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

CONTENTS

This Issue in the Journal

Editorials

Original Articles

Review Article

Clinical Correspondence

Book Review

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

This Issue in the Journal

Taking the pulse: medical student workforce intentions and the impact of debt
William R G Perry, Tim J Wilkinson

The current New Zealand health workforce faces many challenges, including a shortage of resident medical officers. This study explored debt and what factors are important to medical students as they seek to make their decisions about where they will live, work and train after graduation. Fifty-two percent of students planned to leave New Zealand soon after graduation. The average debt was $75,752 which many students thought would influence career choices. The data will help in New Zealand health workforce planning.

Programmatic research in medical education: a national collaboration
Tim J Wilkinson, Jennifer M Weller, Judy McKimm, Barbara J O'Connor, Ralph E Pinnock, Phillippa J Poole, Dale Sheehan, Mike J Tweed, Andy M Wearn

Coordinated research into medical education is needed. This paper summarises a consensus view of priority areas that fit under an overarching theme of "Growing a professional workforce". Seven key areas of activity have been identified: engaging in community and clinical learning environments; improving recruitment and retention; improving phases of transition; assessing professional behaviours; promoting quality feedback; engaging clinical teachers and educational and clinical leadership.

The New Zealand Advanced Choice of Employment (ACE) Scheme: analysis after 7 years of District Health Board cooperation in a competitive employment context
Brandon M Adams, Gregory O'Grady, J Richard Pole

New Zealand medical students in their 6th (final) year of study are called trainee interns. Approximately 360 medical students graduate from New Zealand medical schools each year and compete for jobs as first-year doctors at 20 district health boards. The ACE (Advance Choice of Employment) Scheme is a cooperative matching scheme used by the DHBs and job applicants to administer the complex process of matching employees with employers. The scheme has been run for 7 years and continues to be successful. There are some operational areas that continue to need improvement.

The student code: ethical and professional expectations of medical students at the University of Otago

Lynley C Anderson, Neil J Pickering

Medical students at the University of Otago are now required to sign a 'student code' on beginning medical school. This new requirement has been put in place in response to changes to the medical curriculum that have resulted in earlier and increased contact with patients, healthcare staff and the general public, and in order to recognise and formalise the students' own learning needs. While a student code can most obviously be useful for disciplinary and assessment purposes, the authors make a claim for the code to be used as educational tool to assist students to internalise their obligations to others. The student code, while having common values espoused in other extant codes, is framed with the student experience in mind. The authors discuss the process of development, implementation and proposed review.

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

Array of hope for high-resolution genetic screening services in New Zealand

Christine M Morris, Ursula R Jewell

There is no question that high-resolution genomic profiling by microarray is an important development with high relevance to the clinical diagnosis of an increasing number of human genetic disease conditions. That is why this technology, first introduced in the late 1990s[1,2] and developed since through intensive international research, is now widely implemented as a clinical tool in hospitals and diagnostic laboratories throughout Europe, the USA, Australia and many other countries.

Uptake has been slower than hoped in New Zealand. For this reason the review article published in this issue of the *Journal* by Dr Donald Love and colleagues (http://www.nzma.org.nz/journal/123-1318/4211) summarising key elements of the technology and its diagnostic applications will serve the readership well.

Human genetic disorders are caused by abnormalities that affect genes or chromosomes. Genetic abnormalities include DNA alterations of copy number, structure or nucleotide sequence. Since 2000, the Human Genome Project has shown that the human genome comprises more than 3 billion base pairs (bp) of DNA that are carried through the generations on 23 different chromosomes. Healthy cells that make up our somatic tissue are diploid, having one set of chromosomes from each parent and therefore 46 chromosomes and a total of 6 billion bps of DNA.

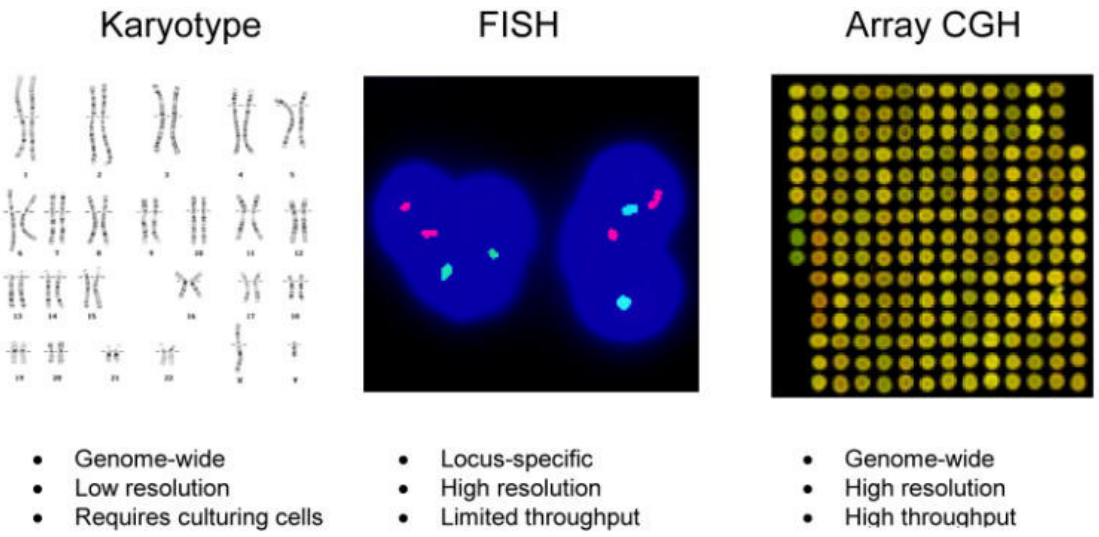
New research shows that only about 2% of total genome content codes for the estimated 20,000 protein-coding genes. Because many human genetic disorders are caused by submicroscopic changes affecting just one or a few of these genes, sifting through this vast molecular mesh to identify disease relevant changes has been hugely challenging. In contrast, changes to the copy number of entire chromosomes (e.g. trisomy 21 associated with Down syndrome), or structural alterations such as translocations or deletions that change the size or shape of chromosomes (e.g. t(9;22)(q34;q11) associated with chronic myeloid leukaemia), are readily identified by conventional microscopic assessment of cultured cells that have been arrested at metaphase.

DNA is highly compacted during this phase when cells are preparing to divide. In healthy cells, each of the 46 chromosomes are visible as discrete entities when aligned into a karyotype (Figure 1). Such cytogenetic methods allow genome-wide assessment, and have been the frontline test for genetic diagnostics in New Zealand since 1961.

Currently, samples referred to diagnostic laboratories for genetic testing are routinely analysed by karyotype assessment, or at the other extreme, using locus-specific molecular genetic assays such as polymerase chain reaction (PCR) often in combination with DNA sequencing to identify mutational changes.

Fluorescent *in situ* hybridisation (FISH), a more recently developed molecular cytogenetic assay, has to a degree bridged the gap to allow identification of aberrations not detectable by conventional cytogenetics and which are not amenable to PCR.

Figure 1. Representation of a conventional normal Giemsa-banded karyotype (left), two interphase cell nuclei after FISH using locus-specific red and green labelled DNA probes (centre), and a section of a microarray chip after hybridisation of test and reference DNA (right)

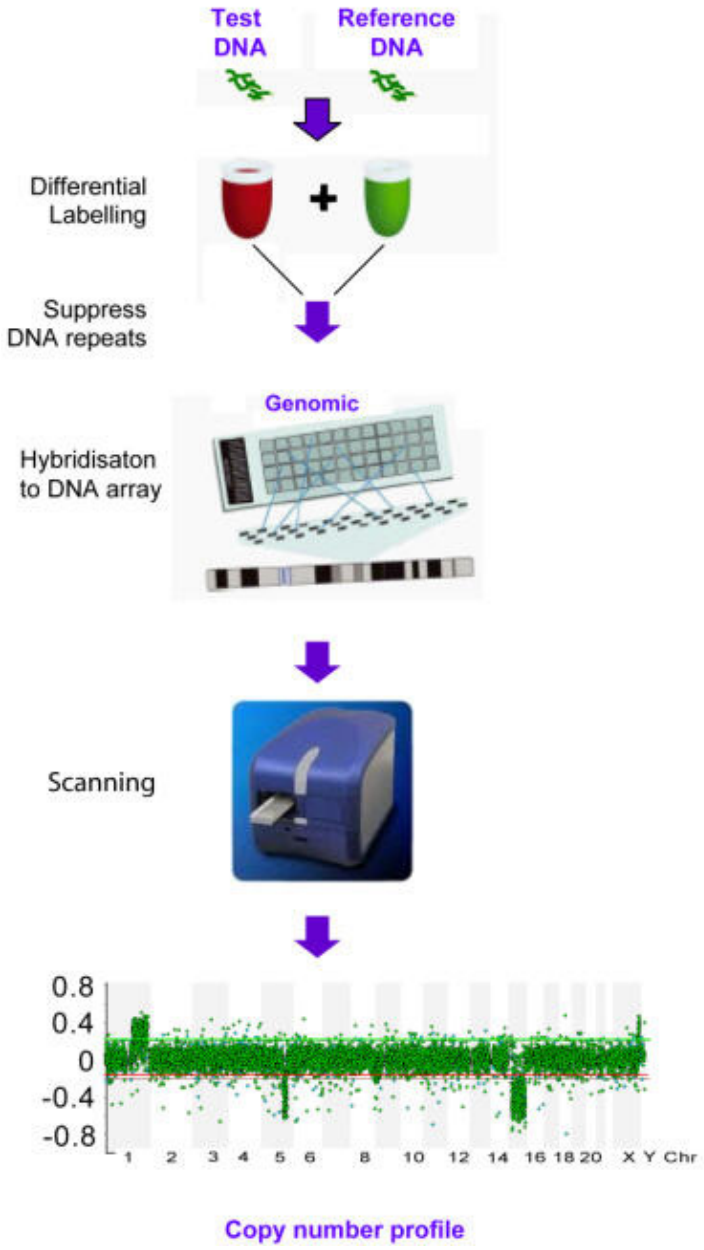


High-resolution genome profiling platforms such as array comparative genomic hybridisation (array CGH) now give opportunity to quantify DNA copy-number imbalances across the genome in one assay at the resolution of entire chromosomes, parts of chromosomes, individual genes or parts of genes. Test and reference DNA samples are labelled with different dyes, then both samples are co-hybridised to a large number of specific DNA sequences that have been spotted onto a glass microscope slide (Figures 1,2).

The spotted DNA sequences are well-defined and can be linked directly to international human genome databases, thereby facilitating immediate identification of genes mapping to copy number alterations associated with any given clone. The DNA that is spotted onto the slide can be in the form of large-insert genomic DNA clones such as bacterial artificial chromosomes (BACs) typically used in FISH assays, cDNA fragments or oligonucleotides.

After hybridisation, slides are scanned to quantify relative binding of test and reference DNA to each spot on the array. Sophisticated bioinformatic analysis tools are now available to assist with analysis of the enormous amounts of data produced by these assays.

Figure 2. Schematic representation of the array CGH procedure



The potential of array CGH is increasingly apparent from the scientific literature, and the commercialised market is attuned to provide diagnostic array platforms which utilise this and related technologies. Indeed, in overseas countries, array CGH data already provides clinicians with crucial information for prenatal and postnatal diagnosis of genetically inherited disorders. Significantly, a recently published consensus statement from the International Standard Cytogenomic Array (ISCA) Consortium declares that chromosomal microarray is now the preferred front-line clinical diagnostic test for individuals with developmental disabilities or congenital anomalies.[3]

There is also increasing awareness that therapy may be better targeted for a subset of patients diagnosed with sporadic cancers including leukaemia and myeloma when stratified according to underlying genetic changes that are exposed by array CGH.[4–6]

Research has shown that most cancers are not inherited, but that they are determined by genetic changes that are acquired during the lifetime of an individual. In many cases, very specific genetic tests can accurately diagnose cancer type, and provide markers to measure subsequent treatment response. The type of genetic change may provide an indication of future prognosis, and may also determine response to particular cancer treatments. The availability of reliable, accurate and timely genetic testing services would ensure that cancer patients are better managed in the early stages of their diagnosis, therapy is safely and rationally administered, and responses precisely monitored.

An unexpected early discovery from high-resolution genetic profiling studies was the identification of copy number variations (CNVs) detected in the genomic DNA of healthy individuals. CNVs are deletions and duplications of DNA strands that range in size from a few hundred bp to several million bp. The exact number of CNVs remains unknown, but many thousands have been identified to date, and they are estimated to occupy 13% of the genome.[7]

Distinction between CNVs that have not been linked to adverse health outcomes, generally referred to as “normal CNVs”, and pathogenic CNVs is essential in the analysis of array CGH data in order to link specific CNVs to disease status. Research initiatives in progress are yielding a wealth of new understanding about the size, frequency and type of structural genome variants that occur, and their role in human disease.[7]

In 2008, we conducted a market survey and identified two main reasons why customers would use a high-resolution genetic screening service rather than order an alternative diagnostic genetic test that they might be more familiar with. The first reason was the high-resolution platform is likely to quickly provide an indication of the underlying cause of the disease. The second reason was such a service is likely to provide guidance towards choice of treatment approach. Our survey indicated that purchasing decisions would also need to take into consideration the economic benefits in patient diagnosis and treatment that such a diagnostic service would provide.

The cost of array CGH is competitive compared with that of conventional cytogenetic and molecular assays. However, the availability of any particular treatment approach is governed by legislation and politics within each country. It is therefore possible that a diagnostic array CGH assay returns a genome profile that is indicative for a specific treatment, but that treatment might not be an available choice for the clinician due to national legislation and/or budgetary constraints. Although in that scenario the genome profile returned by the service would be of no real benefit to the clinician, the patient may value the diagnostic information should he or she choose to find the appropriate treatment overseas.

