no further identification was carried out. It is recommended that three sets of blood cultures are performed in cases of suspected endocarditis as continuous bacteraemia occurs. Contamination usually only affects one sample. This particular patient presented as fever and transient ischaemia attack which retrospectively may have represented an embolic event secondary to infective endocarditis. On the second presentation to the hospital 2 weeks later, three sets of blood cultures demonstrated *S. lugdunensis* and the initial culture was then re-studied and confirmed to be the same organism. Reliable methods for identification of of *S. lugdunensis* have been well described.[1,17,18] *S. lugdunensis* colonies usually appear similar to other CoNS after 24 hrs incubation: small, white and non haemolytic. After 48 hrs, a faint yellow colour is often visible and they may resemble *S. aureus*. A high degree of skill and awareness is required for prompt recognition. Many laboratories use slide and rapid latex agglutination tests to distinguish *S. aureus* from CoNS but these kits do not detect staphylococcal coagulase itself. *S. lugdunensis* can be falsely identified as *S. aureus* due to the presence of clumping factor. In an experienced hand, phenotypic characteristics such as colony pleomorphism and beta-haemolysis are useful in detecting *S. lugdunensis*, in contrast to clumping and synergistic haemolysis, which characterize several CoNS species.[19] Bocher et al in their study found that, *S. lugdunensis* has a prominent beta-haemolysis and characteristic *Eikenella*-like odour 2 days after incubation on Columbia agar with 5% sheep blood; by combining with these features and colony pleomorphism they were able to increase the yield of *S. lugdunensis* identification by 11-fold in all types of cultures.[20]

## Conclusion

*S. lugdunensis* bacteraemia is associated with infective endocarditis in one in three patients. Investigation for suspected endocarditis should include at least three sets of blood cultures, to distinguish contamination or transient bacteraemia from the continuous bacteraemia of endocarditis. Assessment for the presence of endocarditis with echocardiography should be considered strongly in all cases of S. lugdunensis bacteraemia.

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# Did an Acute Medical Assessment Unit improve the initial assessment and treatment of community-acquired pneumonia—a retrospective audit

David G Tripp

**Abstract**

**Aim** Medical Assessment and Planning Units (MAPUs) are proposed as a means to treat medically unwell patients in a timely and clinically appropriate manner, thus improving quality, facilitating safe early discharge, and reducing congestion in emergency departments. This study assessed the impact of opening a MAPU on the initial assessment and treatment of patients with community-acquired pneumonia (CAP).

**Method** A retrospective audit of patients presenting to Wellington Hospital was conducted from January to March 2009 and January to March 2010, straddling the opening of a MAPU. Outcome measures included timeliness of assessment, indicators of clinical quality, length of stay, recommended follow-up and mortality.

**Results** MAPU referred patients were less unwell and younger. Times to first doctor assessment and X-ray were longer than in the Emergency Department (ED) following the introduction of the MAPU; time to physician review for all admitted patients was unchanged compared to before the opening of the MAPU. Compliance with other aspects of evidence based guidelines was patchy and showed no improvement following the opening of the MAPU. Most patients whose length of stay was short were appropriately admitted to the MAPU.

**Conclusions** The MAPU has successfully streamed a cohort of less unwell patients away from the ED. Opportunity exists to improve the timeliness of treatment and compliance with guidelines. A disease-specific audit has served as a useful adjunct to other approaches to assessing a unit's impact.

MAPUs, also known as Acute Medical Assessment Units (AMAUs), are advocated as a means to achieving more timely and appropriate assessment and treatment of acutely unwell medical patients.[1] A large number of AMAUs have opened over the last 15 years. Limited controlled and observational studies suggest reductions in overall length of stay and mortality without increases in readmission rates.[2] Assessments of the impact of AMAUs on the quality and timeliness of the assessment and treatment of common medical conditions are scant.

Community-acquired pneumonia (CAP) is a common medical condition whose treatment is supported by evidenced based guidelines.[3] These include recommendations for a door-to-antibiotic treatment time for the majority of patients with confirmed CAP of less than 4 hours. Compliance with CAP guidelines is used as a means of assessing quality of clinical care.[4,5]

This study sought to retrospectively audit the impact of the opening of a MAPU on the treatment of CAP at Wellington Hospital, with respect to door-to-needle times and other clinical quality indicators suggested by evidence based guidelines.

The MAPU at Wellington Hospital was opened in November 2009, assessing and admitting direct referrals from GPs and patients presenting to and initially assessed by the emergency department (ED). The MAPU was modelled closely on the objectives and organisational structure of the IMSANZ Standards[6] with daily consultant rounds in a purpose designed 18 bed unit (also including a further 6 high dependency beds) close to the ED, with the objective of admitting all general medical patients with an expected length of stay less than 36 hours.

## Methods

A retrospective audit was undertaken of all patients discharged from any hospital service with a primary diagnosis of CAP from January – March 2009 and from January – March 2010. These two cohorts straddle the opening of the MAPU, are matched for season (summer), and exclude the impact of the H1N1 pandemic commencing in April 2009.

A nearby secondary hospital, Kenepuru Hospital, accepted GP referred admissions direct to its inpatient medical service until November 2009. These were discontinued with the opening of the MAPU at Wellington Hospital. Patients from 2009 admitted to Kenepuru have been included in the analysis as these patients would have, in 2010, been referred to either MAPU or the Emergency Department.

Patients were identified by electronically selecting all adult discharges with a principal diagnosis coded as pneumonia or one of its subsets (ICD 10 code J189). Cases seen and discharged from the Emergency Department were not captured.

A total of 217 patients were identified, of which 62 were excluded as outside study criteria as follows:

| | |
|---|---|
| Not pneumonia on presentation: patients presenting with an unclear diagnosis or admitted for another indication | 15 |
| Patients with possible respiratory tract infection, no X-ray change and complex comorbidity | 12 |
| Neutropenic sepsis: Oncology patients with known risk of neutropenia, presenting febrile and treated according to a neutropenic sepsis protocol | 3 |
| Inter-hospital transfers: admitted at another hospital and transferred, typically either for ICU care or decortication of empyema | 13 |
| Coding Error: Primary diagnosis of pneumonia not supported by consultant or radiologist | 8 |
| Elective day case bronchoscopy, for persisting consolidation, coded as pneumonia | 3 |
| Notes incomplete | 3 |
| Other reasons | 5 |
| **Total** | **62** |

"Other reasons" included patients incorrectly coded to general medicine and without pneumonia (e.g. oncology and trauma patients with other lung pathology) and patients recorded as admitted who were only seen as ED patients.

155 cases remained for formal review of hospital case records, collating information from paper notes and electronic records (Emergency Department, Laboratory, Radiology, and Patient Management systems). All ED and Medical histories were reviewed by the author. Pneumonia is a diagnosis often requiring clinical judgement. While formal definitions of pneumonia require focal radiological change, cases were included if the consultant on the post-take round agreed with the admitting diagnosis of probable pneumonia, even if the subsequent radiologist report did not (14% of cases).

Data collected on each patient included:

- basic demographic data
- presentation point and time, and referral source
- time of medical reviews and by doctors of which service. The ED patient tracking system automatically logs the time first seen by a doctor. The paper based system in MAPU relied upon doctors recording the time the patient was seen.
- vitals over the first 4 hours
- content of initial clinical assessment, consultant ward round diagnosis, and resuscitation discussions during the admission
- investigations, including blood tests, microbiology, x-rays
- time, location and class of initial antibiotics
- discharge time and destination

Statistical analysis was conducted using Epi Info software.

## Results

**Demographics—**73 cases were audited in 2009 and 82 in 2010. In 2010, the mean age of MAPU patients was lower and these patients had fewer comorbidities and lower severity illness compared to patients presenting to ED. There were no significant variations in ethnicity between arrival points. Demographic data and disease severity data are presented in Table 1.

### Table 1. Demographics of audited cases

| | 2009 ED & Kenepuru | 2010 | | All Cases | P value (ED '10 vs MAPU) |
|---|---|---|---|---|---|
| | | ED | MAPU | | |
| Number | 73 | 55 | 27 | 155 | |
| Mean age | 65 | 65 | 54 | 64 | 0.04 |
| % Male | 60% | 49% | 66% | 57% | 0.13 |
| | | | | | |
| Other chronic illness[1] | | | | | |
| –Multiple systems | 58% | 62% | 37% | 55% | 0.12 |
| –Single system | 24% | 17% | 26% | 22% | |
| –None | 18% | 22% | 37% | 23% | |
| | | | | | |
| % Arriving by ambulance | 58% | 74% | 33% | 60% | <0.01 |
| Average CURB65[2] | 1.6 | 1.7 | 0.9 | 1.5 | <0.01 |

[1]Comorbidities requiring on-going treatment, but excluding primary prevention (typically hypertension).

[2]CURB65 is a prospectively validated severity score giving 1 point for each of age > 65, respiratory rate >= 30, Urea > 7.0, hypotension (SBP < 90 or DBP <= 60), and confusion. CURB65 scores were only recorded on 15% of admissions. A retrospective CURB65 score was therefore calculated for all patients. Where Urea was not ordered, a point was given if the patient had an acute rise in creatinine or was clinically assessed as dehydrated, although this is an imperfect substitute. The presence or absence of confusion was often undocumented. This calculated score is therefore likely to understate average CURB65 scores.

**Time to assessment and treatment—**Patients' progress through the process of assessment is shown in Table 2. Times are stated in minutes, and are median times given the long tails occurring in both ED and MAPU patients. P values compare 2010

patients in ED compared to MAPU. 33% of MAPU admissions did not record the time of first assessment by the doctor. This potentially biases the average MAPU time to first medical review.

**Table 2. Minutes to assessment and treatment**

| Variables | ED '09 | Kenepuru '09 | ED '10 | MAPU '10 | P value (ED '10 vs MAPU) |
|---|---|---|---|---|---|
| Arrival to first doctor | 39 | 57 | 42 | 86 | 0.00 |
| Arrival to X-ray ordered | 61 | 63 | 65 | 84 | 0.54 |
| From X-ray ordered to X-ray taken | 33 | 52 | 28 | 83 | <0.01 |
| Arrival to ABs | 179 | 233 | 155 | 215 | 0.36 |
| % with ABs within 4 hours | 70% | 58% | 67% | 56% | 0.36 |

**Content of clinical assessment—**The checklist in Table 3 was used to evaluate the admitting medical team's assessment, largely drawing from British Thoracic Society (BTS) Guidelines[3]. The rationale for a MAPU is not only more timely assessment by appropriate specialists, but more relevant and comprehensive assessment. Differences between 2009 and 2010 were therefore of interest.

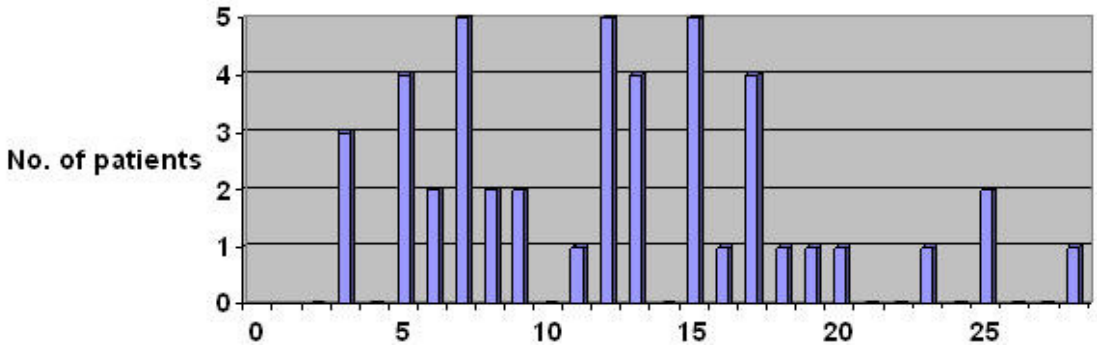
**Table 3. Content of clinical assessment for all patients 2009 vs 2010**

| Variables | Comment | 2009 | 2010 | P value |
|---|---|---|---|---|
| Smoking history | Did the team record smoking history, given it is an independent and modifiable risk factor for CAP[7] | 74% | 72% | 0.33 |
| Confusion comment | Was any comment made on confusion in those age >65 | 43% | 24% | 0.05 |
| Severity comment | Was any comment made on the severity of the illness (including, but not limited to CURB65 score[8]) | 32% | 17% | 0.03 |
| More than one set of observations | Was more than one set of observations taken in the first 4 hours to detect physiological trends | 75% | 81% | 0.33 |
| Urine output considered in hypotensive patients | If SBP <90 or DBP ≤ 60 at any stage in the first 4 hours, was any assessment made of urine output | 11% | 4% | 0.03 |
| Antibiotic<br>–Beta-lactam<br>–Macrolide | – | <br>100%<br>92% | <br>96%<br>75% | <br>0.17<br>0.30 |
| –Appropriate route | Percentage where oral antibiotics were prescribed for CURB65 0 or 1 with no prior oral ABs | 13% | 4% | 0.21 |
| VTE prophylaxis | Was enoxaparin considered at or during admission | 25% | 20% | 0.53 |
| Resuscitation status discussed | If the patient was ≥ 65 and unwell (required non-invasive or invasive ventilation, or had a CURB65 score ≥ 2), was any discussion had with the patient about their wishes in the event of life-threatening deterioration. | 53% | 32% | 0.09 |
| Follow up | Appropriate chest follow-up recommended at discharge where the patient was >50 or a smoker | 45% | 37% | 0.21 |

**First inpatient review—**Median time to next review was longer in MAPU compared to ED (16.3 vs 12.5 hours, p = 0.14), although the time of next medical review was

only recorded in 45 of 82 cases in 2010. The spread of these times is illustrated in Figure 1.

**Figure 1. Hours till next medical review 2010**




For all patients, the next medical review was the post-take ward round the following morning (80%), at the request of nursing staff (16%) or earlier as requested by the admitting registrar (4%).

**Length of stay—**Average length of stay (LOS) from presentation (at either ED or MAPU) to discharge between the 2009 and 2010 cohorts showed a non-significant decrease (5.0 vs 4.4 days, p = 0.28). A statistically significant reduction is apparent across all general medical patients in the year following the opening of the MAPU, so failure to reach statistical significance in this audit is possibly due to small numbers. Length of stay comparisons between patients admitted via ED and via MAPU are not relevant, given the different average age and severity of these cohorts.

## Discussion

This audit aimed to assess the quality of management of CAP in the context of complex and on-going organisational change. In addition to the opening of the MAPU other potentially confounding changes occurred over this time. First, roster changes in June 2009 increased the number of admitting medical registrars in the evening from one to two.

Second, a “6 hour rule” was introduced nationally for emergency departments in July 2009. The aim was for 95% of patients to be discharged or transferred from the emergency department within 6 hours. Staffing and process changes supporting this initiative may have contributed to differences between the 2009 and 2010 cohorts. Despite these potentially confounding factors, a number of useful observations can be made from the data.

The MAPU is attracting a younger, less unwell cohort that would otherwise have been referred by GPs for assessment by the medical team in the emergency department. The average age of the MAPU patient was younger (54 vs 65), they had fewer comorbidities (37% with multiple system comorbidity vs 62% in ED) and had a lower CURB65 score (0.9 vs 1.7). This largely reflects GP filtering of MAPU patients, and

the higher acuity of self-presentations to ED. There remains a significant pool of patients presenting to, and being assessed in, ED who would be appropriate for MAPU assessment: 25 of 55 patients presenting to the ED had CURB65 scores of 0 or 1.

In general, treatment was less timely in MAPU compared to ED. Time to first doctor and times for X-ray were significantly longer, time to first antibiotic was longer but did not reach statistical significance.

Five factors likely to be causing relative delays in MAPU are:

- The presence of sicker patients amongst those presenting to ED.
- Significant attention given to prompt treatment in ED, with electronic systems to record and feedback on progress against clear time targets and formal systems for identifying and prioritising sicker patients. MAPU does not have similar systems or time targets.
- The priority accorded to ED admissions over MAPU admissions by admitting medical registrars, given the pressure of "the 6 hour rule".
- Nursing staff in MAPU managing patients awaiting assessment as well as the on-going needs of existing inpatients, creating complex prioritisation decisions which may delay management of newly arrived patients.
- Logistical issues—particularly accessibility to X-ray.