The New Zealand public, including especially those diagnosed with genetic disorders of unknown cause and some cancer conditions, will reap most benefit from the introduction of diagnostic high-resolution genomic profiling services. But this benefit can only occur when there is raised awareness in the communities of general

practitioners and specialist care, and when the service is made available through properly accredited, appropriately staffed and resourced diagnostic laboratories.

The University of Otago first pioneered introduction of microarray-based technologies into this country, establishing the Otago Genomics Facility for research in 2000. Despite this achievement, and subsequent establishment of core microarray research facilities in other academic centres, the potential for rapid integration of high-resolution genome screening arrays into New Zealand diagnostic laboratories has been largely lost in the quagmire of translation.

For the past 8 years, we have worked collaboratively with clinical and research colleagues locally and overseas to successfully apply high-resolution genetic screening by array CGH to patient samples, mostly from patients diagnosed with leukaemia. In many cases, array CGH assessment has detected clinically relevant chromosomal rearrangements that were not otherwise resolvable using conventional cytogenetic or molecular genetic methods.[8,9(and unpublished data)]

Within New Zealand, to our best knowledge, no public or private service provider is yet offering array CGH routinely as an in-house high-throughput diagnostic service. However, there is hope in that Wellington's Genetic Service has started quietly, but effectively, offering a limited service, and now, Auckland's LabPlus also appears mobilised.

It is unfortunate that funding structures in our country are such that basic or "original" biomedical research endeavours seem to be favoured academically ahead of efforts to translate new findings into the diagnostic laboratory setting. On the flip-side, when research is not their core business, hospital laboratories often have limited scientific expertise and resource capacity to keep abreast of and develop new genetic tests. Because of these funding arrangements, recent and significant biotechnological advancements (such as array CGH) have fallen into a translational grey zone.

Despite these problems, there is no doubt that future application of high-resolution DNA profiling technologies will facilitate identification of genomic aberrations where current diagnostic techniques have failed. These technologies will continue (in years to come) to provide new information that is critical to the understanding of molecular pathways that determine disease development and progression. Identification of the underlying genetic cause of disease is a necessary key step to facilitate improved diagnostic stratification, more appropriate clinical management, and the development of better therapies.

High-resolution genetic screening is a more economical way to diagnose genetic disorders, it will serve to optimise treatment, and will result in better clinical outcomes for individuals diagnosed with genetic disorders in New Zealand.

It is time we caught up.

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Towards more uniform conflict disclosures: the updated ICMJE conflict of interest reporting form

International Committee of Medical Journal Editors (ICMJE): Jeffrey M Drazen, Peter W de Leeuw, Christine Laine, Cynthia Mulrow, Catherine D DeAngelis, Frank A Frizelle, Fiona Godlee, Charlotte Haug, Paul C Hébert, Astrid James, Sheldon Kotzin, Ana Marusic, Humberto Reyes, Jacob Rosenberg, Peush Sahni, Martin B Van Der Weyden, Getu Zhaori

The great variability in the processes that different journals use to ask about and report authors' potential conflicts of interest creates confusion for authors, readers and the public. To help lessen this confusion, the International Committee of Medical Journal Editors (ICMJE) developed an electronic uniform disclosure form and placed it in the public domain in October 2009. The ICMJE member journals piloted the form, encouraged other journals to use it, and invited feedback. We recognised that the reporting of competing interests is complex and nuanced and sometimes contentious, and thus anticipated modifying the form based on feedback received. We are grateful to the many authors, editors and other interested parties who took the time to comment on the form and its implementation. The issues raised ranged from technical problems about the correct deployment of the form (it requires the user to download version 8.0 or higher of the free Adobe Reader software to function) to concerns about the ethics of inquiring about non-financial associations. The Committee considered these valuable comments and revised the form at our most recent meeting.

We made several modifications. The major change in the reporting instrument is the removal of the queries about potential competing interests of authors' spouses and minor children and about non-financial competing interests. We made this change based on the largely negative feedback that we received about these sections. People who commented about this issue made it clear that there is immense difficulty in defining competing interests beyond those that involve the direct exchange of money from an interested party to an individual author or the author's institution. Because the Committee continues to believe that there are situations in which indirect or non-financial factors could influence (or appear to influence) the conduct or interpretation of work, we replaced the specific questions with a single open-ended query (new Section 4) that asks, "Are there other relationships or activities that readers could perceive to have influenced, or that give the appearance of potentially influencing, what you wrote in the submitted work?" This change places the onus on the person completing the form to identify and report appropriate non-financial competing interests. It has the advantage of being less intrusive than the previous queries, while providing a locus where authors can report non-financial relationships that may be perceived as potential conflicts of interest.

In response to comments about the clarity of the form, each field in the form now has a numeric designation. We have modified the language in the instructions and in the individual queries. To make the form more useful to non-native English speakers, we

are creating a glossary of terms used in the form and will be posting guidelines for translation of the form's instructions into multiple languages. The translation of this form is particularly challenging because translations must capture the essence of the queries rather than their literal meaning. The glossary and guidelines will be available at the ICMJE website (http://www.icmje.org) in the next few months; translations will be posted on the ICMJE website as they become available.

The new form, in English, is currently available on the ICMJE website and the websites of our member journals. Authors who have completed the older version of the form in conjunction with a journal submission need not complete the new form, but the new form will be the standard for new submissions. We welcome continued input from the user community. Comments can be sent via the "Contact ICMJE" link at the ICMJE website. The Committee will consider comments received before 1 May 2011 when we prepare the next iteration of the uniform conflict of interest disclosure form.

The complexity, subjectivity and emotionality of conflict disclosure assures that some will consider this vehicle for reporting to be excessively burdensome, while others will think it falls short in one area or another. We cannot, however, let the perfect be the enemy of the good. We hope that the revised ICMJE form will be another step towards simplifying and standardising reporting of conflicts of interest. A more uniform reporting process will alleviate the confusion that prevails when multiple journals use different reporting formats, and will ease the reporting burden on members of the biomedical research community, so they can pursue the research that will improve the care that we deliver to our patients. With these thoughts in mind, we encourage all journals to adopt the new version of the uniform disclosure form.

Note: This editorial is being published simultaneously in all ICMJE member journals.

Disclaimer: Peush Sahni's affiliation as Representative and Past President of the World Association of Medical Editors (WAME) does not imply endorsement of this editorial by WAME member journals that are not part of the ICMJE.

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Taking the pulse: medical student workforce intentions and the impact of debt

William R G Perry, Tim J Wilkinson

Abstract

Aim To define what factors are important to medical students as they make decisions about where they will live, work and train after graduation, and to explore the effects of student debt

Method A mixed quantitative-qualitative questionnaire to all 5th and 6th year medical students residing in New Zealand in 2008. Questions related to students' perspectives of the workforce, debt, and workforce intentions.

Results 372 medical students completed the survey (55% response rate from those in NZ at the time of the survey). Fifty-two percent of students planned to leave New Zealand at the start of PGY2 or 3. The average debt was $75,752. Thirty-six percent said their debt would influence their choice of vocation, 39% their choice of location of work in New Zealand and 64% their choice of locality of work in the world. Twenty-six percent and 25% believed that they would be valued by the hospital management and government respectively. Students most commonly cited financial incentives to work overseas and to locum.

Conclusion Strategies to counter emigration trends in the New Zealand health workforce need an holistic approach. Debt levels need to be countered, and the perceived lack of value of graduates needs to be rectified.

The current New Zealand health workforce faces many challenges. The WHO Report *Can New Zealand Compete*,[1] published in May 2008, highlighted the heavy reliance on overseas-trained doctors to supply our medical workforce, and the vulnerable position New Zealand holds in the 21st Century global doctor market. It is claimed New Zealand has the highest proportion of overseas-trained doctors in the OECD.[2]

Not only is New Zealand importing overseas-trained doctors, but it seems to be exporting locally-trained doctors: the same report identified that loss of doctors in the early postgraduate years was of significant concern, with 28% of New Zealand-trained doctors leaving the country by PGY3.[1] Indeed, a 2006 study suggested that 66% would consider leaving within 3 years of graduating.[3]

Much emphasis has been placed on the factors and conditions that drive doctors in training offshore. Ongoing industrial action, and increasing acknowledgement of the extent of the medical workforce crisis has led many to speculate on the drivers for medical emigration—both from New Zealand to offshore, particularly Australia, and from contractual employment to locum work.

Student debt has been identified as having a significant impact on life choices of doctors in training. In 2001, a series of articles was published focusing on medical student debt in New Zealand.[4–6] It was estimated that mean debt at that time was

above $60,000 per student, and it was noted that there was a significant correlation between the predicted size of debt and students' intentions to practise medicine overseas.[4]

A 2002 survey of medical students in Canada was published around the same time suggesting that increasing levels of debt results in more medical students taking money into consideration when choosing specialty and location of practice.[7] Another has recently shown that medical students are able to accurately predict income by specialty from an early stage of training and have a negative perception of income in general practice, an area of shortage in New Zealand.[8]

The latest figures to estimate the amount of debt are from the University of Auckland in 2008. It was found that one-third of graduating medical students owe more than $75,000 to the Government.[9] Moore et al published two papers in 2006 that showed the total average doctors' debt at graduation was $65,206.[3,10] Twenty-four percent of students owed more than $88,875, with a total of 92% having some form of debt.

The same paper showed 42% of students said their debt had influenced their decision when and whether to have children, and 40% reported that their debt would influence their career choice. Fifty-five percent of respondents had considered leaving the country because of the student loan debt.

As a result of such studies, debt and remuneration are increasingly being recognised as major contributors to the loss of New Zealand doctors offshore. Over the past 5 years we have seen an increase in the trainee intern grant, the introduction of interest-free student loans, and a voluntary bonding scheme—all of which have acknowledged the importance of debt. However, there has been little work on what impact internal values, early medical socialisation, professional attitudes, industrialisation and the changing nature of the training environment have had on senior medical students' perceptions about working and training in New Zealand.

The aim of this study is to define what factors are important to medical students as they seek to make their decisions about where they will live, work and train after graduation. The study also aimed to update figures on student debt, and further identify its influence.

Methods

Study design—A three-part survey was developed by the authors firstly to capture current perceptions and attitudes of senior medical students about living, working and training in New Zealand, and secondly to identify which factors are the most significant determinants in deciding to stay in New Zealand or practise overseas in the short, medium and long term.

The survey comprised sections on students' perspectives of the workforce, their financial status, and their workforce intentions. Response modes included Yes/No, option-select, text and numerical input, and 5-point Likert scales. Respondents were also invited to submit free-text answers.

The survey was piloted by university academic staff and modified where necessary. It was conducted in identical hard-copy and online versions. The online version was developed using Quask FormArtist (v5.1) software and hosted on the website the New Zealand Medical Students' Association. Online surveys could only be completed once. Both versions were confidential and there was no way of identifying which students participated.

All 5th- and 6th-year students enrolled in medical schools in New Zealand were invited via email to complete the questionnaire in October/November 2008. Students on overseas placements at the time were not included. All students were informed of the online questionnaire via student email lists.

Ethical approval for all participants was obtained from the University of Otago Human Ethics Committee.

Statistical analysis—Results from the online survey were converted from Quask to Microsoft Excel 2007 software and merged with the results from the manually-entered hard-copy survey. The two spreadsheets were collated. Not all respondents answered every question and missing responses were treated as absent data in all analyses.

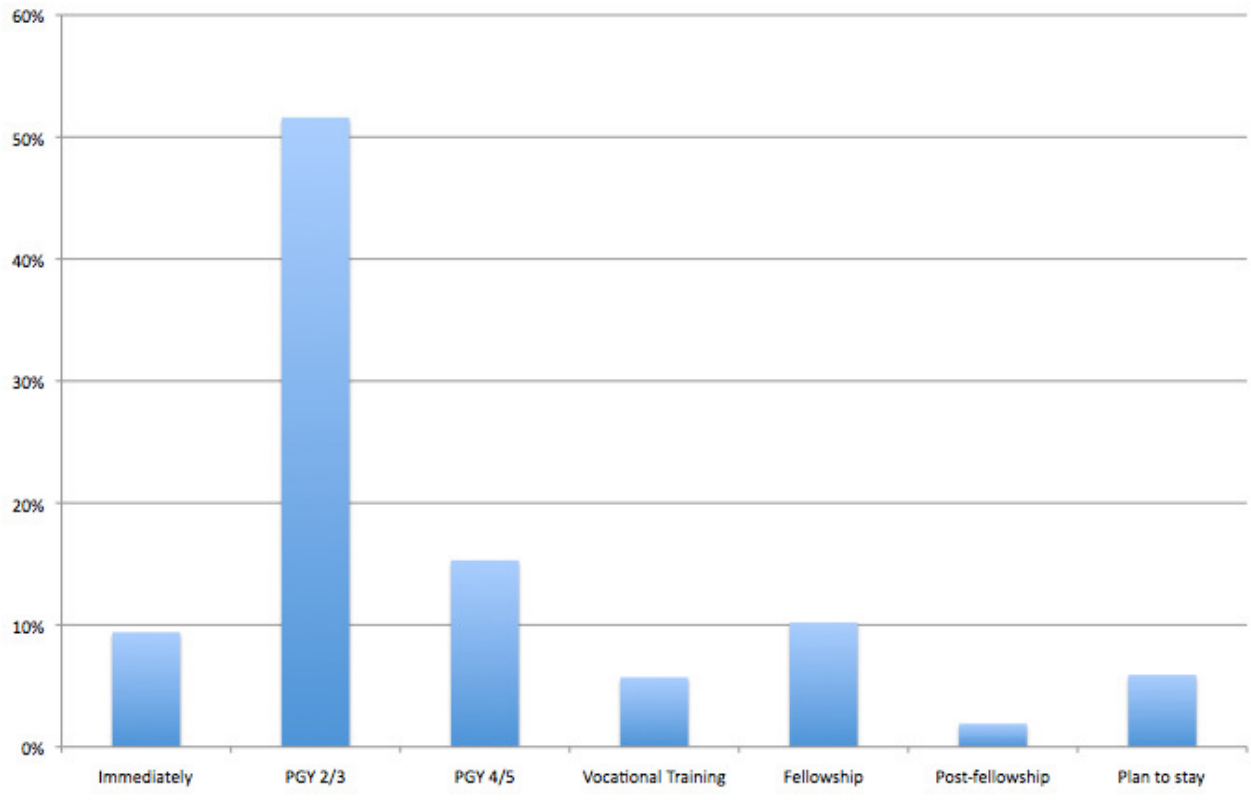
SPSS (v16.0.1) software was used for analyses comparing responses by entry type, gender, ethnicity, relationship status, and year level. Categorical variables were compared using Chi-squared tests. Continuous variables were compared with analysis of variance or by Pearson correlation coefficients as appropriate.