Options to improve the timeliness of MAPU treatment could include:

- Introduction of a tracking system to electronically record and report on arrival and treatment times, similar to those common in Emergency Departments.
- Inclusion of MAPU patients within the national "6 hour rule" target. The distinction between ED and MAPU in terms of priority is both arbitrary and artificial. The pressure to see ED patients first is administrative, not necessarily based on acuity. Having a shared target across both "front doors" to the hospital is clinically appropriate, consistent with the intention of the 6 hour rule, and resolves this distortion to clinical practice.
- Introduction of a nurse-lead sepsis protocol is being discussed to improve the timeliness of triage and investigations, and focus nursing attention on the prompt administration of antibiotics.
- Attention to logistical issues. For example, access to x-ray in ED is prompt due to the presence of a dedicated orderly to transport the patient. MAPU orderlies are drawn from the general hospital pool of orderlies, introducing delay. In a number of cases, the patient could walk themselves if they were x-rayed before being placed in a gown and on a bed.

The timeliness, and appropriate choice and route of antibiotic therapy is of particular interest, given evidence of morbidity from delay in antibiotics,[9] and the impact of route of antibiotic on length of stay.[10] Pressure for early antibiotic administration is tempered by concerns that this may lead to an increase in inappropriate antibiotic use.[11] MAPU showed non-significantly longer times to antibiotics, and both ED and MAPU had very low rates of oral antibiotics in mild pneumonia.

In general, given MAPU patients are less unwell, there may well not be any impact on clinical outcomes as a result of these longer treatment times. However, there are likely to be resource implications and greater clinical risk as a result of the consequently increased congestion.

MAPU guidelines emphasise the value of early specialist review in improving the management of acutely unwell medical patients, although IMSANZ Standards permit once daily consultant rounds with ad-hoc earlier review if clinically appropriate.[6] In this case, hours till next medical review generally reflects the time during the day the patient was admitted.

The longer average time to next medical review in MAPU over ED is largely accounted for by the MAPU not admitting patients overnight, so the average MAPU patient waits longer before the morning ward round. The MAPU is not achieving a common objective in the literature of earlier consultant review.[6] For the subset of lower acuity patients identified in this audit, there are potential gains in terms of earlier discharge from changes to support earlier review.

In terms of the content of the admission, rather than the process, poor compliance with guidelines is consistent with other studies.[12,13] The reason for the decline in the rate of comment on severity, confusion or resuscitation status is unclear. Potential reasons include:

- A different cohort of registrars doing the admissions, and
- The relocation of admissions away from Kenepuru Hospital – which has a largely geriatric focus to its medical inpatients. Assessment of confusion and resuscitation status on admission may be more common in this setting.

Overall, the introduction of a MAPU did not improve the quality of admissions over ED. While this may be expected given the same registrars are admitting in both locations, the MAPU did aim to improve the quality of clinical practice.

## Conclusion

Initial assessment is slower in MAPU than in ED, and time to physician review has not improved as a result of the new MAPU. Most admission assessments omit features recommended by evidence based guidelines – with no difference between ED and MAPU assessments and no improvement over the pre-MAPU cohort. MAPU is successfully capturing lower acuity patients, but remains an underutilised resource in streaming acute medical patients away from ED.

A disease-specific audit has served as a useful adjunct to other approaches to assessing a unit's impact.

**Competing interests:** None declared.

**Ethics approval**: The Multi-region Ethics Committee confirmed ethical approval was not required for this observational study.

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# Old Man's Friend? Resuscitation decisions in patients hospitalised with pneumonia

David G Tripp

**Abstract**

**Background** Community-acquired pneumonia (CAP) is a common illness, for which hospitalisation leads to significant inpatient and subsequent mortality. The frequency and timing of discussion of end-of-life issues with these inpatients is therefore relevant.

**Aim** To determine whether end-of-life discussions occurred for patients with CAP whose prognostic indicators suggested a high risk of dying.

**Methods** A retrospective review of 155 admissions with CAP was conducted. The nature and timing of resuscitation decisions were correlated with age, illness severity and mortality.

**Results** Mortality following admission with CAP increases with age and severity. Of those over 65, 37% die within 12 months of discharge; 11% die on the index admission, and a further 26% die in the 12 months following discharge. Mortality increases dramatically with older age: those over 80 had a 47% 12-month mortality. End-of-life decisions were documented prior to death for all inpatient deaths. However, end-of-life decisions were only documented in a minority of other cases, even amongst those with highest risk of subsequent mortality.

**Conclusions** In a common illness with significant mortality, opportunity exists to better identify those at high risk of mortality and initiate discussions about end-of-life care. A not-for-resuscitation discussion currently appears to function as a surrogate marker for impending death rather than an opportunity to elicit a patient's wishes for their care should they be at high risk of dying in the near future.

Community-acquired pneumonia (CAP) is a common illness leading to hospital admission, with over 8000 admissions per year in New Zealand (265 per 100,000).[1] Particularly in the elderly CAP is also associated with significant inpatient and subsequent mortality.[2–4]

Given this risk of death, it is relevant to consider the timing and nature of discussions occurring with patients about their wishes in the event of a life-threatening illness. Such discussion could allow those caring for the patient to better understand their wishes regarding end-of-life care. These discussions have been shown to improve patient satisfaction, the quality of dying, and reduce psychological morbidity in family members.[5]

The growth in the use of Do Not Resuscitate (DNR) orders (also described as Do Not Attempt Resuscitation (DNAR)—the term is used in this study[6]) amongst the elderly without malignancy over recent decades is a worldwide trend, although it is unclear to

what extent this is driven by more explicit medical decision making, or by more actively soliciting patients' wishes.[6]

There are variations between countries in terms of preferences for or against CPR, and whether patients wish to be involved in decisions regarding resuscitation orders.[7,8] These issues are set within a broader context of significant variation between countries in the quality of and access to end-of-life care.[9]

The aim of this study is to determine whether end-of-life discussions occurred in patients with CAP where the risk of death was high on the basis of simple prognostic factors.

## Method

A retrospective audit was conducted of patients discharged from Wellington and Kenepuru Hospitals with a primary diagnosis of CAP. This audit was originally undertaken to assess the impact on the clinical assessment and treatment of patients of the opening of its Medical Assessment Unit in November 2009.[10]

Data was collected on 155 patients presenting January to March 2009 and January to March 2010. Electronic and paper records were reviewed. Data collected included the date of death if a patient died in New Zealand within 12 months of discharge.

This data also included if discussions were had with patients about their wishes in the event of a life threatening deterioration, and if so whether the patient's status was recorded as "For resuscitation" (CPR) or "Do not attempt resuscitation" (DNAR).

The presence of a resuscitation status was correlated with a variety of variables, including age, illness severity and inpatient and 12-month mortality.

Severity of CAP was assessed using the CURB65 score.[11] This is a prospectively validated assessment score of the risk of 30 day mortality. A score of 0 is mild and 5 is severe, with points given for respiratory rate >30, urea >7.4, the presence of confusion, hypotension and age ≥ 65. CURB65 scores were only recorded on 15% of admissions.

A retrospective CURB Age score was therefore calculated for all patients. Where urea was not ordered, a point was given if the patient had an acute rise in creatinine or was clinically assessed as dehydrated, although it is acknowledged this is an imperfect substitute. Confusion was often not documented. This calculated score may therefore understate average CURB scores.

Results are reported below as aggregated data, with "well" being a score of 0 or 1 (corresponding to mild CAP), and "unwell" being a score of 2 or more (corresponding to moderate or severe CAP). One point of the CURB65 score is allocated for age ≥ 65, which therefore confounds comparisons between age and severity.

## Results

Figure 1 shows the inpatient and 12-month mortality by age band and severity at presentation.

Inpatient mortality from pneumonia in those under 65 is rare. All of the 4 patients under 65 who died either during admission or in the subsequent 12 months had significant pre-existing comorbidities: 3 had liver disease and one had end-stage renal failure on dialysis with a prior disabling stroke.

In the 65–79 year old group, the CURB65 score predicted the risk of inpatient but not 12-month mortality. The CURB65 score was modelled to predict 30 day mortality and does not reflect the burden of chronic, comorbid disease. It is therefore not unexpected that its efficacy declines over time.

Total 12-month mortality rose steeply with age and comorbidity. Of the 33 patients dying over 65, many had significant comorbidities: 12 (36%) had extreme frailty or multiple comorbidities, 8 (24%) had cancer, 2 (6%) had underlying lung disease, and 1 (3%) had liver disease.

The presence of a resuscitation order for inpatient death had a sensitivity of 100%, specificity of 68% and positive predictive value of 18%. Presence of a resuscitation order for subsequent death in those surviving at discharge had a sensitivity of 46%, specificity of 74% and positive predictive value of 29%.

**Figure 1. 12-month mortality by age and severity**

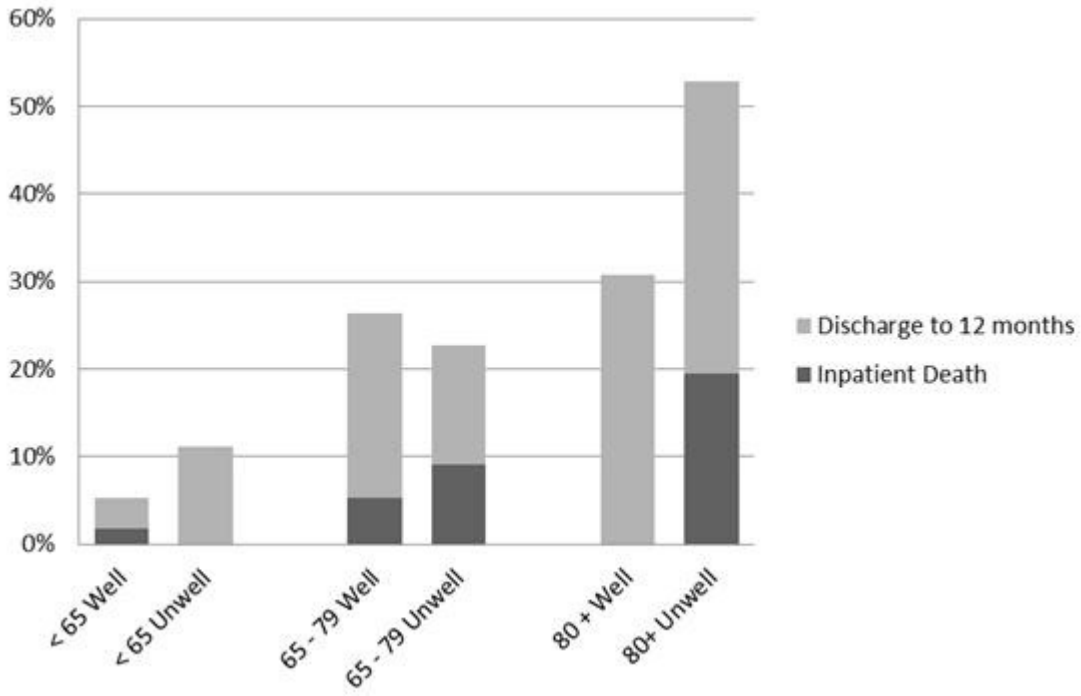


Table 1 details patient mortality and frequency of documentation on resuscitation status in the event of arrest (either for CPR, or DNAR).

The frequency of a documented resuscitation decision rose steeply with age, peaking at 51% in patients over 80. This group had at 46% 12-month mortality.

Table 2 details the timing of resuscitation discussions of those who died between admission and 12 months from discharge.

**Table 1. Mortality and documented resuscitation status by age**

| Patient Group | Total | Documented resuscitation decision | Inpatient death | Died after discharge to 12 months | Total 12-month mortality |
|---|---|---|---|---|---|
| **Age <65** | | | | 2 (4%) | 3 (5%) |
| Well | 56 | 14 (25%) | 1 (2%) | 1 (11%) | 1 (11%) |
| Unwell | 9 | 3 (33%) | 0 (0%) | 3 (5%) | 4 (6%) |
| Total | 65 | 17 (26%) | 1 (1%) | | |
| **Age 65–79** | | | | | |
| Well | 19 | 5 (26%) | 1 (5%) | 4 (21%) | 5 (26%) |
| Unwell | 22 | 6 (27%) | 2 (9%) | 3 (13%) | 5 (22%) |
| Total | 41 | 11 (27%) | 3 (7%) | 7 (17%) | 10 (24%) |
| **Age 80 +** | | | | | 4 (30%) |
| Well | 13 | 7 (53%) | 0 (0%) | 4 (30%) | 19 (53%) |
| Unwell | 36 | 18 (50%) | 7 (19%) | 12 (33%) | 23 (46%) |
| Total | 49 | 25 (51%) | 7 (14%) | 16 (32%) | |
| **All cases** | **155** | **53 (34%)** | **11 (7%)** | **26 (17%)** | **37 (24%)** |

**Table 2. Timing of resuscitation decisions in those who died**

| Patient group | Number | Status documented at admission | Status documented later on ward | Status recorded by discharge or inpatient death |
|---|---|---|---|---|
| Died during admission | 11 | 6 (55%) | 5 (45%) | 11 (100%) |
| Died after admission and within 12 months | 26 | 6 (23%) | 6 (23%) | 12 (46%) |
| Total | 37 | 12 (32%) | 11 (30%) | 23 (62%) |

## Discussion

CAP treated as an inpatient is an illness with significant associated mortality in those over 65. Mortality is greatest following discharge. CAP, especially in those over 80 and regardless of its severity, serves as a marker of significant post-discharge mortality. This is consistent with former studies, the largest of which found a 40.9% 1 year mortality in 158,960 patients over 65 hospitalised with CAP.[4]

Discussions about resuscitation status in the event of in-hospital death are a small part of the potential breadth of advance care planning discussions, but are used here as a marker that the clinician considered end-of-life discussions to be appropriate.

Many guidelines recommend advance care planning for those with a life expectancy of less than 1 year,[12, 13] although many physicians report they would not discuss end-of-life options with terminally ill patients who are feeling well.[14] While end-of-life discussions have been commonly recommended in those with malignant disease, their proactive use is increasingly recommended in patients with non-malignant chronic illness or frailty.[15] New Zealand rates well compared to other countries with respect to awareness of end-of-life options.[9]

For all the above patients, approximately one third had discussions or decisions made about resuscitation status at some point during their admission. This is comparable with other studies in CAP.[16]

All those who died as inpatients had resuscitation orders in place – reflecting the generally predictable decline in those who die due to CAP as inpatients. This is consistent with other NZ studies showing end-of-life discussions in the significant majority of people who die in hospital during their terminal admission.[2]

Rates of end-of-life discussion were higher for those at particular risk of death – both the elderly and those with severe CAP. However, even in groups with high post-discharge mortality, end-of-life discussions were only documented in a minority of cases. For example, those who were over 65 and unwell had documented resuscitation statuses in 42% of cases, despite a 12-month mortality in this group of 44%.

This data therefore suggests that the use of a DNAR order in this institution acts more as a surrogate marker for impending death, than as a process of soliciting the views about end-of-life care of those at risk of dying.[17, 18]

There are a number of potential barriers which limit the frequency of these discussions,[19] including the difficulty of choosing the "right" time,[17] over estimating the benefits or CPR,[7, 20] not considering the prognosis of the illness,[18] and the frequent delegation to junior staff.[21] The role of the doctor's faith and ethnicity is also relevant.[22]

Appropriately timed end-of-life discussions require robust prognostic information. Some have argued that attention to prognosis has declined as our ability to diagnose and treat disease has increased.[23] Further, our estimates of prognosis are not always accurate nor communicated to patients.[15]

Evidence is strongly in favour of patients themselves wishing to discuss prognosis,[24] although this is not a universal finding.[25] However, typical illness trajectories can inform decisions about when to discuss end-of-life care and therefore permit a more gradual and considered transition to a palliative approach.[26] This study further demonstrates that simple prognostic markers in a common illness can indicate high mortality, and hence the appropriateness of advanced care planning.

This is a complex situation, given the sensitivity of the issues, the prognostic uncertainty, and the involvement of staff with different levels of clinical and communication skill working under often considerable time pressure.

However, when faced with a possible life-threatening decline, it remains a worthwhile goal that patients and their families would be included in sensitively conducted and well informed discussions in which the patient's wishes were articulated and subsequently respected. Frameworks for such interventions have been developed,[19, 27] and evidence supporting their benefit to patients and their families reported.[5]

This study is limited by its retrospective and single centre nature, and also by documentation that does not always reflect the content of discussions with patients and families.

## Conclusions

CAP carries with it associated significant mortality. Age >80 and illness severity identify patients at over 50% risk of 12-month mortality. Discussions about end-of-life care are in the minority, even in these groups at high risk of death. Currently, resuscitation status appears to serve more as a surrogate marker for a dying patient, rather than a means of ascertaining at-risk patients' wishes in the event of terminal illness. This represents a missed opportunity to ascertain and value patient's preferences for end-of-life care.

Further research is warranted into the barriers to discussions about end-of-life care, and initiatives to better facilitate and frame these discussions.

**Competing interests:** None declared.

**Ethics approval**: The Multi-region Ethics Committee confirmed ethical approval was not required for the observational study from which this data was subsequently drawn as a sub-group analysis.

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# Implementing and sustaining a hand hygiene culture change programme at Auckland District Health Board

Sally A Roberts, Christine Sieczkowski, Taima Campbell, Greg Balla, Andrew Keenan; on behalf of the Auckland District Health Board Hand Hygiene Steering and Working Groups

**Abstract**

**Aim** In January 2009 Auckland District Health Board commenced implementation of the Hand Hygiene New Zealand (HHNZ) programme to bring about a culture change and to improve hand hygiene compliance by healthcare workers. We describe the implementation process and assess the effectiveness of this programme 36 months after implementation.

**Method** In keeping with the HHNZ guideline the implementation was divided into five steps: roll-out and facility preparation, baseline evaluation, implementation, follow-up evaluation and sustainability. The process measure was improvement in hand hygiene compliance and the outcome measure was *Staphylococcus aureus* clinical infection and bacteraemia rates.

**Results** The mean (95% CI; range) baseline compliance rates for the national reporting wards was 35% (95% CI 24–46%, 25–61%). The overall compliance by the 7th audit period was 60% (95% CI 46–74; range 47–91). All healthcare worker groups had improvement in compliance. The reduction in healthcare-associated *S. aureus* bacteraemia rates following the implementation was statistically significant (p=0.027).

**Conclusion** Compliance with hand hygiene improved following implementation of a culture change programme. Sustaining this improvement requires commitment and strong leadership at a senior level both nationally and within each District Health Board.

Hand hygiene is one of the most effective means of reducing healthcare-associated infections, yet it is done poorly by healthcare workers for many reasons.[1] In a recent systematic review of studies looking at hand hygiene compliance in hospitals, the overall median compliance with hand hygiene was only 40%.[2] Multimodal programmes to achieve improvement in hand hygiene compliance by healthcare workers can achieve significant sustained improvements in hand hygiene compliance and reductions in infections due to methicillin-resistant *Staphylococcus aureus* (MRSA) and other nosocomial pathogens.[3-5]

*S. aureus* causes a significant number of healthcare-associated infections; at Auckland District Health Board (ADHB) it is the leading cause of surgical site infections, and is the second leading cause of healthcare-associated bloodstream infections (unpublished data).Whilst MRSA bacteraemia remains an uncommon event in New Zealand hospitals the rates of patients colonized or infected with MRSA and extended-spectrum beta lactamase-producing Enterobacteriaceae continue to increase

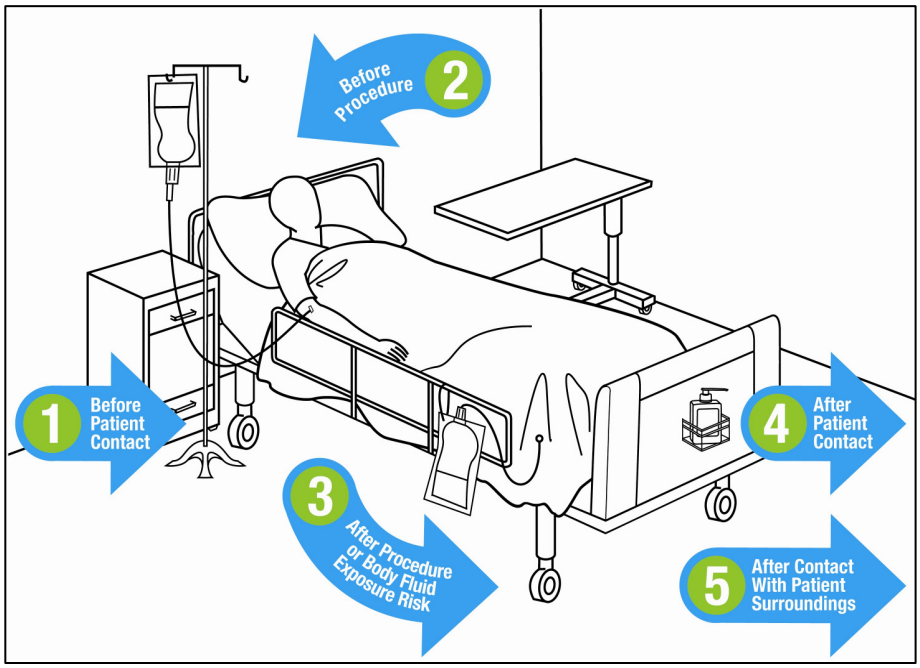
in New Zealand[6,7] and concerted efforts to prevent healthcare-associated infections with these organisms is even more pressing.

In 2007 the Quality Improvement Committee of the Ministry of Health initiated a number of quality improvement projects. ADHB was the lead DHB for the Infection Prevention and Control projects. In conjunction with Waikato and Tairawhiti DHBs, ADHB participated in stage 1 of the national rollout of the Hand Hygiene New Zealand (HHNZ) programme[8], a culture change programme aimed at improving hand hygiene compliance in all clinical areas. The programme was based on the World Health Organisation (WHO) '5 moments for hand hygiene' initiative, figure 1, and was aligned with Hand Hygiene Australia (HHA).

The key components to the programme were as follows:

- Culture change—adopt and promote behaviour which supports hand hygiene practices.
    - The use of alcohol-based hand rubs (ABHR) with placement of the product at the point of care – bedside or clinic room
    - Educating healthcare workers about the '5 moments for hand hygiene'
- Measuring outputs (hand hygiene compliance) and outcomes (*Staphylococcus aureus* bacteraemia and clinical infections) with prompt feedback of results.

**Figure 1. WHO 5 moments for hand hygiene**




In January 2009 ADHB commenced implementation of the HHNZ programme. We describe the implementation process and assess the effectiveness of this programme 36 months after implementation.

## Method

Auckland District Health Board (ADHB) provides care for an estimated 460,000 people. The clinical services consist of Auckland City Hospital, Starship Children's Hospital and Green Lane Clinical Centre comprising of 1100 in-patient beds. In keeping with the HHNZ guideline[8] the implementation was divided into five steps: roll-out and facility preparation, baseline evaluation, implementation, follow-up evaluation and sustainability.

**Roll-out and facility preparation—**A fulltime project manager was employed to implement the HHNZ project. A steering group was formed to oversee the implementation; the membership of the group included members of the senior management team (Director's of Performance and Innovation, Nursing, Allied Health, Clinical Training, General Manager of Operations, Quality Manager, Nurse Leader of Women's and Child Health, Materials Manager), a Clinical Microbiologist and the project manager. The responsibilities of this group were to be the sponsors of the project, ensure that the project was delivered and that it aligned with the strategic goals of the ADHB.

A working group was tasked with the implementation of the project and this group worked with the project manager to provide among other things operational advice and assistance. The membership of this group included senior nurses with expertise in infection control, education and occupational health, the Daily Operations Manager, Procurement Specialists and a Clinical Microbiologist.

The specifications for the ABHR required a product that contained a minimum of 70% alcohol and 0.5% chlorhexidine. The choice of alcohol-based hand rub was made after a period of evaluation in selected clinical areas. Sterigel + (Solumed, Les Entreprises Solumed Inc, Laval (Québec) Canada) met the requirements of the programme and 500ml dispensing bottles were placed at the end of the beds in brackets and 780 ml wall dispensers were also placed outside patient rooms and in other relevant clinical areas.

The Occupational Health and Safety Department undertook to monitor adverse events associated with the product.

**Baseline evaluation—**For reporting purposes, and in keeping with HHA recommendations, HHNZ required a hospital with > 400 beds to report the results of hand hygiene audits in 7 wards/clinical areas and undertake 350 observations in each of these areas during each audit period. These wards/clinical areas were termed the national reporting wards. The 7 national reporting wards were chosen for a number of reasons; the wards/clinical areas had high risk patients for whom healthcare-associated infections had serious consequences, outbreaks or higher rates of multiple antibiotic resistant organisms had been reported in these areas and the senior staff showed a willingness to be involved in the programme.

Baseline evaluation of hand hygiene compliance was undertaken in a staged manner starting with the 7 wards/clinical areas designated as the national reporting wards. All other clinical areas were audited over the next 12 months. Clinical areas were grouped together in medical or surgical services to reduce the volume of auditing required and were audited in a stage manner, groups 2-8. For example, group 2 included the general medical, medical specialty and older person health wards and group 3 included the general and specialty surgical wards. 200 observations were made in each ward/clinical area within each group and then the mean hand hygiene compliance was calculated for each group.

The auditing was undertaken by auditors. The auditors were members of the Infection Prevention and Control Service (IP&CS) at ADHB and had successfully undertaken training in hand hygiene compliance assessment, the use of the data collection tool and data analysis provided at training workshops conducted by HHNZ. Prior to each audit period the auditors were required to demonstrate acceptable inter-observer variability. No less than 85% inter-observer variability agreement in all observations is required before formal data collection can commence.

HHNZ developed an electronic data collection tool using a PDA. Hand hygiene compliance for each of the 5 moments is recorded. At each session, information about the session, type of healthcare worker, hand hygiene product used, glove use and inter-patient healthcare worker activities were recorded.

Compliance was measured against each of the five moments; moment 1, before patient contact, moment 2, before a procedure, moment 3, after a procedure or body fluid exposure, moment 4, after patient contact and moment 5, after contact with the patient environment.

**Implementation—**Baseline evaluation of hand hygiene compliance was carried out and the results were feedback to the ward/clinical area. Healthcare workers in each ward/clinical area were then educated about hand hygiene and the WHO '5 moments for hand hygiene'.

Oral presentations at ward-based education sessions, at medical grand rounds and other clinical forums were undertaken and an online learning package was developed. Promotional activities have included the development of themed posters, participation in World Hand Hygiene Day (5th May), ward compliance competitions and display boards, give-aways, IPC newsletters. The implementation of the programme across all clinical areas took 18 months.

**Follow-up evaluation and sustainability—**Following baseline auditing and education in the ward/clinical area a programme of regular auditing of hand hygiene compliance across all clinical areas was undertaken. The number of observations recorded per audit period for national reporting wards was 350 and for all other clinical areas it was 200.

During auditing the auditors record compliance data directly into the PDA and upon return to their work space the data is automatically downloaded to the national HHNZ database. The data can then be analysed and reported in a variety of ways. The overall compliance rate for each clinical area was determined along with compliance rate per moment and per healthcare worker group.

Since *S. aureus* is the most common healthcare acquired pathogen in New Zealand hospitals, the number of patients with clinical infections and with healthcare-associated *S. aureus* bloodstream infections were calculated as a rate per inpatient days and compared over time.

Baseline rates for the preceding 36 months were available for healthcare-associated episodes of blood stream infection and for the preceding 12 months for clinical infections. The quarterly rate was reported as this information was already been collected for reporting purposes. The rates were compared pre and post implementation using segmented piecewise regression analysis.

The project manager was fulltime during the first 18 months of the project and subsequently the role has reduced to 0.5FTE and integrated into the IP&CS. The role of the hand hygiene coordinator was to promote and sustain improvement in hand hygiene compliance across ADHB.

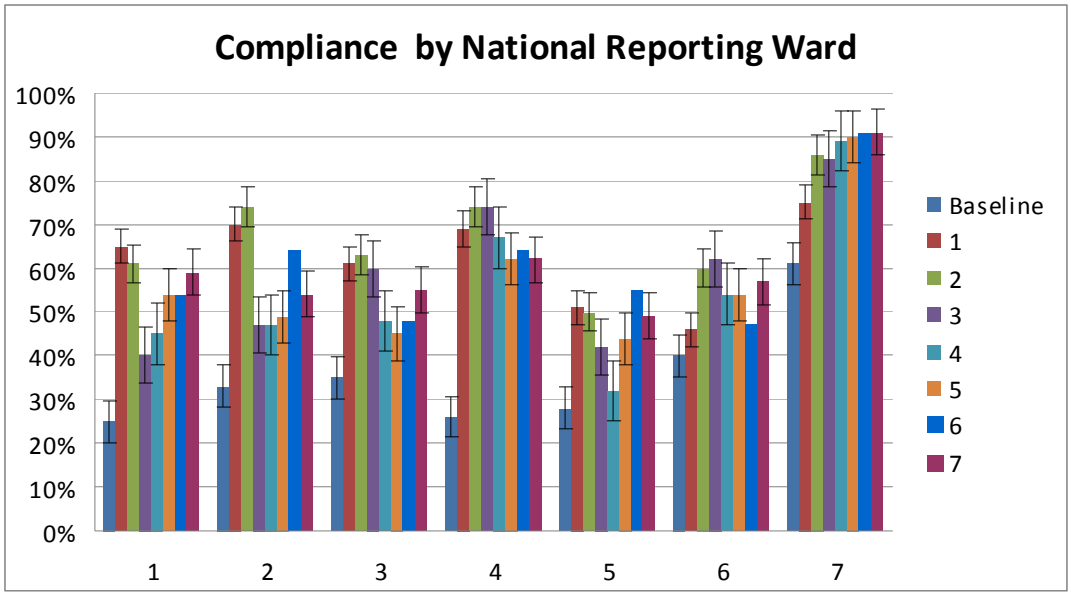
## Results

The project was started in January 2009 and auditing of baseline hand hygiene compliance rates for the national reporting wards was completed in March 2009. This was followed by a staged rollout across all other clinical areas which was completed by August 2010. Four monthly post implementation audits were undertaken in the national reporting wards and a one yearly post-implementation audit was done in all other clinical areas. By November 2011 the national reporting wards had completed seven post-implementation audits and all other areas had had at least one post-implementation audit.

**National Reporting Wards—**The mean (95% CI; range) baseline compliance rates for the national reporting wards was 35% (95% CI 24-46%, 25-61%). Compliance amongst healthcare workers was nurses 38%; doctors 33%, healthcare assistants 46%, and allied health staff 38%. Compliance with individual moments was as follows: moment 1, 28%; moment 2, 31%; moment 3, 42%; moment 4, 49% and moment 5, 24%.

The compliance rates increased over the first two audit periods for all areas. However, by the third and fourth audit period, compliance rates had fallen in three of the seven areas but still remained above baseline, figure 2. At subsequent audits the compliance rate increased in these areas.

**Figure 2. Hand hygiene compliance rates (%) at baseline and after implementation for the national reporting wards**



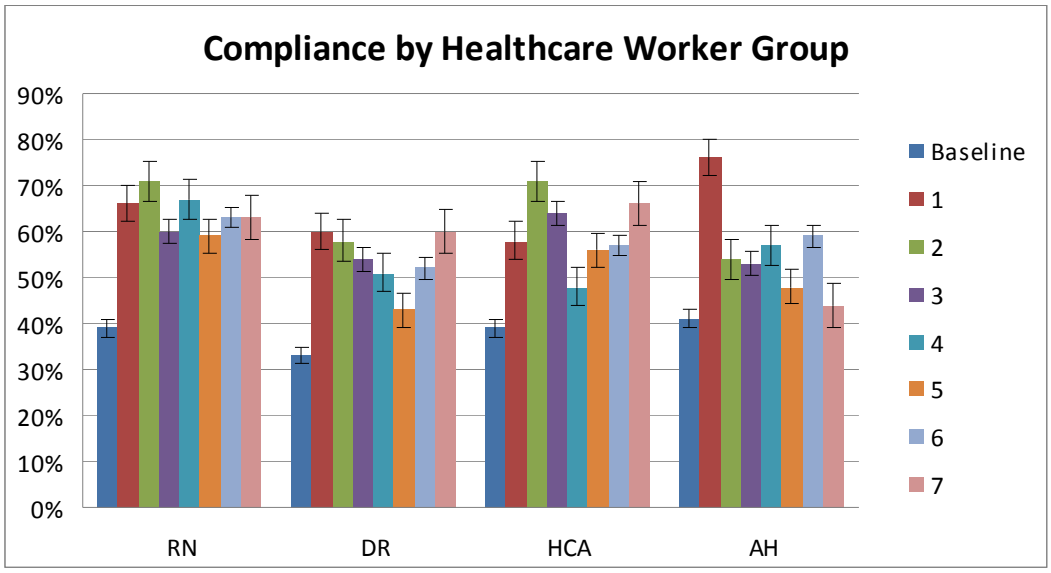

Amongst the healthcare worker sustained improvement was seen in all groups; overall compliance in these four groups by the 7th audit period was 60% (95% CI 46 –74; range 47-91). Nursing staff showed the greatest sustained improvement from 39% to 63%, figure 3. Doctors also increased from 33% at baseline to 60% by the 7$^{th}$ audit but improvement varied between audit periods.