Results

Participants—372 of 681 (55%) eligible medical students responded. The response rate was the same from 5th year as 6th-year students. The mean age of respondents was 24 years (range of 21–44; standard deviation 3.2) and 58% were female. Gender, ethnicity, school of medical study, and entry type were representative of the medical student population. Ten percent of students identified themselves as international students. Thirty-five percent of students identified themselves as being in a long-term relationship, and 9% were married. There were no significant associations with ethnicity or relationship status in the results.

Intentions—94% of students planned to work overseas at some point in their career. Nine percent planned to leave immediately after graduation, and 52% planned to do so at the start of PGY2 or PGY3 (see Figure 1).

Figure 1. Time of intended move overseas



Thirty percent of students planned to leave for fewer than 2 years, 40% for between 2 and 5 years, and 24% planned to leave for greater than 5 years of which 30% planned to leave permanently.

Australia was stated as the most popular destination, followed by UK/Ireland. There were no significant differences between those who identified themselves as international students and other respondents.

Thirty-nine percent of students intended to locum. Of these students, 65% intended to do so for less than 2 years and 32% for 2 to 5 years.

Those students who intended to go overseas were more likely to locum (142/328 or 43%) than those who did not intend to go overseas (3/24 or 13%; Chi-squared=7.56, p=0.006).

Perceptions—73% percent of respondents believed that New Zealand is a good place to work. Only 62% (38/61) of those who entered medical school after a prior degree believed it was a good place to work compared with 75% (234/311) who entered from the other routes (Chi-squared=14.744, p=0.022).

Ninety-five percent of respondents believed that New Zealand is a good place to live, although international students and those who gained alternative entry were less likely to state this (62/73 or 85%) compared with school leaver/health science entrants and university graduates (291/299 or 97%; Chi-squared=21.869, p=0.001).

There was no association between those who believed New Zealand was a good place to live and when they planned to leave the country. However, those students who disagreed that New Zealand was a good place to work were more likely to leave New Zealand for longer: 43% of students who disagreed that New Zealand is a good place to work intended to work outside New Zealand for longer than 5 years, compared with 19% of students who agreed that New Zealand is a good place to work (Chi-squared=11.11, p=0.011).

Sixty-six percent of respondents believed that they would be valued by their medical colleagues in the workforce. Female students (32/217 or 15%) were more likely to believe they would be undervalued by their medical colleagues than male students (9/155 or 6%; Chi-squared=11.437, p=0.003).

Sixty-four percent believed they would be valued by the public, 26% believed they would be valued by hospital management, and 25% believed they would be valued by the Government. Those who felt undervalued by the government were more likely to locum (74/158 or 47%) compared with those who felt valued (26/93 or 28%; Chi-squared=13.112, p=0.011).

Sixty-three percent of students believed the New Zealand clinical environment to be supportive, with 13% believing that it is unsupportive. On the other hand, 57% of students believed the Australian clinical environment to be supportive, with 1.6% believing that it is unsupportive.

Finance—89% of students said they were going to graduate with debt. Their average expected debt at graduation was $75,752. Older students had more debt (r=0.16, p<0.01). International students had on average more debt (mean $104,000; SD

60,000), followed by university graduate entrants (mean $86,000; SD 25,000), "Others" (mean $86000; SD 48,000), and then school leavers/Health science entrants (mean $68000; SD 30,000; F=11.028, p<0.001).

Thirty-two percent of students always or often worry about their debt, and 34% sometimes do so. The amount of worry was positively correlated with the amount of debt (F=5.645, p=0.000) (Table 1).

Table 1. Mean debt levels (in thousands of dollars) categorized by level of worry about debt

How often do you worry about your debt?	Mean *(thousands of dollars)*	SD	N
Never	52.4	31.1	22
Rarely	71.8	42.6	69
Sometimes	72.4	29.0	123
Often	84.6	33.9	88
Always	89.5	39.9	30

Thirty-six percent of students responded that their debt influenced their choice of vocation more than a small amount (i.e. a moderate amount, a large amount a great amount, or would determine choice), whilst 39% said it would influence their choice of locality of work within New Zealand; 64% said debt influenced their probability of doing locum work, and 58% said debt influenced their choice of locality of work in the world.

Students were asked whether having less debt would change their decision regarding vocation, location and taking up locum work. Thirteen percent agreed that having less debt would affect their choice of vocation, and a further 20% stated it might affect their choice. Eighteen percent agreed that having less debt would affect their choice of locality in New Zealand, and a further 24% stated it might affect their choice. Thirty-nine percent agreed that having less debt would affect their choice of locality in the world, and a further 25% stated it might affect their choice. Forty-one percent agreed that having less debt would affect their probability of locuming, and a further 29% stated that it might affect their choice.

The greater the debt students had, the more likely they were to say that having less debt would influence their choice of locality of work in the world (F=7.816, p=0.000), in New Zealand (F=4.148, p=0.017), and their choice of career (F=7.191, p=0.01) (Table 2).

Those students not intending to work overseas were more likely to say that less debt would not affect their choice of locality in the world (16/24 or 67%) compared with

those who did intend to work overseas (116/348 or 34%; Chi-squared= 13.281, p=0.004).

Table 2. Mean debt per student responses as to whether or not less debt would influence career choice, choice of career locality in NZ, and choice of career locality in the world (in thousands of dollars)

If your debt were smaller, would it influence your...	Yes			No			Maybe				
	Mean	*SD*	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*	*F*	*P*
potential career choice	91.9	48.7	46	79.5	30.0	68	71.2	32.9	218	7.191	<0.01
geographic location of work in NZ	85.7	37.5	62	78.3	24.4	84	71.3	38.5	186	4.148	0.02
geographic location of work in the world	82.7	36.8	135	78.1	29.9	89	65.2	36.2	108	7.816	<0.001

Free text responses—Students were asked what factors would make them more likely to go overseas. Ninety-four percent or 351 students provided a response. Fifty-six percent stated financial motivation, 46% stated reasons of greater experience and/or lifestyle, 45% stated greater job prospects, training and/or educational opportunities, 21% stated better working environments, conditions and/or support, and 18% stated reasons related to family, partners, and/or friends.

They were also asked to provide reasons as to why they may locum. Forty-two percent or 154 students provided a response. Eighty-four percent stated financial motivation, 27% stated reasons of lifestyle, family and/or flexibility, 19% stated wanting to travel as a reason, and 14% stated wanting to gain greater and/or broader experience.

Discussion

Despite believing that New Zealand is a good place to live, this study confirms that a high number of our medical graduates plan to leave the country by PGY 3. Nearly a quarter of graduates plan to leave for longer than 5 years. Our data suggests that less are intending to leave by PGY 3, however, in comparison to the 2006 Moore study.[3]

Eighty-nine percent of students said that they were going to graduate with debt, the average of which was $75,752. There was no significant difference between debt

accumulated by male or female students unlike the 2008 Auckland study that suggested that males had bigger loans.[9]

Several advocacy groups have suggested that these high levels of debt are responsible for the large shift overseas. Although often met with some cynicism, the results of this study make it hard to suggest that it is not a contributing factor. Fifty-six percent of respondents cited financial motivations for going overseas, and 84% cited financial motivations for locuming.

Addressing debt and providing greater financial incentives in the workforce, therefore, could not only have a positive impact on career choices and locality of work, but could also reduce the number of doctors who locum and who thereby currently absorb an alarming proportion of this country's medical workforce expenditure.

It is tempting to seek a single causative factor for this emigration trend but the cause is likely to be multi-factorial. This may frustrate those designing policy as it is much easier to do so with single factor objectives, however a more holistic look at the workforce may allow for some change.

It is important to look at whether or not, for example, our workforce feels valued. Responses suggest that medical graduates are not expecting to be greatly valued in the health system. Although nearly two-thirds of students thought they would be valued by the public and medical colleagues, there is still a third with a significant driver to look elsewhere to work.

A 2002 review concluded there was significant correlation between how valued an employee felt and job satisfaction, positive mood, commitment, performance, and lessened withdrawal behavior.[11] It is therefore crucial that our doctors feel valued for their satisfaction and the employer's.

What is more alarming is that only a quarter of students thought that they would be valued by hospital management or by the Government. This is not only disappointing but has significant implications as those who felt undervalued were more likely to indicate they would opt for low-commitment high-paid locum jobs rather than a RMO position at a district health board. This has implications for specialist training, and long-term commitment to New Zealand and the health workforce. Certainly, both the Government and hospital management groups need to explore ways to improve these perceptions of being undervalued.

The free text responses were similar to the Moore study[3] and showed that there are reasons for people leaving the country that cannot be countered at the time; forty-six percent stated reasons of greater experience and/or lifestyle, and 18% stated reasons related to family, partners, and/or friends. It is therefore important that we not only focus on medical graduate retention, but also recruitment of New Zealand graduates who have already gone overseas. Our graduates will have a drive to gain wider experience, and this is ultimately beneficial to the New Zealand public. They should not be punished for gaining this experience but rather encouraged to return.[12]

This study begins to provide insight into some of the factors behind the current workforce crisis. The representativeness of the study could have been improved with a higher response rate, however the demographics of respondents were reflective of

the general survey population and therefore it is believed responses can be taken as representative.

There was potential bias in responses hosting the survey on the NZMSA website, as the Association was at the time of the survey actively in discussion with the Ministry of Health about medical student debt. Students may have provided answers that were more likely to help these discussions. Students were instructed not to complete the paper survey if they had done so online, however there was potential for people to submit two responses this way.

It would be ideal to construct a follow-up study of these students during their early postgraduate training years to determine whether perceptions are translated into actions.

Ultimately it is the young who become the backbone of the established workforce with time. It is therefore important that they are valued. Resources, time and money must be invested not only in their undergraduate education, but their ongoing learning and commitment to the New Zealand public—"If we wish our future health professionals to work for the public good, then is it unreasonable for them also to expect that the public might be good to them?"[12]

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Programmatic research in New Zealand medical education: a national collaboration

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Abstract

Aim We aimed to identify areas that are a high priority for medical education research in New Zealand and that would benefit from a coordinated collaborative approach as an initial step in developing a coordinated research strategy.

Methods A modified Delphi technique was used to reach consensus, among medical education researchers in New Zealand, on the optimal areas of activity.

Results The programme of research fits under an overarching theme of "Growing a professional workforce". Seven key areas of activity have been identified: engaging in community and clinical learning environments; improving recruitment and retention; improving phases of transition; assessing professional behaviours; promoting quality feedback; engaging clinical teachers and educational and clinical leadership.

Conclusion This programme of medical education research projects is in the national interest, assists in theory building, helps develop research groups with similar interests, helps avoid duplications, ensures efficient use of funding opportunities, and makes effective use of existing expertise.

Medical education research is alive and flourishing in New Zealand. There are many exciting projects being undertaken within the Universities of Otago, Auckland and Canterbury as well as within healthcare organisations, postgraduate Colleges and District Health Boards. However, many of these projects are occurring in isolation. To encourage cross-fertilisation of ideas, pool limited resources and reduce the potential for duplication of effort, a more coordinated and strategic approach is required.

Medical education research has grown significantly as a discipline over the past decade. Standards for research have been articulated in initiatives such as the Best Evidence in Medical Education (BEME) Collaboration[1] and the Campbell Collaboration, a subsidiary of the Cochrane Collaboration.[2] Scientific evidence is increasingly being seen as the key driver of educational policy and practice, with medical educators looking to the literature to provide professional guidance on matters as diverse as curriculum design, instructional methods, simulation, assessment and professionalism, both in undergraduate and postgraduate settings.[3]

The need for a more coordinated programmatic approach to medical education research has been stated internationally.[3 4] Furthermore, some projects are better undertaken at national level where collaboration and synergies among institutions can be fostered. Developing and coordinating projects within an overall plan of programmatic research assists in theory building in medical education research,[1–3] helps develop research groups with similar interests, helps avoid duplications, ensures

efficient use of funding opportunities, draws on existing expertise, and is in the national interest.

The aim of this study is to define areas of high priority for medical education research in New Zealand that would benefit from a coordinated collaborative approach.

Methods

We used a modified Delphi technique to reach consensus on the optimal areas of activity.[5] This comprised four stages.

- A group of medical education researchers, drawn from the Australia and New Zealand Association for Health Professional Education (ANZAME) membership, met to identify synergies in research activities and to identify national priorities where collaborative cross-institution research should be undertaken.
- These research areas were collated into themes and key research questions, which were then circulated to the group for expansion, clarification or amendment as needed.
- Once consensus was reached, this was circulated as a discussion document to all members of ANZAME working in New Zealand who had expressed an interest in collaborative research in medical education.
- Finally, feedback from this wider group of ANZAME members was incorporated. The revised document was re-circulated to the initial group and final consensus was obtained.

In developing the key themes for the research programme, the following criteria were considered. The research (1) should have national importance, (2) would benefit from collaboration (or could only be done at a national level), and (3) should have findings that could be generalisable or transferable to other countries and/or to other disciplines outside medicine.

Results

The focus group comprised 17 medical educators. This group, through discussion and subsequent member validation, identified the following six broad programmes of research:

- **Engaging in community and clinical learning environments**
- **Improving recruitment and retention**
- **Improving phases of transition**
- **Assessing professional behaviours**
- **Promoting quality feedback**
- **Engaging clinical teachers**

This was sent for wider consultation to 11 additional New Zealand members of ANZAME who expressed an interest in medical education research and who were not part of the focus group. These members endorsed this approach, helped refine the research questions and added a seventh project: Educational and clinical leadership.

We have classified these programmes under the overarching theme of “Growing a professional workforce”. These are described below. For each area, suggested research questions and potential projects have been identified and are shown in Table 1.

Table 1. Some questions to be considered under each research theme

Engaging in community and clinical learning environments

Engagement in workplace learning

- Based on current literature, what factors have been consistently shown to promote engagement in the clinical learning environment? What further research is needed to identify / confirm these factors in terms of measurable learning outcomes?
- Based on the above, what facilitates or blocks the implementation of these factors? Specifically:
  - What teaching and learning strategies are valued and most effective during medical school and internships?
  - What is the interaction between successful strategies and the context (e.g., medical /surgical /community /rural /Māori health). Do strategies differ, do they need to?
- What are the explicit and hidden learning outcomes of these periods of learning?
- For learners, what is the optimal balance of community-based vs. hospital-based learning environments?

Partnerships, collaboration, boundary crossing

- What are effective models for building community partnerships?
- For learners, organisations and services, what is the optimal balance of community-based versus hospital-based learning environments? What factors might influence this balance?
- What health benefits can be achieved with collaborative approaches
- What are potential models for effective academic- workplace partnerships (esp. across the undergraduate - postgraduate transition)?

Improving recruitment and retention

- What are the effects of current selection methods?
  - How valid are the current selection tools? Are there better ones?
  - Should selection be a meritocracy or of some other form?
  - Should there be restricted entry categories?
  - Are targeted entry programmes resulting in a more diversified workforce? Where do graduates of these schemes end up and for how long?
- What are the effects of current curricula?
  - Which curricular elements have substantial effects on workforce choice and why?
  - How can this information be used to target career choice for priority areas?
- What is the interaction between selection and curriculum?
  - What are the relative effects of selection vs. curriculum in producing a differentiated workforce e.g. regional / rural?
  - Should rural origin students be first priority for rural immersion programmes?
  - What additional support is needed to ensure progression into workforce of students who are Māori or from Pacific Islands?
  - Do different student sub-groups gain any differential effect from the curriculum and learning environments?
- Workforce
  - What will be the role of the doctor in 2025?
  - How can we better "shape" the medical workforce to match health needs?
  - What strategies work best to assist in retention of NZ graduates?
  - What factors would increase the primary care workforce?
  - What is the effect of the new government strategy of targeted bonding to area of need?
  - What levers and drivers optimise retention of PGY1 and PGY2 in the NZ training environment?

Improving phases of transition

- What are the criteria for "effective transition"? How do we measure if students / trainees have made it?
- Do the required competencies progress logically or appear and disappear at the different stages?
- Do some students (or some competencies) get "lost in transition"?
- What is the current evidence on interventions / structures / support/ organisational change or other factors that promote "effective transition"?
- How can assessments be designed to ensure minimum competence levels yet possibly allow accelerated entry into specialty training programmes for competent and confident graduates?
- Closing the quality loop - How can District Health Boards provide feedback from workplace to undergraduate programme and Universities feed forward into pre-registration training?

Assessing professional behaviours

- What are common and/or important elements of lapses of professionalism?
- How can decisions around fitness to practice be made based on observed elements of professionalism or unprofessionalism?
- How do lapses of professional behaviour at medical school relate to future practice after graduation?
- Are there ways to predict those at risk of poor professionalism?
- What should be in a professionalism curriculum and how is it best learnt?
- How can we expose and engage with the hidden curriculum as part of a professionalism curriculum?
- How might an assessment system be constructed to support development of professionalism?

Promoting quality feedback

- How do we measure outcomes of interventions aimed at improving strategies of trainees / learners to encourage feedback?
- Are the currently used approaches to feedback effective in any measurable way?
- What are the current levels of knowledge and skill in teachers in the area of feedback?
- What impact does a particular intervention designed to improve corrective feedback have on the learner?
- What factors affect the success of feedback?

Engaging clinical teachers

- From whom and with whom do medical students and junior doctors learn?
- What motivates these people to engage in teaching medical students and junior doctors?
- What are the needs of this group to support teaching and facilitating learning?
- What factors (personal, professional, organisational) facilitate or create barriers to effective teaching and learning interactions?
- How could these barriers be overcome?
- What evidence is there that an intervention to promote engagement of clinicians in teaching results in improved learning outcomes for medical students and junior doctors?
- How can medical students and junior doctors best be supported to teach?

Educational and clinical leadership

- What are the core components of educational and clinical leadership at different stages of medical education/professional development?
- How should these components be framed (e.g. competencies, qualities, professional attributes)?
- How can medical students and junior doctors learn 'leadership'?
- What motivates teachers and support staff to engage in educational leadership activities?
- What are the needs of these groups in terms of support for educational leadership and management activities?
- What factors (personal, professional, organisational) facilitate or create barriers to effective clinical and educational leadership/management?
- How could these be overcome?
- What evidence is there that leadership development interventions results in improved practice?
- How can we develop capacity to teach leadership?

Engaging in community and clinical learning environments

Effective learning in the workplace is highly dependent on creating an environment where the learner/trainee feels engaged and is able to participate in the daily activities of a healthcare team.[6] This reflects a change in focus from regarding learners as individuals, to viewing learners as members of a community of practitioners.[7] Learning arises from the dialogues and interactions with other team members.

This area of activity aims to explore with learners and supervisors specific and feasible factors that promote engagement in a clinical learning environment, and most importantly how these factors can be encouraged in practice. Secondary aims are to determine if the identified factors are associated with measurable learning outcomes and to explore the effect on the clinical environment of different patterns of workplace-based learning. In short, is the desired symbiosis,[8] whereby both the learning community and the clinical community derive mutual benefit, being realised?

Improving recruitment and retention

It is critical that the medical workforce meets as far as possible the health needs of New Zealand. This means having the right type of healthcare professionals in the right place, doing the right thing at the right time,[9] alongside appropriate health promotion and disease prevention activities. The medical workforce demographics currently do not match the population. Indigenous doctors are underrepresented and there is a high proportion of international medical graduates. A longitudinal study, tracking the journey of medical students through their courses into the workforce, was established in 2006, in collaboration with the Medical Deans of Australia and NZ.[10]

The University of Auckland is into the fourth year of data collection with a complementary study. Linkage of student entry and exit data will be possible from 2010, and data from exiting students is already being linked to the Medical Council of New Zealand registration database. The tracking projects will assist in answering more complex educational questions regarding the interplay among selection, curriculum and the learning environment on career aspiration and destination.[11]

Collaborative projects will enable a comparison of career choices and career locations according to experiences and courses within medical schools across Australia and New Zealand.

Improving phases of transition

Multiple transitions exist in medical training, starting with the move from secondary to tertiary education, and continuing through the various phases of post-vocational training and beyond. The transitions from a predominantly university campus-based education into a clinical environment (such as occurs for early medical students as they progress through the programme) and the move from such environments under university jurisdiction into the workforce can create tensions and highlight previously unrecognised problems.[12]

The transformation from student to expert practitioner requires the assimilation of vast amounts of knowledge, development of appropriate attitudes and behaviours as well as the acquisition of clinical skills within the context of the workplace.[13]

This research area will explore these areas of potential difficulty and identify organisational and educational interventions that can better facilitate these transitions.

Assessing professional behaviours

Professionalism is increasingly recognised as an important component of performance for any health professional. Many of the difficulties that arise in practice seem to stem from problems with unprofessional behaviours.[14] Professionalism is a critical component of ongoing certification of competence and this is an area of interest to many professions. Recent work has described explicit professionalism curricula [15] and highlighted assessable components of professionalism and some potential assessment tools that could be used.[16] However, debate continues around the approach to assessment of professionalism.[17]

This area of research aims to build on existing theory to pilot a programme of assessment of professionalism and to identify effects on practitioner or patient outcomes.

Promoting quality feedback

An important component of learning and ongoing development as a professional is the ability to seek and respond to feedback. A group of medical researchers in NZ and Australia has started exploring models of feedback.[18,19] Traditional models have focused on the role of supervisors and ways in which they can provide effective feedback [20] but newer approaches place more emphasis on the active role that the student or trainee plays in the process.

This area of research aims to investigate strategies that the learner can adopt to recognise, seek, promote and regulate feedback.

Engaging clinical teachers

Much of the teaching and supervision of medical students and junior doctors is undertaken by non-university staff, including other more senior medical students, junior doctors and members of other health professions. This goodwill and altruism

cannot be taken for granted yet is crucial for effective learning of trainees and students in a variety of contexts.

Evidence shows that junior doctors are willing to engage in teaching and, although they perceive a lack of teaching skills, they express a willingness to undertake training in teaching.[21–24] Furthermore, such training has demonstrated positive effects.[21] This project links with the areas of research exploring engagement in community and clinical learning environments.

This area of research aims to explore the motivators, facilitators and barriers to involvement of supervisors/tutors/teachers, and identify strategies that enhance involvement.

Educational and clinical leadership

All sectors of education and healthcare have been subject to massive change, reform and reorganisation and a number of 'failures' have been seen in the way organisations have been equipped to respond to such change. This has raised questions over the leadership capabilities and succession planning within higher education and healthcare organisations responsible for delivering education and training.[25]

Typically, medical education is led and managed by enthusiastic individuals, many of whom have demonstrated achievements in clinical practice, teaching and research, but who have little formal leadership or management development.[26]

The importance of clinical leadership has recently been highlighted by the New Zealand Ministry of Health[27] with the result that increasing attention is being paid to how medical education leaders (many of whom are also clinicians) can be identified, trained and supported. More recently, this has included exploring ways in which medical students and junior doctors might acquire leadership and management competencies.[28]

This area of research aims to explore the motivators, facilitators and barriers to involvement of students, clinical teachers, academics, managers and support staff in leadership roles and to identify strategies for developing educational and clinical leadership capacity.

Discussion

Each of the research headings represents a potential research programme where teams will develop focussed research questions into viable research proposals targeted to funding opportunities.

From an international perspective, New Zealand undergraduate medical programmes have three important features that can contribute to best evidence medical education:

- The **first** is the trainee intern year which is a model of improving the transition from medical schools to the workplace. Currently trainee interns are a discrete, complete cohort closely monitored and supported in an apprenticeship role, yet under the jurisdiction of the universities. An advantage of this is that they remain accessible to well conducted research enquiry.[12,29]
- The **second** feature is the increasing use of a wide range of learning contexts. Both the universities with medical schools and all District Health Boards are

making increasing use of rural, regional and outer metropolitan settings for medical education and training. In recognition of the changing service milieu and issues of patient safety, students are also learning in controlled and simulated environments. We are already getting glimpses of the differing effects that these experiences are having on the student learning experiences. These diverse settings offer an opportunity to explore how they impact on performance of doctors in training and on the implications for future workforce planning.

- The **third** feature is the health sciences first year. Both universities select students into the MBChB programmes on completion of this year, in contrast to other universities that select students either directly from school or after another degree. This provides an opportunity to explore how well the measures obtained in this first year, including the Undergraduate Medical Admissions Test (UMAT), predict subsequent performance in medical programmes and the extent to which the year evens out any biases due to earlier educational attainment and secondary school of origin.

The other advantage of New Zealand for educational research is that there are only two universities with medical programmes. The medical schools have close collaborative links both with each other and with other stakeholders in medical education and health services.

Another differentiating feature is the relatively large proportion (15%) of indigenous peoples in the New Zealand population. There is a strong commitment from leaders of the two medical schools to increase the proportion of indigenous doctors yet, apart from increasing the numbers, there is little known about the best learning environment to optimise completion rates of these students.

In addition to these national opportunities, international priorities can benefit from collaborative research. There is interest in recruitment and retention of workforce, which is largely influenced by the attractiveness of the learning and practice environment for students and new graduates. Part of this relates to easing the transitions into workplaces (both within medical programmes and after graduation) and to enhancing feedback on learning in workplace settings.

Another area of considerable international interest to other disciplines is that of ‘professionalism’ and how it can be developed, supported and assessed. Finally, any health professions’ educational programme depends on willing, enthusiastic and able supervisors, tutors and workplace clinicians. Recruitment, retention and quality education are all dependent on these clinical educators and we need to explore further how they can best be supported, trained and motivated.

Resourcing a research programme is a key challenge but the hope is that by sharing ideas, working together and coordinating research, we will provide evidence on which to inform local decisions, build medical education research capacity within New Zealand and enhance our contribution to the best evidence in medical education internationally.