There was also an improvement in compliance with individual 'moments'; particularly moment 3 and moment 4, Figure 3.

**Other clinical areas—**The mean (95% CI;) baseline compliance rate for the other clinical areas per group was: 2, 30% (95% CI 21-39); 3, 36% (95% CI 27-45); 4, 43% (95% CI 33-53); 5, 30% (95% CI 24-36); 6, 38% (95% CI 30-46); 7, 35% (95% CI 25-45) and 8, 45% (95% CI 33-71). The overall compliance rate for all these areas was 37% (95% CI 32-42, 29-45). The mean (95% CI; range) compliance rate one year after implementation for all these areas was 50% (95% CI 45-55, 41-58).

**Outcome measures—**The overall ADHB rate of healthcare-associated *S. aureus* bloodstream infection per 1000 inpatient days before implementation and for 36 months after implementation (March 2009 – December 2011) is shown in figure 4. There was a statistically significant decrease in the rate over time ($R^2$ =0.44, p=0.027).

**Figure 3. Hand hygiene compliance rate (%) at baseline and post-implementation for healthcare worker groups and per 'moment' for the National Reporting Wards**




RN, registered nurse; DR, doctor; HCA, healthcare assistant and AH, allied health

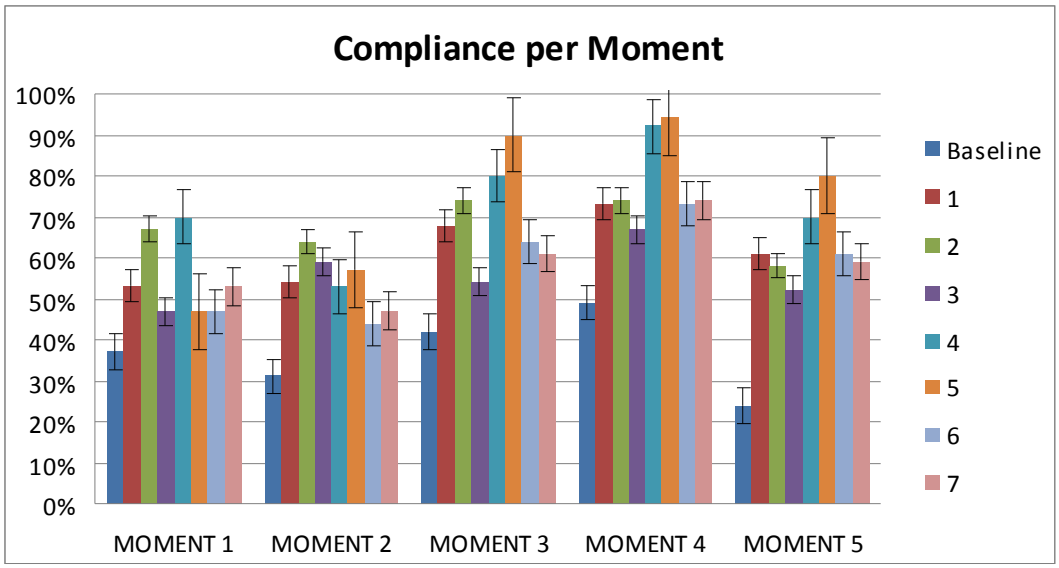
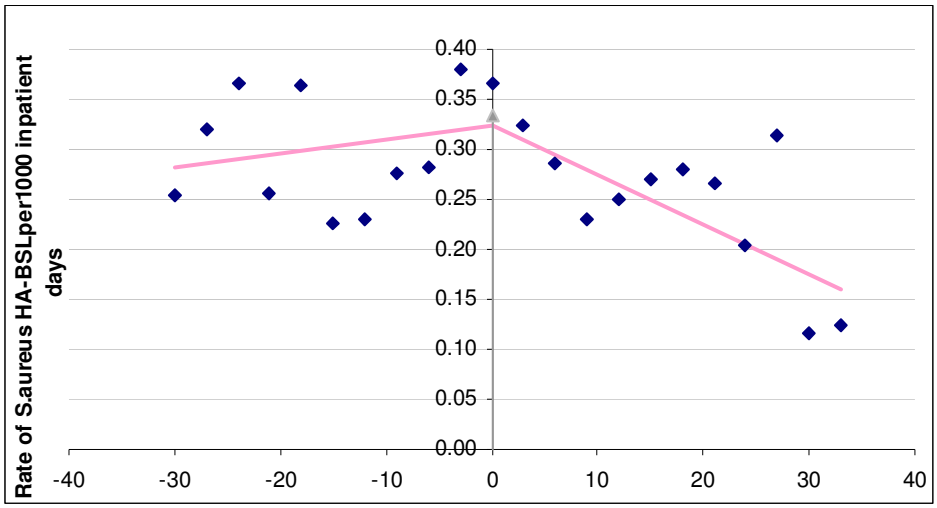
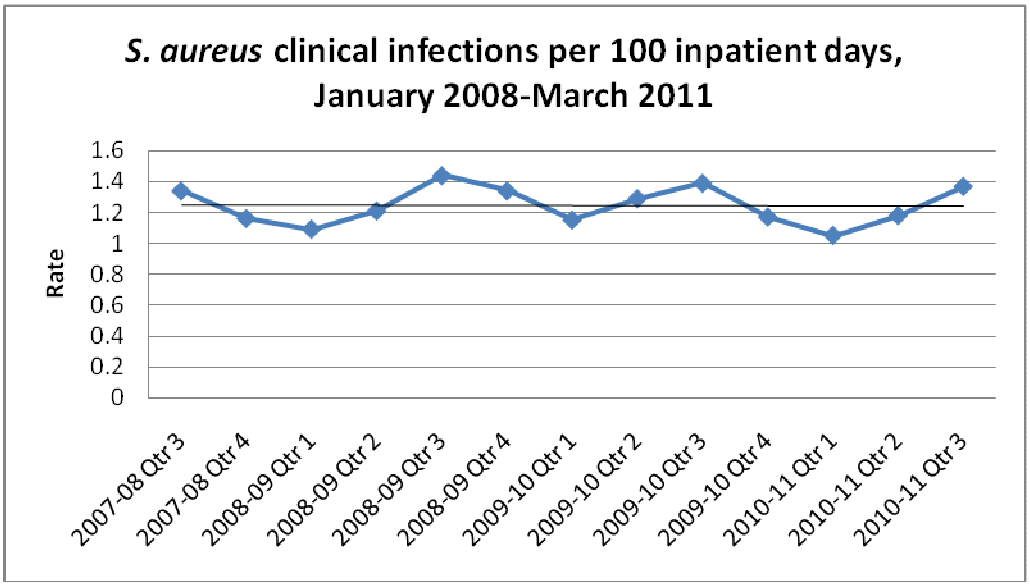


**Figure 4. Quarterly episodes of *S. aureus* healthcare-associated bloodstream infection per 1000 inpatient day's pre and post implementation of the HHNZ programme**




The overall ADHB rate of clinical infection caused by *S. aureus* per 100 inpatient days before implementation and for 24 months after implementation (March 2009 – March 2011) showed no reduction in the rate, Figure 5.

**Figure 5. Quarterly rate of clinical infections due to *S. aureus* per 100 inpatient day's before and after implementation of the HHNZ programme**



## Discussion:

This is the first report detailing the implementation of a hospital-wide 'culture change' hand hygiene programme in a New Zealand DHB. Baseline compliance rates with hand hygiene at ADHB were low but were consistent with reported rates.[2] Rates tend to be lower in intensive care settings, lower among doctors than among nurses and lower before, rather than after, patient contact.[2] Within the national reporting wards the compliance with hand hygiene for nurses was 38% and for doctors 33%. All healthcare worker groups improved compliance with hand hygiene following the implementation of the project. Whilst the nursing staff showed the greatest sustained improvement, the rate of compliance for doctors also increased but was less consistent.

Overall hand hygiene compliance in the national reporting wards increased from a mean rate 35% at baseline to 62% at 4 months and sustained at 60% 36 months after implementation. The improvement in compliance can be considered to be moderate at best in all areas except for one ward which achieved and sustained compliance over 80%.

The baseline rates for 'moment' 1 and 2, the before contact 'moments', were 37% and 31%, respectively compared to the rates for 'moment' 3 and 4, the after moments, which were 42% and 49%, respectively. The greatest improvement was seen with moments 3 and 4. Compliance with hand hygiene following patient contact is universally better than before patient contact.[9] HCW perform hand hygiene due to the perceived risk to themselves of pathogen transfer following contact with the patient or following blood and body fluid exposure. Preventing pathogen transfer to patients relies on the HCW performing hand hygiene before contact with patients and before performing clean or aseptic tasks.

The initial improvement was not sustained beyond 12 months in all areas. In early 2010 the project manager left and was not replaced until the middle of that year. The loss of a project manager has been shown to impact on the sustainability of hand hygiene compliance rates in a pilot programme in Victoria, Australia.[5] The project manager role was replaced with a 0.5 FTE Infection Prevention and Control Nurse Specialist and hand hygiene became core business for the IP&CS.

There was a statistically significant reduction in the rate of healthcare-associated *S. aureus* bacteraemia over the 36 month period following the implementation at ADHB. *S. aureus* bacteraemia causes significant morbidity and mortality in New Zealand and Australia; the all-cause mortality at 30 days is 20.6%.[10] About 40% of episodes of *S. aureus* bacteraemia arise in the hospital and the all-cause mortality at 30 days is significantly higher for hospital onset than community onset (p=0.004).[10] A number of infection control interventions have been shown to reduce healthcare-associated infections including those caused by *S. aureus.*[11-13]

Improvement in hand hygiene compliance was associated with a significant reduction in methicillin-resistant *S. aureus* (MRSA) bacteraemia in Victoria with 65 fewer patients with MRSA bacteraemia 24 months after implementation of a statewide hand hygiene culture-change programme.[5] With a more sustained improvement in hand hygiene compliance we would hope to see a further reduction in the rate of healthcare-associated *S. aureus* bacteraemia.

The rate of *S. aureus* clinical infections following implementation was unchanged. This is not surprising as skin and soft tissue infections caused by *S. aureus* are a common cause for admission to New Zealand hospitals.[14-15] Improvement in hand hygiene compliance by HCW is unlikely to impact on the rate of admissions for *S. aureus* skin and soft tissue infections because 60-75% of these infections are community acquired.[10,15] We conclude that this should no longer be used by HHNZ as an outcome measure.

The auditing is undertaken by trained auditors, members of the IP&CS, and this has ensured consistency of reporting hand hygiene compliance. It also avoids the risk of observer bias that may occur if the observer worked in the area being audited. The timetable for auditing is set by the IP&CS and this prevents avoidance of auditing in poorly performing areas. The results of each audit are promptly reported to the Charge Nurse Manager and Clinical Director in each area. Organisation wide disclosure of individual ward/clinical area results has not occurred; this is under review as it has been proposed as a means of improving quality of care while ensuring transparency and accountability.[16] The benefit of public reporting of hospital hand hygiene compliance is debated.[17]

Promotion of the programme is an important aspect of a culture change programme. Involvement of the Communications Department helped with the initial promotion of the programme and a detailed promotional package was developed. The "Talking Walls"[2] concept was modified to cover posters that were designed to promote hand hygiene. The initial set of posters used to promote hand hygiene at ADHB was from the HHNZ campaign and a further set were developed within house based on pop art. The posters were placed at the entrance to clinical areas and beside the ABHR dispensing units and basins in clinical areas. Individual ward/clinical areas were encouraged to develop their own promotional activities. The IP&CS promotes compliance with hand hygiene regularly and on occasions such as 'World Hand hygiene Day', the 5th May.

One ward had achieved over 80% compliance by the second audit period and has maintained hand hygiene compliance over 85% out to 36 months post-implementation. The healthcare-associated bloodstream infection rate for that ward for the 12 months prior (2008) to implementation was 3.3/1000 inpatient days (95% CI 2.3-4.2) and in 2010 the rate was 1.8/1000 inpatient days (95% CI 1.1-2.5).

Changing culture among healthcare workers with respect to hand hygiene practices is an ongoing challenge. However, multi-modal culture change programmes such as the one undertaken by ADHB can result in improvement in compliance rates and create safer environments for patients by reducing the risk of acquiring a serious healthcare-associated infection.[5,18] A collective responsibility is necessary to improve patient outcomes; it cannot be left to individuals alone to bring about change in practice.

The Health Quality & Safety Commission is now leading the Infection Prevention and Control projects which are aimed at improving hand hygiene, reducing central line-associated bacteraemia and developing a national surgical site surveillance programme. Change management requires leadership to champion the process and to make sure that progress stays on track. It is important to ensure that the necessary resources, support and training are available to bring about the change in practice. The

Commission's role is to oversee the delivery of the projects and to work along side the teams delivering the individual projects.

The ADHB programme is ongoing; as with any change process we have been monitoring the progress along the way. This review has allowed us to take stock of how far we have come, to assess what worked and what did not work, and going forward, what is needed to sustain the programme long term. Achieving a sustained improvement in hand hygiene compliance by healthcare workers will require a long term commitment at a national level and the highest levels of clinical and managerial leadership.

**Competing interests:** None declared.

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# The further and future evolution of the New Zealand Immunisation Schedule

Stewart Reid

**Abstract**

MeNZB was introduced to control meningococcal disease in New Zealand in 2004 and routine use ceased in 2008. In that year, two new vaccines were added to the New Zealand Childhood Immunisation Schedule, pneumococcal and human papilloma virus, and two more, varicella and rotavirus, have been recommended but not funded. By comparison, in the 16 years prior to 2006 only one new vaccine was introduced, *Haemophilus influenzae* type B. Coverage is improving and is now around 90%, making timeliness an important target and supplementary strategies for controlling pertussis of greater importance. A personal view of each of these vaccines is provided in this article.

In 2006 an article on the evolution of the New Zealand Childhood Immunisation Schedule was published.[1] In that article, which covered from 1980 until 2006, there was a brief section on the future. Much has happened since then.

MeNZB has been and is now gone. Two new vaccines have been included on the Schedule, pneumococcal and human papilloma virus, and two more, varicella and rotavirus, recommended but not funded. By comparison, in the 16 years prior to 2006 only one new vaccine was introduced, *Haemophilus influenzae* type B. Coverage is improving and is now around 90%, making timeliness an important target and supplementary strategies for controlling pertussis of greater importance.

In this article I will provide my personal view on each of the above vaccines and the challenges they present, and describe how vaccines get onto the New Zealand Childhood Vaccination Schedule. I will make predictions about which vaccines may be included in the Schedule by the end of this decade and for comparison I present the 2006, 2008 and 2011 Schedules. For more detailed consideration of the diseases and vaccines available please consult the recently published Immunisation Handbook 2011.[2]

## How do vaccines get on the Schedule?

There is no formalised process in New Zealand for vaccines to be included on the Immunisation Schedule, but there are nevertheless a number of hurdles to be crossed. The epidemiology of the target disease in New Zealand must be known and understood, and the impact of the disease must be of sufficient frequency and severity to justify vaccination.

The vaccine must have demonstrated that it prevents disease, has an acceptable safety profile and that it can be manufactured reliably, meeting licensure criteria as determined by the regulatory authority, Medsafe. Experience during the use of the vaccine in other countries will have been considered. How the vaccine will fit into the

Immunisation Schedule is important: are extra visits or extra injections required or, is there a suitable combination vaccine? There has to be a pharmacoeconomic evaluation indicating reasonable cost benefit.

In general an intervention can be considered highly cost-effective if it saves one quality adjusted life year (QALY) for less than the cost of the per capita GDP of the country, and cost effective if it saves one QALY for less than three times the cost of the per capita GDP.[3]

If the vaccine is to be introduced, effective surveillance has to be in place for the target disease, and for vaccine coverage and adverse events following vaccination. If a vaccine passes all these hurdles then the advisory committee is likely to recommend to the Ministry that it be included in the Immunisation Schedule.

The Ministry then has to consider the cost of the vaccine within the context of its total budget and the strategic direction for the immunisation programme and decide whether to make a recommendation to the Minister for funding. It will consider whether there will be a catch-up and, if so, this will substantially increase the first year cost.

The Ministry has to prepare all the necessary documentation for providers and vaccine recipients so that they are well informed. The Minister, if he or she agrees with the recommendation, has to persuade Government to provide the necessary funds. It is, quite appropriately, a process with many steps and no vaccine is included in the Schedule without careful consideration.