A challenge is to persuade funders to see the relevance of such research to the future health of the population, and to provide appropriate support, including resourcing of the endeavours.

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The New Zealand Advanced Choice of Employment (ACE) Scheme: analysis after 7 years of District Health Board cooperation in a competitive employment context

Brandon M Adams, Gregory O'Grady, J Richard Pole

Abstract

Aim The Advanced Choice of Employment Scheme (ACE) coordinates the appointment of postgraduate year 1 doctors in New Zealand (NZ). ACE is a voluntary collaborative operation by all 21 of NZ's District Health Boards (DHBs). This audit evaluates the performance of ACE over its first 7 years of operation.

Methods The proportion of applicants successfully matched and the correlation between their preferred and matched DHBs was evaluated. Qualitative performance was assessed through survey of NZ trainee interns (TIs).

Results Nearly all (99–100%) NZ TIs using ACE have been successfully matched each year. Most (96–99%) of the successful applicants have been matched to one of their top-four preferred DHBs, and a mean of 81% to their most-preferred choice. Qualitative satisfaction with ACE was high (90% good). Applicant concerns included the usability of the online application portal and uncertainty about the fairness of the ACE algorithm.

Conclusion The ACE scheme has been highly successful for allocating PGY1 positions over 7 years and achieves generally high applicant satisfaction. DHBs have successfully cooperated despite their competing interest in recruiting top applicants. This study supports the contention that increased collaboration between DHBs may improve efficiency within the NZ health sector.

The Advanced Choice of Employment (ACE) Scheme is a job-matching system for the allocation of postgraduate year 1 (PGY1) house officer positions in New Zealand. ACE was conceived by the New Zealand (NZ) Medical Students' Association in the mid 1990s in response to dissatisfaction with the previous unfacilitated (laissez-faire) employment process, which was perceived as inefficient and frustrating by many applicants. Prior to ACE, the recruitment process often continued over many months of protracted negotiations, during which time little certainty was provided to many of the applicants and DHBs.[1] The ACE Scheme was implemented by the NZ District Health Boards (DHBs) in 2003 and has now completed its seventh year of operation.

The initial outcomes of the first 2 years of operation of the ACE Scheme were reviewed in a previous article which concluded that the ACE Scheme was "highly effective in assisting smooth transition from education to the PGY1 workforce".[1] In both years, the high majority (96%) of successful applicants secured employment in one of their four most-preferred hospitals. Survey respondents in that study voiced generally high satisfaction with ACE.

The viability of ACE is dependent on the ongoing cooperation of all DHBs in complying with the agreed ACE procedures and time frames. One significant potential threat to this cooperation, for example, is the fact that the DHBs are in direct competition for junior doctors. There is currently a national shortage of junior doctors in New Zealand in the face of increasing demand, posing a threat to effective care[2].

The present study aimed to determine whether the ACE scheme has continued to achieve efficient matching of applicants to positions, and has continued to produce high satisfaction ratings. This was achieved by auditing all of the major ACE outcomes over its 7 years of its operation to date. In addition, the previous 2004 satisfaction survey[1] was repeated on the most recent group of ACE applicants. A discussion is presented regarding the place of the ACE scheme as an example of effective "market design" in medical workforce management and planning in New Zealand.

Overview of the New Zealand ACE Scheme

In 2002, all 21 of New Zealand's DHBs committed to a centralised recruitment strategy for first-year house officer positions. The key component of this centralised strategy was a coordinated process for accepting applications and allocating applicants to first-year house officer positions. This coordinated job-matching process was called the ACE Scheme, and has been in constant use since its implementation in 2003.

Also ongoing since 2003 have been the adjuvant components of the centralised recruitment strategy, including advertisement of the recruitment process through a website and booklets. Potential applicants are also all invited to two educational events that provide them with an opportunity to learn about the ACE Scheme before they apply. The first event is a presentation evening at each medical school that is followed by a question and answer session. The second event is a DHB roadshow in which each DHB has an information stall at each medical school to interact with their potential applicants.

The ACE Scheme is coordinated by a central body (The ACE Centre) which reports to District Health Boards of New Zealand (DHBNZ)—an association that acts in the interest of the DHBs on agreed national issues. ACE is currently administered, through a tendered contract, by Auckland Regional Resident Medical Officer Services (ACE Centre 2009).

Applicants for PGY1 house officer positions in New Zealand make a single application to the ACE Centre through an on-line portal (http://www.acenz.net.nz/login.asp). This portal enables the applicant to rank the hospitals at which they would be willing to work. Applicants do not rank hospitals at which they would be unwilling to work, thereby ensuring they will not be forced to work in a location against their will. Applicants also submit their curriculum vitae and references via the on-line portal. Certain documents are still required to be submitted in hard copy via post (for instance, certified copies of university transcripts).

The ACE Centre then distributes these application packages to all of the hospitals that the applicants have ranked. The hospital personnel, who are blinded to the applicants' preference rankings, prepare their own ranking of their applicants and return this list

to the ACE Centre. Hospitals do not rank applicants who they would be unwilling to employ, thereby ensuring that they are not forced to hire candidates that they deem to be unsuitable. Hospitals are also required to officially report their quota of available PGY1 positions to the ACE Centre.

A computer algorithm is then used to essentially mimic the previous sequential postal process, where jobs were offered, accepted or rejected and then the residual jobs re-offered to the next ranked applicants. In brief, this algorithm impartially matches the two ranked preference lists received from applicants and DHBs. Candidates are matched to their most preferred hospital that had ranked them within their quota boundary of available positions through repeated iterations of the algorithm.

This process is completed within a strict timeframe and all job offers are released on the same date. If unfilled positions remain after this initial match it is possible to enter a subsequent round of matching.

Apart from general improvements to its electronic capabilities, the ACE Scheme has essentially remained unchanged since its inception.

Methods

Audit of ACE matching outcomes—Applicant data is recorded annually by the ACE Centre, including the number of PGY1 applicants, the number of hospitals they applied to, and their New Zealand residency status. The number of total available job vacancies and the outcomes of the matching algorithm are also recorded. Data for the whole duration of ACE's implementation (2003-2009) was made available from the ACE Centre, and was used to quantitatively evaluate the ACE Scheme's efficacy.

The primary outcomes assessed were the proportion of TIs who were successfully matched, and how the hospital positions secured by the applicants correlated with their preference rankings. The efficiency of the ACE process was further evaluated by recording the number of matching rounds required to fill all of the available jobs or to place all of the available candidates.

ACE applicant survey—Qualitative satisfaction of the ACE scheme was assessed via an online survey of New Zealand trainee interns (TIs) graduating in 2009. Survey invitations were sent to all of the 270 TIs without exclusion. The survey was identical to the ACE satisfaction survey conducted by Pole et al in 2004[1]. The principal questions evaluated applicants' satisfaction with the scheme, and their understanding of the scheme. Respondents were also asked if they had applied for employment outside of New Zealand—information that is not recorded by the ACE Centre.

Further survey questions were used to guide potential improvements in the ACE scheme's delivery. These questions asked TIs whether they attended the two ACE educational events, and whether they were of use, or could be improved.

Space was also provided for respondents to provide comments with their responses, and TIs were specifically invited to additionally comment on whether they felt the matching process was transparent, and whether they felt a fair outcome was provided. A thematic analysis of the commented responses was undertaken to identify aspects of the ACE scheme that were problematic for applicants.

The survey was conducted after the matching algorithm was complete and job offers had been posted. A potential source of bias in this survey is therefore that applicant satisfaction with ACE could be dependent on whether an applicant was matched to one of their preferred hospitals or not, an outcome that is independent of the ACE matching algorithm. To evaluate the validity of the survey, two questions were therefore included to compare the survey response population against the total ACE applicant population as provided by the ACE Centre. These questions asked: "Did you get your first choice DHB?", and "How many DHBs did you apply for?".

Results

ACE matching outcomes—The matching of candidates to their preferred (ranked) hospital choices has shown a high level of consistency over the 7 years of ACE (Table 1). Overall, a high proportion of all applicants have been placed in one of their top 4 preferred DHBs (range 96-99%) and between 72% and 84% have been matched to their most preferred DHB (mean 81%, SD 5%; [95% CI: 76, 85]).

Table 1. Cumulative percentage of successful applicants vs matched DHB preference rank

Applicant preference ranking of successfully matched DHB	2009	2008	2007	2006	2005	2004	2003
1	79%	86%	81%	83%	78%	86%	72%
2	89%	93%	88%	89%	89%	93%	86%
3	95%	97%	97%	93%	94%	95%	91%
4	**96%**	**99%**	**99%**	**96%**	**96%**	**96%**	**96%**
5	97%	99%	99%	97%	97%	97%	97%
6	98%	100%	99%	98%	98%	98%	98%
7+	98%	100%	100%	100%	100%	99%	99%

In the last 4 years, a number of NZ TIs have withdrawn from ACE prior to the algorithm being run (range 1-17). Excluding these withdrawn applicants, the proportion of NZ resident/citizen graduates gaining positions through the ACE scheme is high, with 100% successfully being matched for 2006-2009, and 99% being matched for 2004-2005 (Table 2). In 2003, (the inception year of ACE), 14 TIs were initially unmatched, however this outcome was noted by the ACE staff and the DHBs subsequently facilitated positions for 12 of these unsuccessful applicants.

Table 2. Applicant match success by year

Year	Number of PGY1 Applicants	Number of PGY1 Vacancies	Number of Applicants Placed (%)	Proportion of NZ TIs Matched (%)
2009	329	351	320 (97%)	309/312 (99%)**
2008	345	336	317 (90%)	281/298 (94%)**
2007	329	*324*	313 (91%)	281/282 (99%)**
2006	346	*313*	311 (90%)	279/288 (97%)**
2005	338	*308*	308 (91%)	285/286 (99%)
2004	413	301	299 (72%)	289/291 (99%)
2003	404	304*	304 (75%)	297/316 (94%)

* Subsequently increased by 12 to accommodate 14 TIs who were initially unmatched; **100% of TIs who did not withdraw from ACE prior to matching were allocated positions.

The total number of ACE applicants has fallen over the 7 years of the scheme (Table 2). The mean number of applicants in the first 3 years was 385 (SD 41) and in the recent 3 years the mean number was 334 (SD 9). The decline is due to fewer non-NZ TIs applying for jobs via ACE in recent years, with the number of NZ TI applicants remaining relatively steady (mean 296, SD 13; [95% CI: 284, 308]) (Table 2). The number of international medical graduates (IMGs) who apply to ACE each year has ranged between none (in 2008) and 26 (in 2004).

Overall, the proportion of the total applicants that have been successfully placed by ACE ranged from 72-75% between 2003 - 2004, and between 90-97% from 2005 - 2009. The proportion of non-NZ TI applicants successfully matched has ranged from 8% (2003 and 2004) to 77% (2007); overall mean 45% (SD 27%; [95% CI: 20, 72]).

The matching process has been completed and job offers made routinely within 5 weeks of the ACE application closing dates.

ACE applicant survey—Survey responses were received from 119 trainee interns (response rate of 44%). The respondents applied to a mean of 4.7 hospitals, and 83.8% got a job at their first choice DHB. These statistics were close to those reported from the total ACE population above (mean 4.2 hospital applications and 79% getting their first choice), demonstrating that the responder population was a reasonable approximation of the total ACE applicant population.

Satisfaction with the ACE process was rated as "good" by 90% of respondents, compared to 10% who rated satisfaction as "not so good" or "poor". Most respondents (73%) felt they had a "good" understanding of the ACE scheme, with 26% having a "partial" or "incomplete" understanding. Only 0.7% of respondents stated that they had a "poor" understanding of ACE.

A total of 65% (77 / 119) of respondents attended the ACE information evenings, and 55% (65 / 119) attended the DHB roadshows. Elective or clinical placements away from the event centres of Auckland, Hamilton, Wellington, Christchurch and Dunedin were cited as preventing access for many of the non-attendees.

The following qualitative themes were identified from the survey comments: overall positive experience (n=20), difficulties and dissatisfaction with using the ACE portal website (n=33), high satisfaction with the ACE Centre staff (n=10), and suspicion about whether the process was adequately blinded and the algorithm adequately impartial (n=10).

The strongest negative theme from respondents was difficulty uploading references to the portal, and many general comments indicated that the website could be improved in usability and educational content. In particular, concern was indicated that the website did not provide immediate feedback about whether a file upload was successful. There was also concern that there was no capacity to upload references from the beginning of the trainee intern academic year. A number of respondents noted that the website did not have comprehensive information available all year round.

A small number of TIs indicated uncertainty about the validity of the matching algorithm used by the ACE Centre, the level of security of their hospital ranking data, and whether their ranking of DHBs affected DHBs ranking of them or their chance of

being employed by lower ranked DHBs. However, a common positive theme was high satisfaction with the ACE Centre staff, and no negative responses were received regarding this theme. Trainee Interns indicated that they felt more confident in the ACE process after personal contact was made with ACE Centre staff.

Discussion

This study has audited the ACE scheme during its 7 years of operation to date, and has found that it has been able to match nearly all NZ TIs, with the high majority being matched to one of their most preferred DHBs. This process is managed to occur over a five week period which compares favourably with pre-2003 estimates of 12-14 weeks. Satisfaction among applicants has been high. Although DHB satisfaction criteria were not directly examined in this study, the ongoing commitment of DHBs to the ACE process indirectly indicates that it continues to provide value to DHB stakeholders. This study also reinforces the value of ACE to applicants, and presents a strong argument that it should be continued and safeguarded into the future.

The trainee intern satisfaction survey identifies a number of areas where the scheme could be further improved, all of which focus on the procedural aspects of its implementation. The main criticisms were that the website portal was not sufficiently user-friendly, and that the ACE educational sessions should be more widely available. Similar concerns were voiced in the previous audit of ACE in 2004[1], so it is disappointing that they have not been adequately addressed in the intervening years.

The fact that 25% or more of trainee interns may be away on clinical rotations or electives when the principal educational sessions are held is a problematic barrier to educating Trainee Interns about ACE. This finding may be responsible for the ongoing concerns regarding the schemes' transparency and fairness that were expressed by a minority of respondents. However, this educational access problem could be easily resolved with greater use of technologies such as online educational media resources, a solution that was also supported by several respondents in the survey. These observations will be fed back to the ACE Centre. These improvements have resource implications that would need to be addressed by the funders of ACE.

It was noted that following completion of matching through ACE a small proportion (1-6%) of applicants subsequently declined positions at their matched DHB. The reasons for this are not clear, however employment in Australia is a possible cause, because this group are able to readily gain employment there. This behaviour is a challenge to the agreement between stakeholders and therefore needs to be minimised. It could be discouraged by asking TIs during the ACE education sessions not to apply for a position if they intend not to follow through on the match.

We previously predicted the ACE scheme's utility as a tool for generating workforce data[1]. NZ's medical student training capacity is currently in a period of substantial growth, from 365 total annual TI graduates in 2008, to a target of 565 in 2013[2]. Meanwhile, data from this study shows that the number of PGY1 positions have grown by 15% between 2003 - 2009, and that the number of vacancies now exceeds the number of applicants.

Data here also shows that international medical graduates are now successfully being matched via ACE to make up this shortfall, however a sustained decrease in the

number of these applicants is evident. An accelerated and substantial increase in PGY1 positions will be required to accommodate the projected growth in NZ medical graduates, and workforce data made available by the ACE centre will continue to assist in the accurate monitoring of the supply and demand dynamics of the PGY1 workforce.

A potential confounding factor that may bias the reported efficiency of the matching outcome (% of NZ TIs successfully matched) is the number of international medical graduates (IMGs) applying through the ACE scheme. The quality and number of these applicants has the potential to affect average New Zealand trained applicant placement rankings. This is simply an expression of relatively unaltered job availability (demand) and variable applicant volume (supply). The proportion and quality of doctors applying from Australia is of particular interest as these applicants are eligible for ACE on equal terms with NZ graduates (TIs are otherwise given preference in the algorithm).

Australian applicants with stronger academic records or references may therefore be able to out compete weaker NZ TIs. Non Australian IMGs are not able to compete in the first round match and therefore have less impact on NZ Trainee Intern application success rates. In terms of total % matched, our results demonstrate that this has not been a major issue to date, because nearly all of the NZ TIs wanting to be matched have successfully achieved one. Of interest, there has recently been a major expansion in Australian medical school positions, which may impact on the matching outcomes in future.

The information presented in this paper may be of interest to other jurisdictions where employment matching of graduates is not performed currently. Our results show that the ACE scheme is an example of effective "market design"—where intelligent intervention in the hiring of new doctors has lead to a functional and highly efficient market clearinghouse effect.

The National Resident Matching Program (NMRP), which similarly provides a clearinghouse for new doctor positions across the United States, is a long-standing, successful and well-documented "market design" project.[4] The ACE Scheme represents a similar development in the realm of New Zealand medical workforce management and planning, which has been variously condemned in leading reports as: 'fragmented',[2] 'iterative, ad hoc and poorly coordinated',[5] and in need of 'better coordination and a more integrated approach'.[6]

Outcome data from the US residency MATCH scheme is not directly comparable to the results of this study, because the US program matches applicants to both employer and specialty training program. There is little other data in the literature with which to compare matching efficiency and satisfaction.

ACE is directly dependent on the ongoing cooperation of all DHBs in complying with the agreed ACE procedures and time frames. For example, if one DHB was to offer PGY1 employment contracts outside of ACE and before the agreed date for posting matched job offers, then this would convey an unfair advantage to that DHB, and undermine the success of ACE. DHBs are in direct competition for junior doctors, and there is a worsening national shortage of junior doctors in New Zealand[2].

The fact that the ACE scheme has maintained the confidence and participation of both employers and applicants, despite this highly-competitive employment context, is a strong testimony to its ability to satisfy the requirements of both these groups.

The voluntary nature of DHB participation in the ACE Scheme is also a risk for its long-term viability. Compliance with ACE relies on consensus and voluntary adherence, and a failure of consensus and voluntary adherence was a critical factor in the downfall of the earlier New Zealand MATCH scheme, a predecessor of ACE that operated in the 1980s.

The current emphasis on driving cooperation in the health sector, as manifested by the establishment of a National Health Board charged with "reduc(ing) duplication of information technology, payroll, logistics and other 'back office' services",[7] should result in recognition of the ACE scheme as a successful example of organic stakeholder cooperation in a competitive environment.

Significantly, the concept of facilitated placement is being considered/used by Australasian Colleges. In particular, the Royal Australasian College of Physicians Trainees' Committee have recently called for a bi-national matching scheme for the allocation of advanced physician training positions.[8] A controlled job-allocation process is already in place for many surgical trainees, via specialist training boards, albeit with necessarily less junior doctor discretion than ACE allows.

Seven years after its introduction, ACE is performing well. The scheme presents an effective example of successful market design within the New Zealand health context, and continued DHB cooperation should be encouraged.

Competing interests: None known.

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The student code: ethical and professional expectations of medical students at the University of Otago

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Abstract

Medical students at the University of Otago are now required to sign a 'student code' on beginning medical school. This new requirement has been put in place in response to changes to the medical curriculum that have resulted in earlier and increased contact with patients, healthcare staff and the general public, and in order to recognise and formalise the students' own learning needs. While a student code can most obviously be useful for disciplinary and assessment purposes, the authors make a claim for the code to be used as educational tool to assist students to internalise their obligations to others. The student code, while having common values espoused in other extant codes, is framed with the student experience in mind. The authors discuss the process of development, implementation and proposed review.

In this article we describe a code of ethics developed for medical students at the University of Otago and stake a claim for its importance as an educational tool.

Medical students do not have the standard university student experience. Unsurprisingly medical students see and do many things that are uncommon for other groups of students on a university campus. The most obvious activity that springs to mind is the dissection of cadavers, but that is just a small element of the differences. As medical students progress through their training, they will have increasing interaction with patients. They will talk to and have access to patients' personal stories; they will examine the bodies of patients, and bear witness to significant events in patients' lives including birth, death, and the consequence of illness and injury.[1]

The unique level of access medical students have into the lives of others needs to be acknowledged and some consideration given to standards the medical school and the public expect of students in this role.

Because of this unusual student experience, medical students have always been asked to sign forms giving undertakings which it would be unnecessary for many other students to give. For example, historically, medical students on first arrival at medical school signed a confidentiality and consent agreement. But such undertakings were not much used educationally—they were more administrative, and were often signed along with other similar forms.

Anecdotally, when asked later if they could remember having signed the confidentiality and consent agreement, few could (even when shown the form again). Students are also expected to sign yet another document rather clumsily entitled 'Code of Practice for Fitness to Practise' (CPFP). This document is written as part of a memorandum of understanding between the Medical Council of New Zealand (MCNZ) and each training institution.

Currently the MCNZ do not register students, but will credential the 'fitness to practise' policy of each training institution.[2] The New Zealand structure is in contrast to some overseas medical boards that register students on admission to medical school, for example, the New South Wales Medical Board registers medical students on enrolment.[3]

The CPFP document helpfully describes the policy if a student comes to the attention of the training institution as raising concerns for future practice, but it does not set out what the conduct or behaviour of a student should be. For this, students are directed to yet another document, the MCNZ's *Good Medical Practice*.[4]

Good Medical Practice is written for all registered medical practitioners, and as such has little relevance for a medical student traversing their studies. The most immediately relevant guides to *student* behaviour come in the shape of informal 'ground rules' for the operation of small groups. But, no document pulled together all the threads of ethical and professional obligations directly relevant to a student. Three staff members (Neil Pickering, Lynley Anderson and Hamish Wilson from Bioethics, Professional Development, and General Practice) decided to change that.

A student code was therefore developed entitled *Ethical and Professional Expectations for Medical Students at the University of Otago*[5] ('the student code'). This document sought to bring together common values from existing documents as well as other student based concepts such as expectations for learning. A code format was selected as an appropriate method for putting these ideas across, partly because codes of ethics are familiar in medicine, and students will be faced with codes once they move into the workforce.

This article describes the rationale for developing the student code at this point, how it reflects the students' experience, and the process of its development and ongoing use. We then offer a rationale for its use in medical student learning.

Why now?

Medical students have been trained at the University of Otago for over 130 years,[6] so it could be reasonably asked why a student code is needed now. Recent changes to the medical curriculum at Otago have meant that students get to see patients earlier. Previous curricula were structured so that medical students covered basic sciences and theories in the first 3 years of medical school, followed by immersion into clinical work during subsequent years.

The marked distinction between preclinical and clinical students has been reduced and students now interact with members of the community, including patients, from the first year of medical studies. It was perceived by staff that students needed to be aware of the responsibilities that came with such access.

The student code: reflecting the medical student experience

A code of ethics serves to express the shared values of a group and the virtues demanded and desired of its members. A code can be used not only to inform and guide individual members of a group about the kind of behaviour expected but also as a yardstick against which to measure the behaviour of someone considered to be

acting outside expected norms. Later disciplinary action by regulatory boards is strongly associated with such unprofessional behaviour amongst medical students.[7]

A primary aim of the student code was to provide meaningful standards of practice and aspirations across the range of actual situations the students were likely to find themselves in on a day-to-day basis. Given the students' increasing contact with patients and members of the community in the new curriculum, the student code needed to reflect the importance of keeping personal health information confidential, getting informed consent, of not exploiting patients, and respecting patients' needs, values and culture.

Similar expectations apply to students' interactions with their peers, for example students increasingly practice core clinical skills on each other. The new curriculum also facilitates greater engagement with health professionals. Thus we wanted the code to encourage effective and respectful relationships with medical, nursing and allied health professionals, as well as hospital and university administrative staff. Students interact daily with teaching staff, so we also wanted to include material that was relevant to the students' interactions with their teachers, including a responsibility to provide feedback.

The new curriculum also encourages a variety of learning methods, for example, collaboration among students to produce short presentations, and a good deal of self-directed learning, where the onus falls on the student to follow up ideas presented in lectures and labs. Thus we also sought to spell out the kind of expectations students should have about their learning, including supporting their peers, being aware of their own health and wellbeing and when and how that might impact upon patient care.

Development and ongoing use of the code

A search for similar codes for students led the authors to the Australian Medical Students' Association who had already developed a code of ethics.[8] That document formed the basis of our code, which has been significantly altered to add items particularly relevant for students in New Zealand, and further elements we considered to be important.

The first draft of the student code was sent to senior medical school staff in the three teaching centres (Wellington, Christchurch and Dunedin) the New Zealand Medical Students' Association and others for comment, correction and additions.

In developing the student code, we considered some important elements that should be present in any well functioning code of ethics.

Compatibility with other codes and legislation—Codes should generally seek to be compatible with relevant legislation in the country of practice.[9] As stated earlier, some New Zealand legislation applies to students working with patients and this needed to be acknowledged.[10]

A student code, while laying out expectations directly relevant to the student experience, should generally also be compatible with other codes that the student will be subject to on graduation, thereby making the transition as streamlined as possible.[4]

Correct balance between minimal standards and aspirations—We selected a must/should structure found in other codes,[11,12] because it allowed for the expression of minimum standards expressed through the term 'must', while the term 'should' was used to express aspirational aims.

The use of 'should' statements allows for guidance in situations where it would not be possible or appropriate to set a rule. Deciding what expectation is to be a 'must' and which is to be a 'should' is a particularly difficult task which requires a great deal of consideration. If behavioural expectations are too high then they may be unachievable. Similarly placing 'should' in the wrong place may undermine minimum standards.[9]

Appropriate level of detail—A code that contains too much detail will be long and unwieldy, potentially challenging its usefulness, both as a guide for behaviour and as a tool for learning. Attempting to cover every possible scenario that a medical student might encounter will inevitably lead to problems when some unconsidered possibility has been overlooked. This leaves the student unsure how the code applies, and may paralyse the development of the ability to explore the meaning of a general idea in a specific situation.

On the other hand, a code that is too general can also cause problems.[13] Statements such as 'always act for the good of the patient' without further explanation will be of limited practical use. Such general statements leave people unsure about how they should behave in specific situations, and makes it difficult to measure a student's actions against.[9]

Reflecting the needs of key stakeholders—Students are the greatest stakeholders in the code as they will bear the greatest burden from the obligations or expectations placed on them. Patients are also stakeholders as they also have an interest in the behaviour of students. Although no empirical research was done into the ethical concerns of medical students, we did seek input directly from senior representatives of the New Zealand Medical Students' Association.

Criticism could be levelled at this code because instead of expressing the shared values of a group (as stated earlier) the values espoused in the code are imposed on students on entry to medical school. In defence, the code was based on one drafted by students (admittedly Australian medical students), consultation on an earlier draft was carried out with the New Zealand Medical Students' Association, and students will be involved in future reviews of the code. A variation on this criticism is that students do not get the opportunity to consent to the code, at a stage when they could not reasonably be expected to understand its full meaning. In short, the imposition of the code does not appear to model its own concern with one of its central values of fully informed consent. There is some force in this criticism, but it is not uncommon, and nor is it regarded as inappropriate for people entering a group to be presented with an existing code.