## Meningococcal vaccination

**Group B meningococcal vaccination—**Between 1991 and 2008, New Zealand suffered an epidemic of group B meningococcal disease dominated by a single subtype. This subtype, characterised by its porA type, P1.7b4, was responsible for approximately 85% of invasive disease caused by Group B meningococci.[4]

The predominance of this single subtype meant that a tailor made vaccine had the prospect of controlling the bulk of group B meningococcal disease in New Zealand. Chiron Vaccines (now Novartis), in collaboration with the Norwegian Institute of Public Health, contracted with the New Zealand Government to produce an outer membrane protein vaccine against the New Zealand subtype.

MeNZB was studied in a series of trials conducted in New Zealand by the University of Auckland. Using a schedule of three doses of MeNZB™ with an interval of 6 weeks, it was demonstrated that for all age groups, except infants, at least 60% of vaccine recipients achieved a four fold rise in SBA titre,[5–8] the predetermined criteria for licensure. Infants, who received three doses concurrent with the routine immunisation schedule required a fourth dose at 10 months of age to achieve the predetermined criteria.[9]

Underpinning licensure was a comprehensive safety monitoring plan. This was required because 3300 doses were administered during the clinical trials, a rather small safety data set for a vaccine planned to be given to 1,000,000 New Zealanders aged 20 years and under.

The key features of the safety monitoring plan were the use of several data sources, including active hospital based monitoring for key events of interest, staggered delivery of vaccine with progress from one area to another occurring only after analysis of the available safety data and, most importantly, the creation of an independent safety monitoring board which assessed all safety data.[10]

Three important reasons resulted in the MeNZB™ vaccination campaign ceasing in 2008, though the vaccine remained available for high risk groups until 2011. Firstly, the incidence of group B meningococcal disease caused by the epidemic strain had fallen significantly.

Secondly, trial data indicated there was rapid antibody decay following vaccination, meaning protection would be short lived as circulating antibody rather than immune memory is required for protection from meningococcal disease.[11]

Thirdly the only group being vaccinated in 2008 was infants who required four doses to achieve a protective SBA response and the coverage for the fourth dose was low. A further reason was that pneumococcal vaccination was being introduced into the NZ Schedule and no data were available on the concurrent administration of MeNZB with pneumococcal conjugate vaccine.

A consideration of the efficacy of MeNZB is outside the scope of this article and is well covered elsewhere though it does seem likely that the vaccine contributed to the substantial decline in disease.[12,13]

The MeNZB™ vaccine campaign did, however, leave an important legacy. The safety monitoring strategy, which underpinned vaccine licensure, was dependent upon the creation of the National Immunisation Register which now provides accurate up-to-date information on childhood vaccine coverage throughout the country.

The future of group B meningococcal vaccines is uncertain. Generic group B vaccines based on a combination of outer membrane proteins and other proteins derived from studies of the meningococcal genome, are being studied in clinical trials. An article describing the current status of group B Meningococcal vaccines has been published recently.[14]

**Conjugate group C meningococcal vaccination—**This vaccine has been introduced into several countries, notably the UK and Australia but the incidence in New Zealand, when it was discussed in 2009, was not sufficiently high to merit its introduction. This may well have changed given recent outbreaks of group C meningococcal disease in New Zealand.

The vaccine presents some interesting possibilities for those deciding how it should be used. A modelling study indicated that the optimum schedule for conjugate MenC vaccination is a five-dose schedule with doses at 2, 4 and 12 months and 12 and 18 years of age. However this schedule was only marginally better than a two-dose schedule with doses at 12 months and 12 years,[15] and some countries, e.g. The Netherlands, have had excellent control of Group C meningococcal disease with a single dose at 14 months and a catch up for all aged 1 to 18 years.[16,17]

The vaccine strategy will depend on the epidemiology of the disease in New Zealand prior to the vaccine's introduction. If the epidemiology justifies vaccinating infants then two (or possibly three) doses will be offered in the first 6 months of life with a

booster dose in the second year; experience in the UK has established that a second year of life dose is required.[18] Currently the Immunisation Handbook recommends that this vaccine be offered to young adults entering hostel accommodation, particularly in their first year,[19] though this is not funded.

## Conjugate pneumococcal vaccine

The decision to introduce a conjugate pneumococcal vaccine was very straightforward on scientific grounds. The incidence of invasive pneumococcal disease in New Zealand was high, particularly in children of Maori and Pacific ethnicity.[20]

The seven valent vaccine, Prevenar, containing serotypes 4, 6B, 9V, 14, 18C, 19F and 23F, is highly efficacious in preventing invasive pneumococcal disease caused by the vaccine serotypes.[21] It also demonstrated modest efficacy against pneumonia and otitis media, though the prime reason for the introduction of conjugate pneumococcal vaccines is (and remains) the prevention of invasive pneumococcal disease.

Furthermore, data from the USA indicated a significant herd effect with two cases prevented in adults, predominately in those aged 65 and older, for every case of invasive disease prevented in child vaccine recipients.[22] This is probably because grandparents were less likely to be exposed to pneumococci by their vaccinated grandchildren.

In New Zealand the vaccine was introduced in June 2008 to all born from 1 January 2008. Surveillance data from 2004–2009 indicate a decline in invasive pneumococcal disease in those aged two and under during 2008 and 2009, in comparison to previous years. To date no reduction in the incidence of pneumococcal disease in elderly people has been observed.[23]

One of challenges of introducing pneumococcal vaccination was that it required a change to the *Haemophilus influenzae* type b (Hib) vaccine used. When the introduction of pneumococcal vaccine was being considered, there were three injections at each of the first three visits, DTaP-IPV, Hib-HepB and MeNZB.

To avoid adding a fourth injection, a change to the hexavalent vaccine, DTaP-IPV-HepB/Hib, was recommended, necessitating a change in Hib vaccine. All currently available Hib vaccines contain poly ribosyl ribitol phosphate (PRP), derived from the polysaccharide capsule of *H. influenzae* type b, conjugated to a carrier protein, which enhances the immune responses to the PRP.

A variety of carrier proteins have been used: an outer membrane protein (PRP-OMP) of *Neisseria meningitidis*, a mutant diphtheria toxin (Hb-OC) and tetanus toxoid (PRP-T). PRP-OMP, the Hib vaccine in the Hib-Hep combination, had been selected ahead of the other available conjugate Hib vaccines because it produced a particularly strong antibody response following the first vaccine dose, and thus provided protection more rapidly than the alternative Hib conjugate vaccines.[24] However the change, in 2008, to the hexavalent DTaP-IPV-Hep/Hib vaccine (Infanrix Hexa), meant that the Hib conjugate would be PRP-T, which stimulates a weak response after the first dose but does offer some protection after the second dose.[25] This meant that there was a difficult trade-off between either using the combination DTaP-IPV-Hep/Hib vaccine with a loss of early immunity against Hib, or giving four injections:

DtaP-IPV, Hib-HepB, pneumococcal vaccine and MeNZB™ at each of the first three visits.

In the end it was decided to use the combination vaccine and, as the use of MeNZB™ subsequently ceased, only two injections are given at each visit in the first 6 months. Despite the weak response to PRP after the first dose of Infanrix-Hexa the control of Hib disease has remained excellent since the change of Hib vaccine.

In 2011, to broaden protection against invasive pneumococcal disease, PCV7 was replaced by PCV10 which contains the same serotypes as Prevenar plus serotypes 1, 5 and 7F. PCV13, which contains the same serotypes as PCV10 plus additional serotypes 3, 6A and 19A, was considered but, on cost-effectiveness grounds, PCV10 was chosen. PCV13 is offered to high-risk children because it is important that those children receive the broadest protection.[26]

The main concern about using PCV10 is that it will not offer sufficient protection against invasive disease caused by serotype 19A which has increased in several countries, some of which have routine pneumocoocal vaccine and some of which do not. However immunogenicity data on PCV10 suggest that cross protection from serotype 19F may offer some protection against 19A.[27] Whether protection against 19A will be seen with widespread use is yet to be determined.

Very careful serotype surveillance of invasive pneumococcal disease is required; if the incidence of invasive disease caused by 19A increases significantly, a change in vaccine may be considered.

Conjugate pneumococcal vaccines offer some protection against otitis media caused by vaccine serotypes. Some of the serotypes in PCV10 are conjugated to an immunogenic protein from non typeable *Haemophilus influenzae* (NTHi). It is possible that this may provide some degree of protection against otitis media caused by NTHi.[28]

An additional possibility is to use a 2+1 schedule (two doses in the first 6 months and a booster dose in the second year of life) rather than a 3+1 schedule, as is done in some Scandinavian countries, Italy and the UK.

Immunogenicity studies suggest that a 2+1 schedule may be sufficient.[29] The main risk is a decline in antibody titre (and protection) prior to receipt of the dose in the second year of life, emphasising the importance of administering this dose on time.

## Human papilloma virus (HPV) vaccine

The decision to recommend this vaccine was relatively straightforward. In clinical trials both HPV vaccines (Gardasil and Cervarix) demonstrated a high level of efficacy against persistent infection with vaccine HPV genotypes 16 and 18, and cellular changes caused by these genotypes. They have the potential to prevent the approximately 70% of cases of cervical cancer caused by genotypes 16 and 18. Gardasil, the vaccine currently used in New Zealand, also contains HPV genotypes 6 and 11, and has the potential to prevent 90% of genital warts.

Although injection site reactions occur and some adolescent girls faint following vaccination, which is an injection not a vaccine reaction, both vaccines have an excellent safety profile with serious adverse events being rare.[30] Trials of a higher

valency HPV vaccine with the potential to prevent approximately 90% of cervical cancer are ongoing.

This vaccine was introduced to the Immunisation Schedule in September 2008. There was a catch up for all females born from 1990 onwards, but now the main group of potential recipients is females aged 11 or 12.

It is disappointing that uptake of this vaccine has been relatively low, less than 50% for three doses in the eligible population, (Ministry of Health Data, October 2011). Reluctance to accept that girls are sexually active at a young age, concerns about duration of immunity, persistent anti vaccine publicity and opposition from Faith based groups underpin the low uptake.

Data from New Zealand clearly indicate that a significant percentage of girls (around 15%) had first sexual activity by age 12 or 13.[31,32] This argues very strongly for vaccinating at age 12 or possibly earlier, prior to the onset of sexual activity.

Data on the duration of protection are limited by the length of time the vaccine has been available. Current data indicate stable protection for 8.5 years for the HPV 16 monovalent vaccine[33] and it is expected that protection from HPV vaccines will be stable long term. There is additional reassurance for those aged 12 years or younger. Data indicate that the younger one is when vaccinated the higher the immune response. For example when the immune response in girls aged 9–15 is compared to that in women from age 16, the height of the antibody titre is approximately doubled in the younger group.[34]

More recent data indicate that 2 doses of either vaccine given at 0 and 6 months in 9-13-year-old girls produce a non inferior immune response to the standard three-dose schedule in 16–26 year old women.[35,36] As a result, Canada's British Columbia, for example, has introduced a two-dose, 0 and 6-month schedule for adolescent girls with the possibility of a third dose at 60 months.

In my view the decision to offer this vaccine to adolescent females is very straightforward and I anticipate that the acceptance rates will increase as confidence in the duration of protection increases, and evidence emerges of its protection against cervical cancer: more so if the number of vaccine doses required is reduced.

I anticipate that in a few years time as the vaccine price drops, and evidence of the protection against HPV-related cancers in other sites increases, it will become cost effective to offer it to young males as well. HPV vaccines are licensed for women to age 45. The peak age of HPV acquisition is much younger but the vaccine will protect older women against persistent infection by vaccine serotypes with which they are not already infected.

## Varicella vaccine

Varicella vaccine has been recommended for introduction into the childhood schedule and a recent article has drawn attention to the case for its introduction.[37] Almost everyone gets chickenpox and even with a low complication rate there can be a large number of serious outcomes.

Immune compromised individuals, in whom chicken pox is more likely to be severe, remain at risk because of continued circulation of varicella virus. The number of

children hospitalised with varicella has quadrupled over the last 40 years.[38] Varicella vaccine has not been introduced for fiscal reasons and because it was thought that the greater priority was to increase overall coverage with already funded vaccines.

There are three interesting issues relating to this vaccine with regard to its introduction to the schedule and its use on the private market. Firstly, should the vacccine be administered as a one or two-dose schedule. Secondly, how should the first dose be administered, given that there are already three injections at the 15-month visit? Thirdly, in light of the US experience (see below), what is the duration of vaccine-induced immunity and will vaccinating children mean that we are creating a large number of young adults who become susceptible at an age when the disease is more severe?

In my view, a single dose is all that is required at present and this opinion is discussed in detail below. When varicella vaccine is introduced to the schedule, two doses at 15 months and 4 years should be offered from the start, with both doses being given at the same time as MMR. I would not recommend a catch up, meaning that the first children to receive a second dose would be those first immunised at 15 months, when they reach the age of 4.

Those who received a single dose at age 4 years would have their immunity boosted by regular exposure to wild varicella which would still be occurring, given the small percentage of the population that would be vaccinated in the first years after its introduction.

MMR, PCV and Hib vaccines are given at age 15 months and the addition of varicella vaccine would mean that four injections are necessary. However there are two licensed MMRV vaccines. Data from the USA indicate that there is an increased risk of febrile convulsions when MMRV is given compared with MMR and varicella vaccines given separately to children aged 12–23 months. The excess risk is one febrile convulsion for every 2000 children vaccinated.[39]

So, in the absence of a new formulation of MMRV which could eliminate this increased risk of febrile convulsions, there is a choice: four injections, an increase in febrile convulsions or an extra visit. There is no obvious answer and it may be necessary for the Ministry to commission focus group research among parents and vaccinators prior to the introduction of varicella vaccine, to determine the most acceptable strategy.

At present no MMRV vaccine is available in New Zealand. This means that, if varicella vaccine is being given privately, it would have to be as a single antigen varicella vaccine and, at parents' choice, it could be given at the 15-month visit with MMR, Hib and Pneumococcal conjugates.

Thirdly, the issue of duration of immunity is pertinent but it is necessary to consider the context in which immunisation against varicella is given.

The first context is that in which there is no national programme, the number of vaccinees is small and chickenpox continues to occur endemically: the current situation in New Zealand. In this situation those vaccinated will be regularly exposed to chickenpox and their immunity will be regularly boosted leading to secure long-term protection.

Data from Japan indicate that protection lasts for at least 20 years if chickenpox continues to circulate at high levels giving many opportunities for regular boosting of vaccine induced immunity.[40–42] Coverage in Japan, where the vaccine is "voluntary", was estimated to be around 20%. Antibody levels were higher at 20 years post-vaccination than at 10 years post-vaccination, confirming that boosting of immunity had occurred.[43,44]

The second context is that of a national programme when all children are offered routine varicella vaccination and the opportunity for boosting of immunity is significantly diminished. In the USA, following introduction of single-dose varicella vaccination in 1995, coverage for children aged 19 through 35 months had risen to 88% in 2005. These immunisation rates resulted in a 71% to 84% reduction in varicella cases, an 88% decrease in varicella-related hospitalisation and a 92 % decrease in varicella deaths in 1 to 4-year-old children when compared to the pre-vaccine era.[45] However, in the absence of regular boosting, following a single-dose 15–20% of children suffer breakthrough varicella, though it is a less severe illness than varicella in unimmunised children.

Put another way, vaccine effectiveness for a single dose is of the order of 80%–85% and, if a single dose strategy is retained, there are likely to be ongoing outbreaks of varicella. After a second dose in children the immune response is markedly enhanced with >99% of children attaining an immune response thought to provide protection and the height of the antibody titre is also significantly increased.

Estimated vaccine efficacy for two doses, over a 10-year period, for prevention of any varicella disease is 98%, with 100% efficacy for prevention of severe varicella. The likelihood of breakthrough varicella is reduced by a factor of 3.3.[45–47]

The USA commenced routine varicella immunisation 16 years ago and those vaccinated in the early years are now in their late teens. Any adverse change in disease epidemiology as a result of vaccination will be seen in the USA well in advance of New Zealand.

A vaccine against herpes zoster which provides approximately 60% protection when given to those age 60 years and older has been licensed in New Zealand but is not commercially available at present. It contains the came vaccine virus as varicella vaccine but at a titre increased approximately tenfold.[48]

## Rotavirus vaccine

There are two rotavirus vaccines licensed in New Zealand; both are orally administered, meaning inclusion of either in the Schedule would not result in an increase in injections. Both are highly efficacious against severe rotavirus gastroenteritis, of which there is a significant burden, including hospitalisation, in New Zealand.[49–51]

Experience in other countries indicates that the efficacy seen in the clinical trials is also seen when the vaccines are in widespread use and there does appear to be a herd effect.[52,53] An increased risk of intussuception following receipt of these vaccines at the rate of 1–2/100,000 infants vaccinated has been observed.[54]

The barriers to the introduction of a rotavirus vaccine into the New Zealand Schedule, like that for varicella, are fiscal and because the greatest priority has been to increase overall vaccine coverage. The single cost benefit study indicates that the vaccine costs $46,000 per QALY saved. This is quite a high cost for New Zealand even though it is within the three times per capita GDP per QALY which WHO considers a cost-effective intervention.[55]

This figure does not take into account the work time lost by parents when their child suffers rotavirus gastroenteritis; between 2.3–7.5 days work are lost by parents when their child has an episode of sufficient severity to require a medical consultation.[56] And it is possible that the vaccine price would be less at tender than was assumed in the above cost benefit study, making the cost per QALY significantly less.

There is an additional important factor to consider: the potential of these vaccines to improve on-time coverage. Rotarix is administered in a two-dose schedule with doses separated by at least 4 weeks. The first dose should be given by 14 weeks and the last by 24. Rotateq is administered in a three-dose schedule with doses separated by at least 4 weeks. The first dose should be given by 12 weeks and the last by 32.

Data from National Centre for Immunisation Research and Surveillance in Australia indicate that the introduction of rotavirus vaccine has improved on-time (within 4 weeks of due date) coverage, and a similar improvement in New Zealand would be of considerable benefit, especially for the control of pertussis.[57]

## Pertussis

To control pertussis well, the target has to be 95% vaccine coverage for three doses by six months. Currently about 60% of infants have the first three doses of vaccine administered within 4 weeks of the scheduled time (6 weeks, 3 and 5 months); there is plenty of room for improvement[58].

There is some encouragement however. It seems likely that the increase in vaccine coverage in the last few years to 90% has contributed to the much lower incidence of pertussis during the 2009–2010 epidemic compared to the previous epidemic in 2004–2006.[59] However ESR data from November 2011 with a substantial rise in incidence of pertussis indicate that the optimism in the above statement may be misplaced.[60]

Whilst the most important measure in Pertussis control is to improve on time coverage in infants and children additional strategies[61,62] are also important and as on time coverage increases they assume greater importance.

The aim of these additional strategies, vaccination of healthcare workers and childcare workers and cocoon immunisation around newborns, is to reduce the likelihood of children who are too young to be protected by vaccination from being exposed to pertussis. At least 8% of adults, who seek medical care for a cough illness of at least 5 days duration, will have pertussis.[63] Infants with pertussis are usually infected by a family member, most commonly the mother[64].

Thus it seems the theoretical case for cocoon vaccination around newborns is strong, though evidence supporting its efficacy currently is lacking. When pregnancy is diagnosed older siblings should be offered any overdue pertussis vaccine and adults in

the household and other significant adults likely to have contact should be offered a pertussis containing vaccine if one has not been received in the last 10 years.

The mother could be offered pertussis containing vaccine shortly after delivery, though US authorities have recently recommended that accellular pertussis vaccine may be given during the 2nd and 3rd trimesters of pregnancy.[65]

It seems to me that there is a strong case for healthcare workers who have contact with infants aged less than 6 months to receive a pertussis containing vaccine every 10 years. This would include at least paediatric, obstetric and primary care, including Emergency Department, staff.

The case for immunising childcare workers is less strong.[62] As stated in the Immunisation Handbook 2011 the recent receipt of a tetanus and diphtheria containing vaccine should not prevent the receipt of a pertussis containing vaccine, which in New Zealand will also contain tetanus and diphtheria toxoids.[66]

Another strategy which may be considered is neonatal vaccination with single antigen pertussis vaccine with the aim of protecting infants at an earlier age.[67,68]

Note pertussis-containing vaccines for adults (Tdap) are not currently funded beyond adolescence.

## Conclusion

The vaccination schedule will continue to change and will include more vaccines in the future. However the antigen load of the vaccination programme is unlikely to be as great as it was when whole cell pertussis vaccine, with its approximately 3000 antigens, was included. The most important challenge for vaccination in new Zealand is, and will remain, obtaining high coverage with 95% of infants and children receiving the scheduled vaccines within 4 weeks of the due date.

I suggest that by the end of this decade the vaccination schedule will include some new vaccines and some changes in timing and number of doses. The key changes I predict are, the introduction of varicella and rotavirus vaccines, and the introduction of a meningococcal vaccine at least against group C disease. HPV vaccine will be given in a two-dose schedule to adolescent males and females.

Pneumococcal vaccine will be administered as a two-dose schedule in the first year of life with a booster dose after 12 months of age. I anticipate that MMR vaccine will be given at 12 instead of 15 months as presaged in the 2011 Immunisation Handbook[69] and, provided coverage of the first dose reaches 95%, no change in timing of the second dose will be required.

However it is important to remember that as Neils Bohr, the great Danish physicist, said “Prediction is very difficult, especially about the future”.

**2006 SCHEDULE**

| | Dtap-IPV | Hib-Hep | Hep B | Hib | MMR | Tdap |
|---|---|---|---|---|---|---|
| 6 weeks | X | X | | | | |
| 3 months | X | X | | | | |
| 5 months | X | | X | | | |
| 15 months | | | | X | X | |
| 4 years | X | | | | X | |
| 11 years | | | | | | X |

**2008 and 2011 SCHEDULES**

| | DTaPIPV Hep/Hib | PCV | Hib | MMR | DtaP IPV | Tdap | HPV |
|---|---|---|---|---|---|---|---|
| 6 weeks | X | X | | | | | |
| 3 months | X | X | | | | | |
| 5 months | X | X | | | | | |
| 15 months | | X | X | X | | | |
| 4 years | | | | X | X | | |
| 11 years | | | | | | X | 3X |

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# Mondor's disease in a patient previously treated for breast carcinoma in situ: a case report

Brenda Leal, Sabas Vieira, Bárbara Carvalho, Airthon Correia, Benedito Almeida

**Abstract**

Mondor's disease is a thrombophlebitis that affects mainly the superficial veins of the breast. The aetiology of Mondor's disease is multifaceted and there are reports in the literature of an association between Mondor's disease and breast cancer. This disease occurs more commonly in women than men, mainly in the third and fourth decades of life, leading to a spontaneous remission in most cases. We report a case of a 45-year-old female patient that had been treated for breast carcinoma in situ.

In 1939, the French surgeon Henri Mondor[1] described a rare, self-limited condition of benign nature characterised by thrombophlebitis of superficial veins of the breast, more commonly the thoracoepigastric vein and its branches.[2] The clinical hallmark is a fibrous cord, occasionally with the aspect of rosary beads, that can be asymptomatic or cause pain.

Its aetiology is multifaceted and there are reports in the literature of an association between Mondor's disease and breast cancer. This disease occurs more commonly in women than men, mainly in the third and fourth decades of life,[3] leading to a spontaneous remission in most cases.

We report a case of a patient that had been treated for breast carcinoma *in situ*.

## Case report

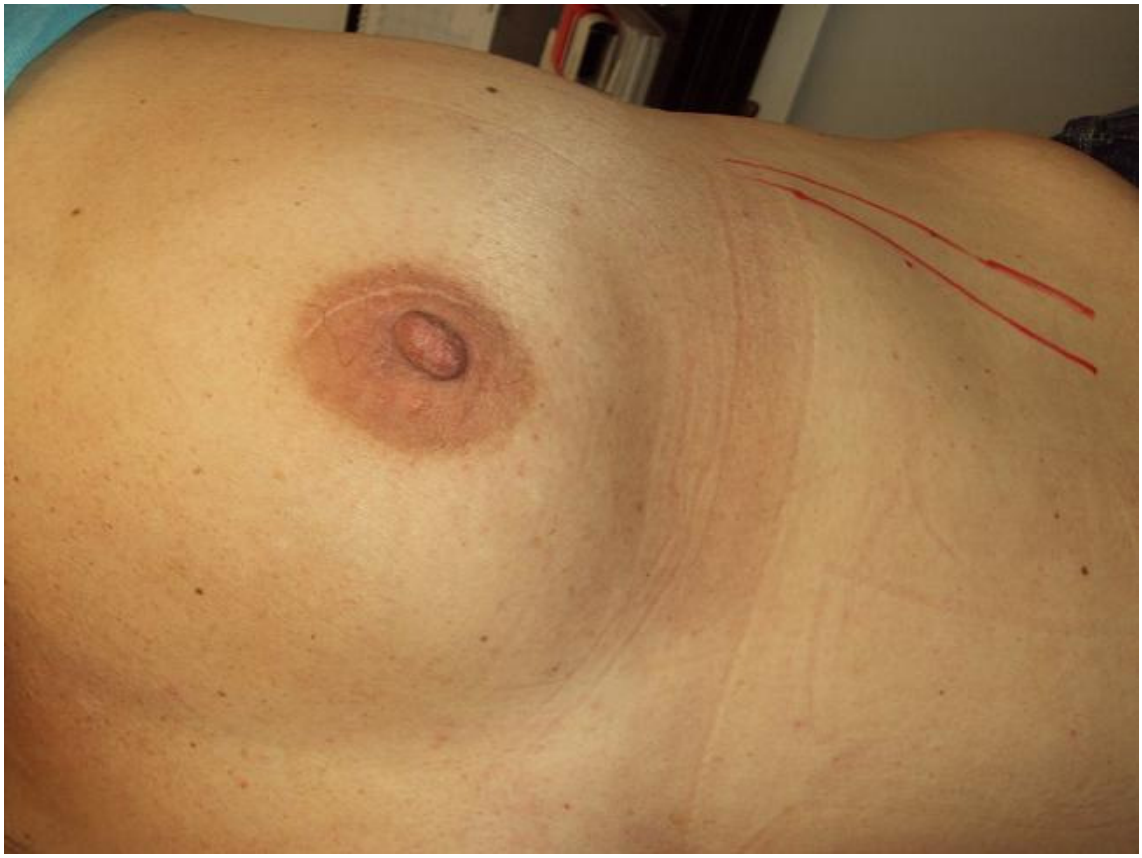
A 45-year-old female patient with a history of carcinoma *in situ* on the left breast had undergone segmental resection of the left breast with intraoperative frozen-section evaluation of the margins 9 months prior to developing Mondor's disease. The frozen and paraffin sections demonstrated tumor-free surgical margins. The patient received postoperative adjuvant radiation therapy and progressed with mild actinic dermatitis, which then resolved completely. She had been taking tamoxifen 20 mg/day for 8 months without significant side effects, except for hot flushes.

Three days earlier the patient experienced severe pain accompanied by a painful cord-like hardening on the left chest wall and a "pulling" sensation. On the physical examination, her breasts and axillae were normal and a proper healing of the left breast surgical scar was noted. There was no evidence of ongoing oncologic disease. The patient had a fibrous cord and a thickening of approximately 20 cm located on the topography of the left lateral thoracic vein (Figure 1) consistent with thrombophlebitis of the left lateral thoracic vein (Mondor's disease).

Breast mammography and ultrasound had been performed 4 months earlier and were unremarkable.

Non-steroidal anti-inflammatory drugs were prescribed and the condition subsequently resolved. Four months after the diagnosis, the patient remains asymptomatic.

**Figure 1. Fibrous cord with about 20cm in the topography of the lateral thoracic left vein**



## Discussion

Mondor's disease is a thrombophlebitis that affects mainly the superficial veins of the breast. The blood vessels most involved are the lateral thoracic, the thoracoepigastric and the superior epigastric veins.[4] Rarely, it affects areas such as the penis, groin, abdomen and upper limbs.[2]

The disease affects more women than men, at a 3:1 ratio.[3] About half of the cases have an idiopathic origin. Among other causes are hypercoagulable states, thoracic surgical traumas (mainly after breast biopsy or removal of this gland), wearing of tight clothes, breast infection and inflammation, physical exertion, and breast carcinoma (which account for up to 12% of cases).[5–7]

This condition is related to the compression of superficial vessels of the breast by tumors or metastases, leading to a blood stasis.[8] To date, we have not found any report in the literature of the occurrence of a similar case after treatment of breast carcinoma

*in situ* and no other factor has been identified as associated with Mondor's disease in this case.

The major symptoms are pain, breast enlargement and skin tethering on the site of the thrombosed vessel. On the physical examination, the primary hallmark is a fibrous cord or a palpable mass. There are also asymptomatic cases.[9] The diagnosis is essentially clinical and the treatment is based on anti-inflammatory and analgesic drugs.[10] The patient of the present case progressed to complete resolution of symptoms, after treatment.

Patients with a previous diagnosis of breast cancer, or any alteration of the breast, leads to stress, as they usually relate these alterations to a recurrence of the disease. Therefore, a comprehensive understanding of the disease is essential in an attempt to reduce the patient's stress and prevent unwarranted procedures.

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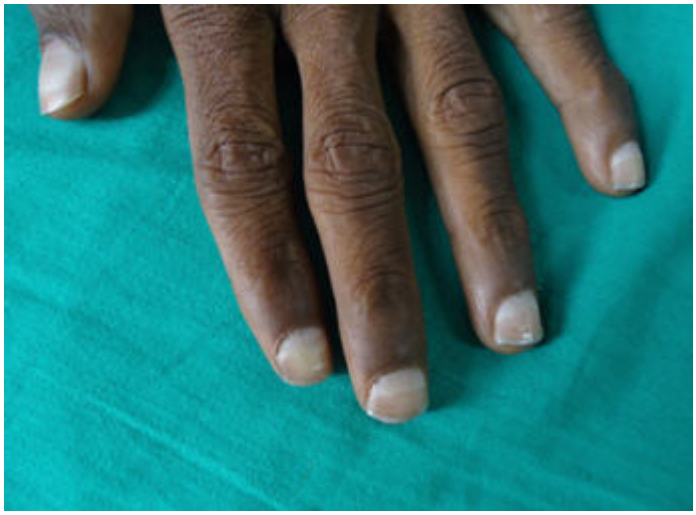
# Half-and-half nail

Anirban Das, Sabyasachi Choudhury, Sudipta Pandit, Sibes K Das

A 37-year-old man with uncontrolled hypertension for last 7 years presented with progressive shortness of breath for 2 months. Laboratory evaluation revealed haemoglobin 7.2 g/dL, fasting plasma glucose 96 mg/dL, blood urea nitrogen 122 mg/dL, serum creatinine 7.3 mg/dL, sodium 125 mEq/L, and potassium 6.3 mEq/L.

On examination, his fingernails had a pink transverse band distally and dull whitening of the proximal nail beds (Figure 1).

**Figure 1. Fingernails showing half-and-half nail changes**



Half-and-half nails (brown arcs or Lindsay's nail) show red, pink or brown distal bands occupying 20–60% of total nail length with the remaining proximal portion exhibiting a dull white ground glass appearance. The line of demarcation is sharp and runs parallel to the distal or free margin of the nail.

It was first reported by Bean in 1963.[1] It is more common in fingernails but may occur in toenails. This disorder is commonly found in patients with chronic kidney disease and infrequently with Behcet's syndrome, yellow nail syndrome with hyperthyroidism, pellegra, and in healthy persons.

Frequency of half-and-half nail changes in renal failure varies between 20–50% and there is no correlation between severity of renal disease and the length of the distal bands. The lesion often appears early and remains permanent even after haemodialysis, but disappears completely within 2 to 3 weeks after successful renal transplant.

It was proposed that the discoloration was secondary to melanin deposition in the distal portion of the nail plate.[2] Possibly the toxic substances of uraemia stimulate the nail matrix melanocytes to produce melanin, and the associated slow nail growth in renal failure results in large accumulation of the pigment. Others postulated that increase in the number of capillaries and thickening of the capillary walls in the nail beds were responsible for the lesion.[3]

The presence of these nail changes warrants thorough evaluation to exclude chronic kidney disease.

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THE NEW ZEALAND MEDICAL JOURNAL
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## Breast thermography review

The terms of reference for the thermography review (Fitzgerald and Berentson-Shaw. *Thermography as a screening and diagnostic tool: a systematic review*. NZMJ 9 March 2012) resulted in a specifically narrow "silo" of acceptable studies relating to breast cancer screening that eliminated most of the thermography literature. However, thermal imaging potentially identifies abnormal breast metabolism prior to oncogenesis. Sequential imaging of hyperthermia and vascular patterns can then show any responses to hormonal, lifestyle or other interventions.