Criticism could also be levelled because patients were not directly involved in the development of the code. However it was considered that the presence of a student-specific code could only be an advance for patients. Future reviews of the code could canvas patients for their input.

Introduction and implementation—The authors decided, with the support of senior academics in the medical school, that student signing of the document needed to be a significant occasion for students. During the very first morning of their very first official day of medical school new medical students are given two copies of the code, one to keep and one to sign and hand back to us.

After a break and an opportunity to read the document, students are asked to stand and make a declaration to their peers and staff that they agree to comply with the expectations listed within the document. This ceremony is attended by senior staff members.

Review—The authors plan a full review of the document during 2010 and to review the document on a regular basis thereafter. Already we have discovered areas in the student code that could be improved, but this is part of the ongoing evolution of the document in the light of experience with its use. The make up of the review committee is yet to be determined. We are also considering ways in which the document can be used as a means of assessing professionalism among students.[14]

The student code as a tool of medical education

The most obvious use for a code for students is as a disciplinary tool. Educationally speaking, a clear related use follows, that is the use of the student code for the assessment of student progress and professionalism. Students at Otago are assessed in multiple ways. One significant mode of assessment is the Professional Attitudes and Summary of Achievement Form (PASAF) which is administered by tutors who have a good on-going knowledge of the individual student, through having personal contact with them, e.g. in a small group learning setting.

The student code's standards and aspirations are highly relevant to the PASAF's concern with behaviours in contexts such as community, and small-group learning settings.

But a code of ethics can be a learning instrument for other more subtle and intrinsic reasons.

We suggest that the code can have an educational role because its guidance and aspirations can become an embedded part of the students' own personal understandings of what it is to be a student doctor. By using a code early on that has similarities and resonances with codes used on graduation, it is hoped that the student can learn to identify with and internalise these expectations. In this way the student code aims to become embedded in the students' gradual growth toward maturity of practice.

In this regard, consider the following scenario:

> A student attends a lecture at which an identified patient is interviewed by a senior clinician. The patient speaks of many events in his life and in the lives of his family, and the student takes extensive notes.
>
> At the end of the lecture the clinician reminds the students of their confidentiality obligations. But what does this mean for a student? How is this expectation to be translated into reality? The student then meets with other medical students in a café. It is a public space – she is still interested in discussing aspects of the patient's story, but she is concerned about whether it is appropriate to do so in this venue.

> That evening, the student returns to her flat, everyone is talking about their day, and she is tempted to tell her flatmates (who are not medical students) about the patient interview—will it be OK, she wonders, if she doesn't name him, and changes some of the details?
>
> Her partner visits, and sees her studying notes from the interview. She puts the notes away in her bag, but reflects that perhaps next time she should leave the patient's name off the notes, and wonders where best to store them. She recalls the confidentiality section in the student code and reviews the content. She discovers that some guidance is offered for the situations she has encountered and this resonates with and validates her concerns.

What makes the code an element of this student's learning is precisely that it raises the student's consciousness of these questions, and demands of the student that she think through the implications of her acts. By this means, the code ceases to be external and abstract and starts to be internal and living.

But there may be a degree of scepticism voiced about this hope. In a challenging article published in the *Journal of Medical Ethics*,[15] Christopher Cowley argues that students in medical schools should be encouraged to use their own moral vocabulary rather than be supplied with quasi-technical terms. He has terms such as beneficence and non-maleficence particularly in mind. The fear he expresses might be extended to the student code, as it employs words—autonomy, disclosure, confidentiality and informed consent—which are not common outside medical ethics.

Cowley argues that these words may replace ('hijack' is his term) the ordinary everyday moral terms students arrive at medical school already equipped with. Cowley's concern is more than a worry about language: it is a worry about practice—including the practice of ethical reflection and action informed by well-understood concepts which the student has grown up with. These common-or-garden terms, he implies, are internalised (and personalised) and are part of the students' moral lives; the 'quasi technical' terms of academic bioethics aren't—and he might object that the statements of the student code are in the same boat.

We have some sympathy with Cowley's point, and we have endeavoured to use commonly used terms where possible. However, we have retained some quasi-technical terms, such as 'autonomy', 'disclosure' and 'informed consent' which Cowley might object to. Moreover, Cowley might object to use of a student code since codes are not standardly part of ordinary moral life and are external and depersonalised.

However, ethically speaking, being a student doctor is not a simple extension of being a student. For example, student doctors have to start to learn to exercise ethical and professional judgement in contexts which may be quite different from anything they have experienced before. The student code reflects the multiple expectations and challenges inherent in the students' educational context. As they become more familiar with these contexts—speaking to people about their health, visiting rest homes, working collaboratively, discussing differences, and so on – the guidance and aspirations in the code will become a meaningful part of practice.

Terms such as autonomy, disclosure and informed consent, used in the code, may never have the ring of ordinary language, but a student can become sensitised to these concepts and become aware of the sometimes bitter experiences of patients that their use reflects. Further, personalised ordinary ethical notions are not sufficient for medical practice; for doctors have professional obligations as well as personal ones,

and these are often expressed in a language adopted by the profession, with which the students need to become familiar.

Conclusion

The student code developed for medical students at the University of Otago has codified the expectations and aspirations which come with the medical students' unusual situation. It places these expectations and aspirations in the context of the day-to-day experience of the medical student. This context includes contact with members of the community, including patients, for educational purposes, and an unusually high degree of access to their health and other personal information. In this context, the student code plays the role of setting standards. But it also plays an educational role, getting students used to the sorts of considerations they will need to take into account and reflect upon as they mature towards full professional practice as a doctor.

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Array comparative genomic hybridisation: a new tool in the diagnostic genetic armoury

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Abstract

The traditional understanding of genetic disease, that, with the exception of aneuploidy, it is due primarily to single base pair changes or small deletions and duplications has been challenged over the last decade. This challenge has been spearheaded by increasing evidence of the frequency and significance of larger genomic rearrangements. It now appears that a substantial proportion of Mendelian conditions are caused by deletions and duplications that involve the copy number of one or more contiguous genes. It is becoming apparent too that *de novo* chromosomal events are much more frequent than spontaneous point mutations and that chromosomal rearrangement is likely to account for the vast majority of sporadic disease.

Background

The extent of copy number variation between apparently healthy individuals and the importance of this variation in the development of disease were not appreciated until early this decade. Much of this discovery has been precipitated by a novel molecular cytogenetic technique, array comparative genomic hybridisation (aCGH). This technique is paving the way for a revolution not only in disease gene discovery and our understanding of the molecular basis of complex disease, but also in clinical diagnostics.

While the use of aCGH as a research tool has been examined extensively in the literature, the principal aim of this review is to discuss its place in diagnostics, with an emphasis on its advantages and limitations when compared to more conventional cytogenetic techniques.

Introduction

It was initially thought that the completion of the Human Genome Project would provide a standardised reference template of the entire genetic code.[1] It was estimated that the genomes of healthy individuals were 99.9% identical, with differences in the remaining 0.1% resulting in phenotypic variation.[1]

Studies published in the early 2000s, such as the landmark studies of Sebat et al[2] and Iafrate et al[3], established that there is significant variation between apparently normal individuals. This variation lies not in the DNA sequence itself but in the number of copies an individual has of each particular DNA sequence.[1–4]

Copy number variants (CNVs) have been defined as chromosomal segments of more than 1kb (kilobase) in length whose copy number varies, as a result of deletion or duplication, between individuals in the population.[1]

The majority of CNVs appear to be benign and have no clinical significance, but others have been linked to single gene disorders with high penetrance (such as Charcot-Marie-Tooth disease type 1A), single gene disorders with incomplete penetrance (hereditary neuropathy with liability to pressure palsies) and multiple gene disorders with high penetrance (Williams syndrome).[5,6]

The term genomic disorders is used to refer to diseases that are caused by abnormal dosage or dysregulation of one or more genes resulting from rearrangement of the human genome.[5,6]

The role that CNVs play in the development of disease is not yet completely understood. Several modes of action have been suggested: a dosage sensitive gene may be contained within the CNV region; a hemizygous deletion within a gene region may unmask a recessive mutation on an homologous chromosome; there may be a positional effect on a gene due to disruption of regulatory elements that are located within a CNV; or a gene may be directly disrupted by the breakpoint of a CNV.[7]

The cytogenetic techniques conventionally used to detect chromosomal abnormalities include the Giemsa-banded karyotype and fluorescence *in situ* hybridisation (FISH). Standard karyotyping (550 band), however, is limited by the resolution of the banding and is therefore only able to accurately identify deletions or duplications of more than ~5Mb (Megabases),[8] while FISH can only examine a certain number of loci at once and requires a clinical suspicion of the genes involved.[9]

Recent advances in array-based technology allow the simultaneous screening of the whole genome at a high degree of resolution, detecting unsuspected genomic changes that are too small to be resolved by karyotyping or FISH, and too large to be observed by DNA sequencing.

Array comparative genomic hybridisation (aCGH)

Comparative genomic hybridisation (CGH) was first developed as a genome-wide method to detect copy number changes of >10Mb in solid tumours.[10] It was initially performed on a spread of metaphase chromosomes, but as the technique evolved it was recognised that greater resolution could be achieved if many small probes were employed instead—indeed the resolution was limited only by the number and length of probes.[11,12]

Array CGH entails differential labelling of a test and a control sample followed by co-hybridisation of these samples to an array of DNA segments of known sequence. The consequent fluorescence ratio is measured and the results interpreted to determine if there are differences in the copy number between the two samples.

The resources generated for the Human Genome Project had already allowed a library of cloned DNA fragments to be produced which accurately spanned the entire genome.[13] Probes derived from this library were selected to interrogate a particular genomic region of interest, then fixed to a glass or silica slide and the first microarray was born.[13]

Probes employed since then have ranged from large-insert clones of 40–200kb, to small-insert clones (1.5–4.5kb), cDNA clones of 0.5–2kb, genomic PCR products of

100bp–1.5kb and oligonucleotide probes of 25–80bp.[13] The first arrays were constructed by manually or robotically spotting the desired probes onto the slide.

Current practice involves either spotting or the *in situ* synthesis of oligonucleotides using piezoelectric printing or photolithography, respectively.[13] It is now possible to have more than 2 million probes on a single array slide (25mm × 76mm).[14]

A range of microarray formats is available, covering a spectrum from genome-wide to highly targeted arrays. Traditional genome-wide arrays employ evenly spaced probes across the entire genome.[15] The problem with the use of genome-wide arrays in a clinical setting has been that casting the net so widely inevitably led to the detection of CNVs of unknown clinical significance.[15]

Targeted arrays, on the other hand, have had denser probe coverage, and therefore higher resolution, in regions of particular interest and hence could better delineate the breakpoints of genomic rearrangements.[15] With ongoing refinement of technology, the distinction between formats is increasingly less clear-cut.

Most arrays currently available for clinical use employ a combination of the two methods: probe coverage across the entire genome, together with coverage of a higher density in chromosomal regions known to be important in pathogenesis (such as the telomeres) and in clinically important genes.[15] In this way a single microarray is able to harness the power of both targeted and genome-wide approaches simultaneously.

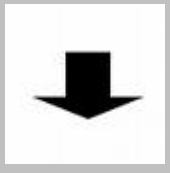
The conventional workflow of an aCGH approach is described in Box 1. Although variant formats exist that offer the same outcome, comparative analysis of these formats is beyond the scope of this review.

Array CGH in the clinical setting

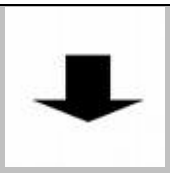
The high resolution and broad surveying capacity of aCGH are perfectly suited to the research laboratory, where novel findings are key. For the diagnostician, however, the optimism engendered by the technique is necessarily tempered by the need to put the new wealth of information into a clinical context. The identification of a microdeletion as the cause of a child's developmental delay, for example, is of obvious interest, but of greater importance is how this result can be translated into an improvement in the clinical management of that child.

Box 1. Array CGH—the method

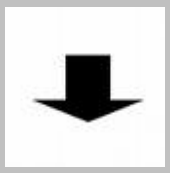
Equal amounts of test and control DNA are labelled with different fluorescent dyes and competitively hybridised to the microarray slide. This slide contains probes of known chromosomal location in the genome.[9]



The excess (unbound) DNA is washed off, the array is scanned and the image files are exported to a computer.[9]



Specially designed software extracts the signal intensities at each probe location and obtains a log ratio.[9] If the ratio of the two fluorescence intensities is equal then the copy number of the particular genomic sequence is assumed to be the same in the test and control DNA.[9] If the fluorescent signal from the test DNA is more intense in a particular area then a copy number gain (for example a duplication or a trisomy) can be inferred and vice versa for a copy number loss (deletion or monosomy).[9]



Any genomic imbalances that are identified are validated by other cytogenetic and molecular methods such as FISH analysis, quantitative PCR methods, customized multiplex ligation-dependent probe amplification (MLPA) assays or microarray formats with higher resolution in the area concerned.[1,9] Testing of parental samples is sometimes also required to determine whether the abnormality is inherited or *de novo*.