Historically, abnormal thermograms have been associated with developing cancer. 1416 patients with persistently abnormal breast thermograms for 8 years had an actuarial breast cancer risk of 26% at 5 years.[2] In the 165 patients with non-palpable cancers, thermography was the only test that was positive when compared to mammography and ultrasound in 53% of these patients at initial evaluation. The authors concluded that a persistently abnormal thermogram, even in the absence of any other sign of malignancy, was associated with a high risk of developing interval cancer.[2]

Similarly, 1527 patients with abnormal thermograms were followed for 12 years and 40% developed malignancies within 5 years.[3] These so-called "false" positives gained further significance after an abnormal thermogram was associated with more rapidly growing tumours with a shorter disease-free interval.[4] Patients with hot tumours have significantly worse disease-free and specific survival than those with cold tumours;[5] as do younger women[6,7] where 367 of the 2654 breast cancer cases occurred in those ineligible for State-subsidised mammography (NZ National Statistics 2009).

Mammography is less specific with fibrocystic breasts with the cancer detection rate falling to 55% in Grade IV breast density.[8] Boyd discussing dense fibrocystic breasts concluded "Annual screening in women with extensive mammographic density is not likely to increase cancer detection rate (due to masking)…. Attention should therefore be directed to the development and evaluation of alternative imaging techniques for such women".[9] In this regard, thermography found 58 of 60 biopsy-proven breast cancers for a 97% sensitivity, 44% specificity, and a 82% negative predictive value in 92 women with dense breasts recommended for breast biopsy based on mammography or ultrasound evaluations.[10]

To quote Kennedy[8] "No single tool provides excellent predictability; however, a combination that incorporates thermography may boost both sensitivity and specificity. In light of technological advances and maturation of the thermographic industry, additional research is required to confirm the potential of this technology to provide an effective non-invasive, low risk adjunctive tool for the early detection of breast cancer."

The writer imported an American thermography system in 2002 and since 2009 has used the German InfraTec/InfraMedic computerised system registered as a medical device in the EU[1] and with MedSafe (WAND). The following results demonstrate clinical relevance:

- A 48-year-old woman with fibrocystic breasts and a normal mammogram and ultrasound (U/S) at age 44 requested a thermogram that revealed a large vascular complex in the upper right breast. Repeated mammography and U/S reported benign fibrocystic breasts. A year later the thermogram had deteriorated with higher contralateral temperatures. Mammography and U/S again reported benign fibrocystic breasts. A surgical opinion was sought and a guided core biopsy performed in some upper outer quadrant thickening. Histology confirmed a Grade 11 lobular carcinoma.

- A 53-year-old woman requested thermography. Mammography and U/S performed 2 weeks previously had identified fibrocystic changes and indeterminate micro-calcifications deemed inconclusive. The left breast revealed an abnormal vascular complex. Three months later, the thermal image had deteriorated. A repeated mammography and U/S were again reported as only consistent with fibrocystic changes with less obvious micro-calcifications. The thermal abnormality persisted with comparative imaging 6 months and a year later. After further discussion with the radiologist, the patient had magnetic resonance imaging following which an 8mm tumour was identified and confirmed as an infiltrating ductal carcinoma after excision.

- A 57-year-old woman developed a diffuse, bulky and mobile mass in the upper outer right breast. The mammogram (March 2007) stated: Both breasts show relatively dense stromal appearance with bilateral benign vascular calcification. In the area of clinical concern, there is a focal area of somewhat increased density with reasonably well defined margins.

  Ultrasound was performed and reported: A 1 ×1.5cm relatively well defined area which is predominantly hypo to anechoic. Internal echoes are seen with good posterior enhancement suggestive of a probable benign cyst. A fine-needle biopsy was reported as benign. The patient requested thermal imaging before making a decision whether to have surgery. Thermography showed heat over the mass and abnormal vascularity. Surgical excision confirmed an infiltrating ductal carcinoma (T2NoMo).

Whilst much remains to internationally standardise thermographic technology and protocol, 10 years of breast thermal imaging at the primary health-care level have confirmed clinical usefulness with a unique ability to monitor breast health. It warrants wider support.

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## Author response

New Zealand Guidelines Group (NZGG) was an independent, government-funded body with no conflict or vested interest in any type of test or intervention, and was funded only to investigate the science surrounding the use of thermography as a screening tool, a diagnostic tool and as an adjunct tool to mammography.

Dr Godfrey criticises the ‘narrow silo’ of studies and claims that this review ‘eliminated most of the thermography literature’. There appears to be a misunderstanding about what constitutes a systematic review. There are many health care agencies conducting systematic reviews internationally and generally, there is consensus that a systematic reviews seeks to collate all evidence that fits pre-specified eligibility criteria in order to address a specific research question and to minimise bias by using explicit, systematic methods. To this end, the types of studies required to prove the effectiveness of thermograph as a tool to screen, or to diagnose breast cancer should measure thermography against a reference standard, and any review of such studies should be as scientifically rigorous as other systematic reviews of effectiveness, not less or more. The inclusion criteria for this systematic review including the types of patients, interventions, comparisons and outcomes are clearly explained, as are the types of studies eligible for inclusion.

Determining effectiveness of a test or intervention requires careful appraisal of individual studies in order that the results of any analysis are reliable, valid and of high enough quality to make decisions about health care. All of the studies included in this review had methodological weaknesses; the studies that were not included fell outside the inclusion criteria, most often because their design did not permit

diagnostic accuracy data to be calculated. This systematic review has undergone extensive peer review by several stakeholder groups including the National Screening Advisory Committee, Cancer Control New Zealand, and the Australian Population Health Development Principal Committee. To this end, we are confident that we have not missed relevant studies nor included inappropriate studies, presented erroneous data, or misrepresented the data.

The historical data outlined by Dr Godfrey includes results from studies using methods of thermography that are now obsolete. Currently, the most common method is digital infrared thermography and this systematic review specifically excluded studies conducted prior to 1984 when the thermography methods used today did not yet exist. We feel it is reasonable to have excluded studies using different technology conducted more than 30 years ago.

Many of the studies Dr Godfrey cites relate to the use of thermography as a cancer risk prediction tool (i.e. its relative risk, odds or survival benefit) which is a separate issue to that of the accuracy of thermography as a screening or diagnostic test. Thermographic changes in isolation are highly unlikely to provide an accurate picture of the risk of breast cancer in an individual patients; it may be one of several risk factors, all of which should be taken into account. Over the past two decades, several risk prediction models have been developed to assess the risk of breast cancer in both populations, and in individuals. Current models are based on combinations of risk factors, and in general their outputs include a breast cancer risk estimate over a specified time.

There are several factors known to place women at higher risk of developing future breast cancer; the presence of substantial family history of breast cancer is considered to be one of the most important factors; early menarche or late menopause, use of the combined contraceptive pill, mammographic breast tissue density, lobular carcinoma in situ, atypical ductal or lobular hyperplasia have proven to have some of the strongest links to future breast cancer. It might well be that results from thermography can be considered a risk factor, but as yet there does not appear to be any evidence that thermography has been considered together with other known risk factors in a risk prediction model.

Dr Godfrey suggests that the thermography scanner he imported has FDA approval; while this may well be the case, this statement appears out of context. FDA approval relates to the safety of a device in that it will not cause undue harm to patients, not that it is a reliable tool as part of screening or diagnosing breast cancer. In 2011 the FDA published safety information on its website[1] and made this available in a report to consumers[2] outlining its views on the scientific and clinical validity of thermography for breast cancer screening and diagnosis. They reported that: "*The FDA is not aware of any valid scientific data to show that thermographic devices, when used on their own, are an effective screening tool for any medical condition including the early detection of breast cancer or other breast disease. The FDA is concerned that women will believe these misleading claims about thermography and not receive needed mammograms*."

Data on the effectiveness of thermography as a tool to screen patients, or to detect breast cancer is yet to meet the required scientific standard. We would suggest that there is a lack of understanding of the scientific paradigm of evidence based medicine.

We encourage those that operate thermography clinics to invest in good quality studies that would prove their tool effective and safe; there is no lack of literature available which lays out the criteria for such quality scientific investigation.

Anita Fitzgerald and Jessica Berentson-Shaw

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# Survey of hot water temperatures in campgrounds: elevated scalding risk and energy wastage

The epidemiology of scalding injuries in New Zealanders (particularly children) and the need for prevention has been detailed by health professionals for over three decades. There have been articles published in the 1970s,[1] the 1980s,[2–5] the 1990s[6,7] and in the current century.[8–10]

A recent study identified a total of 1015 hospital admissions for 862 tap water burn events in New Zealand from 2000 to 2009.[11] Combined with these persisting health concerns are the growing need to use electricity more efficiently to reduce running costs and to lower the greenhouse gas emissions which contribute to climate change.

At present the *New Zealand Building Code 1992* specifies that stored hot water in residential dwellings should be held at temperatures greater than 60ºC (irrespective of whether a mixing device is installed) so as to kill the micro-organism, *Legionella*. The Code also specifies that this hot water should be delivered at not more than 55ºC (or 45ºC for retirement homes and early childhood education centres), so as to reduce the risk of scalding.

Given this background we aimed to expand the study of New Zealand hot water temperatures from the previous studies in domestic settings, to an unstudied public setting: i.e., public campgrounds. In particular, we aimed to: (i) assess the extent of hazardous water temperatures (i.e., scalding risk) in sanitary fixtures used for personal hygiene in a sample of New Zealand campgrounds; and (ii) to assess the potential for further energy savings in these settings.

**Methods—**Convenience sampling was performed involving 25 New Zealand campgrounds that three of the authors holidayed in over a 4-year period (i.e. while participating in cycle touring holidays). The public campgrounds were located in both main islands and in the following regions: Southland/Otago/Canterbury (n=8, February 2008), Otago (n=5, December 2008), Northland (n=4, December 2009), Waikato (n=4, December 2010), and Otago/Southland (n=4, December 2011). Sampling was mainly performed by one author (NW) but also by another (JJ).

We measured the temperature of hot water: (i) that was running into a basin in the men's toilet block (maximum temperature reached within 5 minutes); and (ii) in the men's shower with just the hot tap flowing (recording maximum temperature). We aimed to measure the temperature as close to 1600h on day of arrival at the campground and as close as possible to 0700h on the following day of departure. A thermometer with range of up to 150 degrees Celsius (°C) and accurate to within 0.1°C was used (a LCD digital pen type stem thermometer [ST-9282], Winning Technology Ltd, China). This thermometer showed no indication of any performance problems (based on regular comparisons with an identical thermometer). Other data collected included: if wood (wet-back) water heating was used; and if the taps were labelled hot/cold (words or colour-coding).

**Results and Discussion—**The key findings from this study were the relatively high mean and median temperatures for both taps and showers, with 74% of these temperatures exceeding 55°C, the maximum level specified in the Building Code (Table 1). The American Academy of Pediatrics recommend a maximum level of 120°F, equivalent to 48.9°C,[12] which was exceeded by 90% of samples. This lower level (49°C maximum) is also set in certain legislation (e.g. Washington State, USA) and various codes (the Ontario Building Code, and the International Plumbing Code).

Although mean hot tap temperatures were slightly higher than shower temperatures (hot setting), the differences were not statistically significant. Similarly, there were no statistically significant differences between morning and evening temperatures for all devices (62.3 vs 62.4°C respectively) and when analysed by device.

The campgrounds that used wood-fuelled heating systems (n=3), tended to have hotter water temperatures (means for all devices = 65.1 vs 61.8°C, but with this difference was not statistically significant). Two of the campgrounds using wood fuel had warning signs in the toilet/shower block regarding the potentially high water temperatures.

Of note is that reducing hot water storage temperatures is one of cheapest and most cost-effective energy saving opportunities for hot water systems. Standing losses (the heat loss to maintain storage temperatures) in many hot water systems amounts to 30–40% of total hot water energy consumption. Each 1°C reduction in hot water storage temperature reduces standing losses by approximately 3%.

For the basin taps, colour-coding (e.g. red for hot, blue for cold) or word labels were present in 60.7%, partially present (e.g., just one of two taps coloured or labelled) in 32.1% and completely absent for 7.1%. For showers, the equivalent figures were: 60.7%, 3.6% and 35.7% respectively.

These results have various limitations, particularly the non-random sampling of campgrounds, the modest number of campgrounds sampled (n=25), and the limited number of samples per campground. Furthermore, sampling was generally in early December and so was outside the peak season for campground use. When campground use is high, average hot water temperatures will probably be lowered as water may be not fully heated to the set temperature. Nevertheless, it is plausible that some campground operators may respond by setting temperatures even higher at peak use times. Vulnerable people, such as children, may use these facilities more often outside the times of peak use, and therefore be exposed to greater scalding risk.

Ideally further studies would clarify the hot water situation in New Zealand campgrounds, and better identify the societal optimum for hot water temperature levels in a range of domestic and public settings. That is, such work should ideally determine the optimal trade-off between striving for lower water temperatures (to prevent scalds, save costs and lower greenhouse gas emissions), with the potential benefits of higher temperatures (possibly extra convenience and possibly legionellosis prevention[13]).

Of note is the uncertain role of hot water systems in buildings causing legionellosis in New Zealand,[14] and the absence of analytical evidence for any such relationship in the international literature.[11] Therefore, we suspect that the current 55°C level in the

Building Code is probably too high from health, economic and societal perspectives. This point has also been articulated by others in the New Zealand setting.[11,15]

Furthermore, there are two regulatory approaches which could be used to ensure that campgrounds reduce the scalding risk (at least to below the current level in the Building Code):

- Safe water temperature and proper tap labelling could become part of the Compliance Schedule and annual Warrant-of-Fitness which are required by Territorial Local Authorities under the *Building Act 2004* (a change that would probably occur without any new legislation).
- Safe water temperature and proper tap labelling could be built into a revision the *Camping-Grounds Regulations 1985*.[16]

In summary, the excessive temperatures identified in this study probably warrant further action by government agencies on the grounds of reducing the risk of scalding. Reducing hot water storage temperatures will also contribute to more efficient use of energy and save fuel costs for campground operators.

**Table 1. Sanitary fixture (basin hot tap and shower) temperatures in 25 New Zealand campgrounds (summer months, 2008 to 2011)***

| Device sampled and period of the day | No. of samples | Sampling time of day – median (range) | Maximum temperature (°C) | | | Percentage of samples >55°C** | Percentage of samples >48.9°C** |
|---|---|---|---|---|---|---|---|
| | | | Mean | Median | Range | | |
| Hot tap | | | | | | | |
| – morning | 20 | 0714h (0616–0850) | 64.8 | 65.4 | 46.2–86.4 | 85.0% | 95.0% |
| – evening | 21 | 1700h (1530–2043) | 63.4 | 64.8 | 45.1–80.1 | 71.4% | 90.5% |
| – both times | 41 | – | 64.1 | 65.0 | 45.1–86.4 | 78.0% | 92.7% |
| Shower (on hot) | | | | | | | |
| – morning | 19 | 0705h (0610–0810) | 59.7 | 62.1 | 43.3–69.5 | 68.4% | 84.2% |
| – evening | 22 | 1652h (1438–2047) | 61.5 | 62.3 | 47.1–74.1 | 72.7% | 90.9% |
| – both times | 41 | – | 60.6 | 62.1 | 43.3–74.1 | 70.7% | 87.8% |
| All taps/showers | 82 | – | 62.4 | 64.2 | 43.3–86.4 | 74.4% | 90.2% |

* Two campgrounds did not have hot taps in the toilet/shower block facilities. In one campground the basin/shower at a lodge were also sampled in addition to the communal facilities block. In one other site a stay of two nights allowed for repeat evening samples. See Methods section above for other details.

** The 55°C level is the maximum at the tap as in the current NZ Building Code (1992). The 48.9°C level is that recommended by the American Academy of Pediatrics (equivalent to 120°F).

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# A case of X-ray dermatitis

*Excerpt from article written by P. Clennell Fenwick, M.B. London, M.D. New Zealand, F.R.C.S.E., Surgeon to Christchurch Hospital, and published in NZMJ 1911 May;10(38):14–18.*

The use of -the X rays both for Diagnosis and Treatment has become so universal that I have thought it would be interesting to lay before you a case which proves the necessity of caution in the use of this agent. Before reading the history of this case, I would like to briefly point out the difference in the application of the rays for therapeutical and diagnostic purposes.

For the treatment of disease, the rays are applied with the definite purpose of destroying such tissues as are diseased, and limiting the spread of infection in the surrounding tissues. In such cases much longer exposures are legitimate and the object of the operator is to push the action of the rays as far as justifiable in order to effect cure. In diagnosis, no such heroic measures can ever be permitted. The operator is merely a photographer or demonstrator, using a dangerous agent on healthy tissues and may through ignorance or enthusiasm cause irreparable damage to the patient.

The case I record here is one of damage caused by the rays used for, diagnosis only, and the resulting misery and illness has impressed me immensely as a surgeon who uses the rays constantly for skiagraphy, with the need of greater caution in my own practice. I accompany this paper with wax models or records of the patient's wound taken at frequent intervals. I find this a very convenient method of keeping a faithful and permanent record of wounds and deformities.

To ensure accuracy, I take a plaster cast of the object and then re-cast it in wax. In this case the ulcer was so intensly painful that I could only secure the record by placing a piece of oiled tissue paper over the wound and tracing through this the size and shape of the injured area, and then transferring this to the melted wax. The matter of colouring the model was often very difficult. I have never seen such a variety of colours as I had to record. I do not accept as correct any record unless, when it is placed side by side with the patient's skin, I am satisfied that the appearance is a fair and truthful copy.

I have no doubt that most people who see these records will think the colouring to be more enthusiastic than truthful, but I can vouch for the accuracy of the colours, bizarre as they must appear to anyone who has not seen the original. Dr. Inglis, the Radiologist to Christchurch Hospital, has watched the case all through and has passed the models as correct.

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## Coronary artery disease in men—the role of the Y chromosome

Men are more commonly affected with coronary artery disease than women. This study explores the role of the Y chromosome in coronary artery disease in the context of this sexual inequity.

The researchers genotyped 11 markers of the male-specific region of the Y chromosome in 3233 biologically unrelated British men from three cohorts. Each Y chromosome was tracked back into one of the 13 ancient lineages defined as haplogroups. Of nine haplogroups identified, two (R1b1b2 and I) accounted for roughly 90% of the Y chromosome variants among British men. Carriers of haplogroup I had about a 50% higher age-adjusted risk of coronary artery disease than did men with other Y chromosome lineages. They speculate that this haplogroup interconnects with common genes related to inflammation and immunity which have a strong relevance to atherosclerosis and may explain the higher incidence of coronary artery disease in this cohort.

Lancet 2012;379:915–22.

## Does cannabis use by drivers increase the risk of a motor vehicle collision?

Apparently simulated laboratory studies suggest a dose–response relationship between cannabis use and reduced driving skills. This study is a meta-analysis of nine studies which compare accident rates between cannabis users and non-users. Cannabis use was documented by toxicology or self reporting. Only motor vehicle collisions resulting in serious injury or death were included. The authors report an almost two-fold (odds ratio 1.92) increase in the risk of serious accident in the cannabis users. They note that they had insufficient toxicological data to measure any dose–response effect. They speculate that cannabis may also be relevant in minor collisions.

BMJ 2012;344:e536.

## Proton pump inhibitors (PPIs) and the risk of postmenopausal hip fracture

The US Food and Drug Administration warned of this possibility in 2010. Hence this report which prospectively examined 79,899 postmenopausal women enrolled in the US Nurse's Health Study who provided data on the use of PPIs and other risk factors biennially since 2000 and were followed through to 1 June 2008.

During the follow-up there were 893 hip fractures with an absolute risk of 2.2 events per thousand person years amongst the PPI users compared with 1.51 events in non-users. It is of note that cigarette smoking is involved in the equation and non-smoking PPI users did not have an increased risk of fracture.

BMJ 2012;344:e372.

## Cardiovascular magnetic resonance (CMR) versus single-photon emission computed tomography (SPECT) in the diagnosis of coronary heart disease

In this prospective trial, patients with suspected angina pectoris and at least one cardiovascular risk factor were scheduled for CMR, SPECT, and invasive X-ray coronary angiography.

39% of 752 patients had significant coronary disease identified by angiography. For CMR the sensitivity was 86.5%, and 66.5% for SPECT, a significant difference. Currently SPECT is the most widely used test for the assessment of myocardial ischaemia but this report strongly suggests that CMR is better. It also does not expose patients to ionising radiation. On the other hand, CMR has limitations—cost, patient claustrophobia, some patients will have incompatible cardiac devices (pacemakers) and some with renal impairment may not tolerate this gadolinium used as a CMR image enhancer.

Lancet 2012;379:453–60.

## Oral rivaroxaban for pulmonary embolism

The authors of this study note that a fixed-dose regimen of rivaroxaban, an oral factor Xa inhibitor, has been shown to be as effective as standard anticoagulant therapy for the treatment of deep-vein thrombosis, without the need for laboratory monitoring.

They speculate that such a regimen may be equally effective in the management of pulmonary embolism and have conducted an appropriate randomised study. They randomised 4832 patients who had acute pulmonary embolism with or without deep vein thrombosis to either rivaroxaban (15 mg twice daily for 3 weeks, followed by 20 mg once daily) or standard therapy with enoxaparin followed by an adjusted-dose vitamin K antagonist for 3, 6, or 12 months.

Rivaroxaban proved to be non-inferior to the standard treatment for efficacy. There was less bleeding seen in the rivaroxaban cohort. It is noted that with no need for therapeutic injections or monitoring of laboratory results there may well be economic benefits as well.

N Eng J Med 2012;366:1287–97.

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# Hon Sir Peter Wilfred Tapsell

*KNZM, MBE, FRCS, FRCSE, LLD(Hon)*

Peter Tapsell was born on 21 January 1930 to a farming family who scraped a living from a small Maketu farm in the Bay of Plenty.

His father an honourable, hard-working Maori, his mother an ex-school teacher, a non-Maori. His secondary education was in Rotorua, where he lived for 5 years with family friends.

It was never Peter's way to accept only what seemed possible in life but rather to aim for the apparently impossible dream. For him that was to become a Doctor.

It was fortunate that his rugby skills (First XV and Bay of Plenty rep, while still a school boy) and his people skills (Senior Prefect and Regimental Sergeant Major) were noted by the teaching staff of Rotorua Boys' High School. At that time the school's 6th form subjects did not include University Entrance level in physics or chemistry.

Both were offered to Peter, as a single student, by the co-operation of the school's teachers. This gave him the background to study for the Medical Intermediate exams at Otago University, which he passed and gained entry to the medical school at his first attempt.

Peter was a good student, but not an outstanding one. He was, however, an outstanding rugby player and once he had passed the 3rd-year 1st Professional exams he returned to the game with the same ability and enthusiasm he had demonstrated as a high school student. His immediate placement in the University A side was rapidly followed by his selection in the Otago team (the outstanding provincial side of the 1950s), the NZ Universities side, and the 1954 Maori All Blacks of which he was the vice-captain. Subsequent to his qualification in 1954 he played in Waikato and was selected for the Waikato representative side, while doing his first-year House Surgeon's job at Waikato Hospital.

A year as an anatomy demonstrator and 2 years as a registrar in orthopaedic surgery with the Professorial team in Dunedin, saw the completion of Peter's New Zealand training. In the UK he continued with his surgical training first in general surgery and later in orthopaedics. Much of his latter training was at Oswestry under the tutelage of Sir Reginald Watson-Jones, considered by many as the outstanding figure of his generation in orthopaedic surgery in the UK.

His basic training complete and his Fellowships behind him, Peter returned, in 1961, to his home area of Rotorua as the first ever Maori surgeon and with a brief to develop an orthopaedic department in the rapidly expanding Rotorua Hospital and the associated Queen Elizabeth Rheumatology Hospital.

His dexterity as a surgeon, supported by his surgical results, were considered by many who worked with him or who observed his work, as being quite exceptional. Especially this could be said of the techniques he developed for the surgical treatment of the hands and feet of chronic rheumatoid arthritics. Techniques that are still practiced in many orthopaedic centres worldwide.

Early in his time in Rotorua Peter became interested in the Maori side of his ancestry. From being a non-speaker of Maori he taught himself to speak the language. In 1966 he was elected as the chairman of the Ngati Whakau Tribal Lands Incorporation, and the following year the chairman of the Maori Arts and Crafts Institute.

In 1968 he was made a Member of the Order of the British Empire (MBE), for his services to medicine and the Maori people. In the same year, and for much the same reasons he was selected as one of three outstanding New Zealanders, representing New Zealand on a 3-month tour of the United States, under the auspices of the American State Department.

Peter served 2 terms as a Councillor, Chairman of Works and Deputy Mayor of Rotorua. With this as his initiation into the political scene, and despite his increasing reputation in the field of orthopaedic surgery, he stood as the Labour Party candidate for the Rotorua electorate in 1975 and 1978 but was not successful in entering Parliament until the 1981 election when he stood as the candidate in Eastern Maori. At various stages of his parliamentary career Peter served as the Minister of Internal Affairs, Arts, Police, Civil Defence, Science, Forestry and Defence.

After the 1993 election, with the National Party having a majority of only one seat, the Prime Minister, Jim Bolger, chose Peter to be the speaker of the House. Jim Bolger later told me that his choice was an easy one to make, as Peter was the only MP who every other member, from both sides of the House, endorsed (with the exception of Winston Peters). He was the first ever Maori Speaker of the House of Representatives, and only the second ever Speaker to hold office while not a member of the governing party.

As Speaker of the House he hosted Her Majesty Queen Elizabeth when she formally opened the refurbished Parliament House in 1995. He was awarded the KNZM the following year.

In the 1996 election Peter lost his electoral seat, prompting his complete retirement from politics. He returned full time to his 720 hectares farm at Ruatoria, on the East Coast. He assisted several medical charities, became the Patron of the Monarchy in NZ, and was appointed as an independent chairman to a number of resource management hearings where Maori concerns were the basis of the appeal process. The University of Waikato awarded him an Honorary Doctorate in 1997.

Peter died quietly in his sleep on 5 April 2012. No major illness or symptoms preceded his death. His was a life of service and there would be few who could equal his contribution to his communities and the country as a whole.

He remained always a humble man without guile or pretention. He was renown for his immaculate suits, his buttonhole and his courtly behaviour, but sometimes ran into trouble for his plainly expressed views. He told me only a few days before he died “I have never regretted anything that I have done, but I do regret some of the things I have said”.

He is survived by two daughters and two sons; his wife Diane died in 2008.

Dr Arthur Hackett, a friend and colleague, wrote this obituary.

THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

# Jeremiah Alfred Chunn

*15 February 1923 – 14 April 2012*

The wild West Coast of the South Island should have shaped Jeremiah Alfred Chunn, born in Greymouth in 1923, into a bruff and brawny Kiwi codger. What his five children remember instead is an articulate, thoughtful and gently witty father who inspired them through his actions rather than direct instruction. I am his youngest son.

Life on the Coast was Spartan, but Jerry's father, a bookmaker whose office consisted of public bars, recognised his son's potential and sent him to St Bede's College in Christchurch. Many years later Jerry's family of five, mothered by nurse Yvonne Williams, whom he married in 1951, heard many times of his achievements in the St Bede's First XV rugby and First XI cricket teams.

It wasn't until I went there with Dad and his brother Jack in 2002 that I realised the probability of making both teams in the early 1940s was made better by the student intake level at the time.

Dad studied hard, and medical school in 1943 came next, followed by the rigours of internships at hospitals in England and Scotland which were inadequately heated, we were told much later. Jerry returned to New Zealand in the mid-1950s to set up practice in Otahuhu, South Auckland, and in 1968 set out in his course to pursue asthma and allergies. Trips followed to the United States in the late 1960s and early 1970s, when Dad visited specialists using provocative neutralising treatment, new at the time.

Dr Chunn set up a practice in central Auckland offering treatment for allergies and during her eulogy at Jerry's funeral in April, his daughter Louise pointed out that during a school holiday when she helped out on reception at his surgery in Dilworth Building on Queen Street, "we were quite untroubled by patients". In fact, some of Jerry's peers in his early years of applying the provocative neutralising method referred to him, playfully or not, as "a quack".

But the practice grew, and the family refrigerator at 469 Parnell Road in the mid-1970s was host to distillations of allergens in little bottles which would be taken to his new surgery at 473 Parnell Road and tested on an ever-growing number of patients. To a child who would sometimes venture next door for a look at what his dad did, it appeared a very simple procedure. All you needed to do was make a neat line of pricks up a patient's arms with an assortment of hypodermic needles. The result would be either nothing special at all, or vivid red blotches which indicated Dad was getting nearer to a diagnosis.

Back at home he kept strict patient privilege, only going so far as to sometimes mention the emotional strength families of hyperactive children must require to live with an affliction which was so misunderstood and destructive and yet almost lampooned by those who had no idea. The families came from all levels of society, and as far as I know Dad didn't show great alacrity in pursuing bad debtors. Over the decades I have met many strangers who, when they recognise the surname, say: "Your father helped my family so much."

Dad admired many authors, from Shakespeare to Tom Wolfe, but P.G. Wodehouse was a constant paperback companion throughout his life, as the music of Bing Crosby or Frank Sinatra drifted softy from an adjacent room. None of his children entered the sciences, but Jerry followed their paths as they ventured off into the music business, opened restaurants and worked in journalism or labouring.

His eldest son, Mike, was a founding member of Split Enz, and no other Auckland doctor attended so many concerts by the band in the 1970s. Citizen Band, or CB (for Chunn Brothers), came next, fronted by eldest sons Geoff and Mike. Dad even showed up to a blaring gig by one of my bands in the 1990s in Sydney. He kept an open mind, and he was never judgemental.

The little church in Parnell was packed for Jerry's funeral, with some people standing at the back or filling up the choir loft. At the end of the service, when Dad's casket was rolled out, everybody clapped.

Jeremy Chunn, a son who is a journalist in Sydney, wrote this obituary.

THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

# Andrew Richmond (Tangi) Martin

*MB ChB, Dip Obst (15 July 1921 – 2 February 2012)*

Dr "Tangi" Martin started his medical practice in Taupo in 1954. Both he and Libb (his wife) were Wellington people and decided to start a practice somewhere in New Zealand 'close to water'.


At that time Taupo's population was about 2000 and there were two other small practices but those doctors soon retired. Electricity had just arrived in Taupo and Tangi did night surgery by candle light in his temporary rooms and then later they were lit by a cable from a hut next door.

Taupo then was a very different place to what it is now. There were no sealed roads, no supermarkets, shared party lines, a dodgy local telephone exchange and homewares came with travelling salesmen. A doctor's practice ranged far into the surrounding countryside. In those days Taupo's community was half Maori and half Pakeha.

The local Maori dubbed Tangi the 'takuta', the Maori word for doctor. He wasn't always paid in money (a consultation cost half a crown); usually it was venison, trout, fruit, eggs and (rarely) whisky.

Tangi's practice was half home calls and half surgery visits. Many of the more complex family matters he preferred to handle at night surgery when he could spend longer sorting out the family problems. And of course there were many maternity cases—that is until the 'pill' arrived in the 1960s. The Maternity Home was his second home and if he wasn't there during the day he was called out during the night, pyjamas sticking out from under his trousers.

Local doctors were integral to the community. Tangi was the police and St John's doctor, attended the boxing and racing in the capacity of medical officer and eventually when the original hospital was built, became the first Medical Superintendent. Local doctors did most of the minor surgery there although Tangi said they were severely limited by the availability of drugs and equipment.

Specialists were few and far between—General Practitioners had to deal with a huge range of ailments; people flinging themselves over the Huka Falls, depression and other mental illnesses; a lot of asthma in the Taupo region; car, boat and ski accidents; and often a trek into the surrounding forest to tend to accidents. Then there was a weekly surgery in Turangi including visiting the two local prisons, the convent at Waihi and a local marae.

For many years he was the Chairman of the Waikato/Bay of Plenty Disciplinary Committee of the Medical Council. It was indeed a busy life for a doctor which one would have thought left little time for other interests. But Tangi packed a lot into his life outside of medicine. No golf or bridge for him and anyway with six children, leisure time was spent teaching them to ski.

He became a founding member of both the local water and ski clubs and an early member of the Lions Club, In the 1980s he built an historic village—called Huka Village—on the outskirts of Taupo, assembling a group of charming older buildings such as the local Presbyterian church, an early school house and Maori whares to show how Taupo was in the olden days. This passion of recording the old meant that for all his years in Taupo Tangi took photographs of new developments around the town; these now reside in the local museum.

He inherited his business acumen from his father J T Martin—a well known businessman in Wellington. This led him to be on the board of the Association of Medical Practitioners as well as the Medical Assurance Society which he helped to shake down in the early days and which is now a multi-million dollar company.

Tangi always took a pragmatic approach to life. He put it down in part, to his 2 years as a medical officer in the Korean War. As a doctor there he had to invent, beg or borrow much of his medical equipment, even bargaining gin for medical supplies from the Americans. In Korea he got on with everyone and it was this common touch with people that endeared him to the Taupo community and his friends and family at large.

Libb, who was a huge support to Tangi during his eventful life, died just 6 weeks before he did. He is survived by his six children and numerous grand and great-grandchildren.

Robyn Turner, a daughter, wrote this obituary.