Potential benefits

Array CGH is more sensitive than standard karyotyping or FISH and is therefore more likely to enable a definitive diagnosis to be made, a diagnosis which carries with it a probable clinical course and long-term prognosis.[16] This increased diagnostic certainty has several significant benefits for the clinical team, the affected individual, and their family:

- For previously recognised conditions, making the diagnosis at a molecular level allows more accurate advice to be given when counselling family members with regard to risk of recurrence and possible pattern of inheritance.[16] It also enables prenatal and carrier testing to be performed if appropriate.[17]
- For chromosomal abnormalities that are not reported in the literature, analysis of the genes affected can reveal potential complications and indicate the most probable clinical course.[16] Physicians involved in the care of the patient are then able to anticipate these complications and undertake appropriate surveillance.[16] Mutations in the *CEP290*, *NPHP1* and *RPGIP1L* genes, for instance, result in a cerebello-renal phenotype which includes renal failure in the first or second decade of life.[17] If alterations of these genes are identified early then anticipatory measures can be undertaken.[17]
- If there is no efficacious therapy for the particular disorder, a molecular diagnosis will allow the affected individual to be placed in an appropriate clinical trial (if available) and aid in new therapeutic developments.[17]

- Children are able to be proactively placed in appropriate programmes involving, for example, occupational therapy and early speech and language therapy, as opposed to watching and waiting until particular functional deficits become obvious.[17]
- Affected individuals and their families appreciate being given concrete information.[16] The guilt which frequently surrounds the birth of a child with multiple congenital anomalies, for instance, can be assuaged when parents learn that these anomalies are not because they 'did something wrong' when the baby was *in utero*.[16] For many people even an unfavourable diagnosis is preferable to the uncertainty of the unknown. Local or international support groups can be sought, bolstering emotional well-being and strengthening support networks.

There are significant benefits for laboratory staff also. The diagnosis in question is reached more quickly when aCGH is employed.[18] There is no need to culture cells, greatly reducing sample preparation time.[18] Much of the process is able to be automated, simplifying the workflow regime.[12] Furthermore, the quantity of DNA that is required is much smaller than that needed for karyotyping or FISH analysis, and as cells are not going through the culturing process, the patient's tissue sample does not need to be of high quality.[12]

Potential limitations

As mentioned above, the high resolution of aCGH is at once the attraction of the technique and also one of the main clinical limitations at this time. The high prevalence of CNVs in the healthy population means that not all variants discovered in affected individuals can be viewed as causative of the presenting phenotype.[16,19]

If the particular variation in question is found in an unaffected parent it can usually be assumed to be benign[1,19,20] (although this assumption is complicated by low penetrance and variable phenotypic expression[18,19]); likewise if the variation is described in the literature as occurring in the normal population.[12,20] If the variation is found to be *de novo* then it is more likely to be pathogenic.[1,16,19,20]

Pathogenicity is supported if there are reports of similar variations in the literature and if the genes involved in the alteration are consistent with the phenotypic abnormalities that are evident clinically.[12,16,19]

Large international databases such as the Database of Chromosomal Imbalance and Phenotype in Humans using Ensembl Resources (DECIPHER) (http://www.sanger.ac.uk/Software/analysis/decipher/database.shtml), the European Cytogeneticists Association Register of Unbalanced Chromosome Aberrations (ECARUCA) (http://www.ECARUCA.net) and the Database of Genomic Variants (http://projects.tcag.ca/variation; Toronto database) have been established to allow the assembly of data from multiple sources and to elucidate the connections between genotype and phenotype.[1,12,20]

It is hoped that as these databases become more comprehensive, diagnostic laboratories around the world can be increasingly confident when evaluating the clinical significance of their CNV results.[1]

There have been concerns expressed, too, about the cost of integrating microarrays into routine diagnostic practice. The largest outlay is the initial cost of the scanner, followed by that of the microarray slides themselves. A cost-analysis study performed in the United Kingdom by Wordsworth et al[18] formally examined the possibility of the NHS funding aCGH as a first-line diagnostic test for idiopathic developmental delay.

Their analysis found the technique to be entirely feasible in this context,[18] resulting in less money being spent in total per diagnosis. Despite the test being more expensive than karyotyping, multi-telomere FISH or multi-telomere MLPA, the process is more automated meaning that staff costs are lower and fewer follow-up or confirmatory tests need to be done to reach a diagnosis.[18]

Diagnoses made earlier also avoid additional diagnostic tests, including neuroimaging or invasive procedures such as muscle biopsy, and a negative result on aCGH allows follow-up testing to be limited.[18]

Specific clinical scenarios

Since its inception, aCGH has been used extensively in the research of a diverse group of disorders, including (but not limited to) idiopathic and syndromic developmental delay, congenital anomalies, various neurological and neuropsychological disorders and a range of malignancies,[9] and is now finding its way into diagnostic laboratories.

Prenatal screening

Referrals for prenatal genetic testing essentially fall into one of a series of categories: positive maternal serum screen, advanced maternal age, abnormalities detected on ultrasound scanning, or a significant family history.[21] In New Zealand this subset of expectant mothers are offered a diagnostic test for foetal chromosome aneuploidy and foetal trisomy 13,18 or 21 *via* karyotype and FISH testing.[22]

Further targeted testing is performed if there is a specific concern, such as a characteristic abnormality on ultrasound scan suggestive of a particular syndrome, a family history of a certain disorder (such as cystic fibrosis or sickle cell anaemia), or if parents or other family members are known carriers of balanced chromosome rearrangements.[22]

The detection rate of clinically significant abnormalities when aCGH is applied to samples routinely referred for prenatal testing is approximately 7%, more than three times that of conventional analysis with karyotyping and FISH.[23]

Array CGH can not only screen for all the copy number imbalances detected by standard G-banded karyotyping together with aneuploidy FISH, but is also useful when conventional analysis is difficult due to small sample size, poor growth of cultures or limited numbers of cells in mitosis.[23]

The identification of CNVs of unknown clinical significance is particularly important in the prenatal setting, especially when consideration is being given to the termination of pregnancy. The detection of variants of unknown clinical significance is reduced by using a targeted microarray format.[23]

The Medical Genetics Laboratory at Baylor College of Medicine, for example, has developed an array for prenatal testing which, in conjunction with a standard karyotype, is recommended for patients who are at an increased risk of genetic disorders, or for whom there are concerns about foetal genetic abnormalities.[24] This array tests specifically for more than 150 genetic disorders, containing probes for almost all known microdeletion/duplication syndromes as well as having increased coverage in the subtelomeric and pericentromeric regions.[24]

Van den Veyver et al[21] recently performed karyotyping, FISH and aCGH analysis (using a custom-designed targeted array) on 300 prenatal samples. Additional significant information was provided by aCGH in 2.3% of cases (7/300), including 2 cases in which the chromosomal disorder would not have been found if only standard karyotyping or aneuploidy FISH had been performed.[21]

The authors put this into striking perspective by noting that the 'risk' of missing the diagnosis if aCGH had not been used is equivalent to 1/150.[21] This risk is comparable to the term pregnancy risk for Trisomy 21 of a 38-year-old woman, or to the total term risk of all common aneuploidies of a 36-year-old woman.[21]

In order to ensure that adequate pre and post-test counselling are provided, further large studies are required to clarify:

- The appropriate resolution and format of the array;[23]
- The ratio of the detection of clinically significant abnormalities to that of abnormalities of uncertain clinical significance;[23] and
- How identifying the additional abnormalities will alter prenatal and immediate postnatal management.[23]

Until these studies have been performed it is likely that aCGH will remain an adjunct to, rather than replacement for, standard karyotyping and aneuploidy FISH in the prenatal context.[16,23]

Developmental delay (with and without dysmorphic features)

Global developmental delay is a common clinical problem—with an estimated prevalence of 1–3%.[18] The underlying cause is unclear in more than 50% of cases but the condition is known to be extremely heterogeneous in aetiology, with multiple chromosomal anomalies implicated.[9]

A wide range of syndromes include developmental delay amongst their phenotypic characteristics, and with the aid of aCGH the list of microdeletion and duplication syndromes is consistently increasing.[9,25] A large number of children also have idiopathic developmental delay without dysmorphic features or congenital anomalies.[9]

The current investigation of patients with developmental delay/intellectual disability includes a karyotype and a subtelomeric FISH screen, as abnormalities in the subtelomeric and pericentromeric regions are implicated in these conditions.[26] Targeted FISH can also be used to look for particular syndromes if these are suggested by the clinical presentation.[27]

One of the major benefits of employing aCGH in the setting of a heterogeneous condition such as developmental delay/intellectual disability is that the referring clinician does not need to have any suspicion of the particular chromosomal abnormality involved.[28] It is also undoubtedly useful in the further investigation of abnormal conventional cytogenetic results in order to:

- Delineate the extent of the deletion or duplication, and more accurately identify the genes involved,[29] OR
- In the case of an apparently balanced rearrangement, to exclude cryptic deletions or duplications at the breakpoints.[29]

Array CGH is also less labour intensive, offers higher throughput, and is more rapid and cheaper (per locus) than multiple targeted FISH tests.[18]

The important questions to be considered, then, are how the diagnostic yield of aCGH compares to that of standard karyotyping and FISH, and whether the higher resolution of aCGH means that it should supplant these techniques in routine practice.[30]

A recent retrospective analysis of 36,325 Dutch patients with developmental delay or intellectual disability, performed by Hochstenbach et al,[30] aimed to answer these questions.

The diagnostic yield of aCGH as an initial test was estimated to be 19% based on an extensive literature review.[30] This figure contrasts with an 8% abnormality rate detected by standard karyotyping and FISH.[30] Critically, only 0.78% of those cases with an abnormal karyotype or FISH result involved balanced rearrangements which would not have been detected by aCGH.[30] 0.48% of these were familial and 0.23% were *de novo* balanced rearrangements.[30]

At this time the published guidelines for the use of aCGH in the investigation of developmental delay/intellectual disability recommend using arrays in the event of a normal karyotype. [16,20,27] However, this situation is extremely dynamic. It is likely that as experience with aCGH in this clinical context grows, and with advances in streamlining the workflow and reduction in labour costs, aCGH will become the first-line diagnostic test.[30] Karyotyping would then only be performed following a normal aCGH result in order to identify the <1% of patients with a balanced chromosomal rearrangement.[30]

Autistic spectrum disorder

Autistic spectrum disorders (ASDs) are a heterogeneous group with a complex aetiology and a prevalence of approximately 1/166.[31] They can be clustered into complex autism, when there are dysmorphic features or other factors suggestive of a chromosomal disorder/syndrome, and essential autism (without these features).[9,32] Historically a genetic cause has been identified in only 5–10% of people affected by an ASD.[32]

Gene mapping *via* linkage analysis has shown autism candidate gene loci on 20 different chromosomes, including the X chromosome.[31] ASDs are also associated with several single gene disorders, including Rett syndrome, fragile X syndrome and tuberous sclerosis.[9]

The higher resolution that aCGH allows has been used in several large studies, which show that *de novo* deletions and duplications play a significant role in the aetiology of autism, particularly complex autism.[31,33] Two seminal studies detected copy number changes in 30% of individuals with complex autism (Jacquemont et al)[33] and 10% of individuals with essential/idiopathic autism (Sebat et al).[31]

An Autism Chromosome Rearrangement Database has been established, and is a reference site delineating the breakpoints and other genomic features that have been described in publicly available literature.[9]

Cancer

It has been well recognised that somatic chromosomal rearrangements and dosage alterations have a role to play in tumourigenesis.[9] They affect gene expression and can disrupt normal growth control pathways by activating oncogenes or inactivating tumour suppressor genes.[9]

Much research has been done to characterise the aberrations found in association with a wide range of cancers.[34] It is hoped that ongoing high resolution microarray analysis will provide an ever more comprehensive understanding of the molecular mechanisms involved in the development of specific cancers.[9,34] The goal is to develop a database of known genetic alterations responsible for each malignancy, along with the phenotype and clinical course.

Determination of each individual's tumour profile at diagnosis would then enable not only classification of tumour type, but also prediction of prognosis and susceptibility to particular therapeutic agents—thereby improving the specificity of the therapy given and avoiding unnecessary treatments.[34] Array CGH analysis in this instance will be complementary to existing diagnostic and prognostic markers, helping to build a more complete, complex and accurate picture for the clinician(s).

There are already steps being taken in this direction. Chronic lymphocytic leukaemia is associated with a wide range of clinical outcomes, with disease progression ranging from indolent to rapid.[35] There are, however, a range of characteristic copy number changes that are routinely used as prognostic markers.[35] The deletion of 13q14 in the absence of other abnormalities, for example, is associated with a more favourable prognosis.[9,35] Traditionally FISH has been used to detect these abnormalities and provide prognostic stratification.[35]

A recent study by Patel et al[35] showed that a custom-designed targeted microarray including all regions implicated in CLL was able to test for all abnormalities simultaneously and with a higher yield than conventional karyotyping and FISH (detecting 37 compared to 34 abnormalities). With B-cell clonal enrichment the sensitivity of aCGH was 100% for cases with aberrations in at least 25% of the cell population.[35]

Array CGH has proven itself useful, too, in the identification of individuals with an increased susceptibility to developing malignant tumours. Adam et al[36] have reported three cases in which genome wide testing using the commercially available EmArrayCyto6000 (an array with resolution equivalent to a 6000 band karyotype and targeted coverage of telomeric, centromeric and gene-rich regions) was performed on patients referred with developmental delay/ dysmorphic features/ congenital

anomalies. None of these patients had a clinically recognisable cancer predisposition syndrome and each had normal routine cytogenetic analysis.[36]

Interestingly, aCGH revealed a different *de novo* deletion in each patient, but with the loss of genes that are known to affect tumour susceptibility.[36] The results of the copy number analysis on these patients had a direct bearing on their clinical management, with appropriate tumour surveillance protocols being initiated.[36]

Conclusions

Array CGH is a powerful technique that is leading a revolution in the field of genomic medicine. The use of microarrays is enabling the elucidation of the chromosomal aetiology of known syndromes, the expansion of clinical phenotypes and the discovery of previously undefined syndromes.

Microarrays are less labour intensive than traditional testing platforms due to the automation of many of the processes. The great flexibility of their design and the recent major reduction in cost, coupled with the need for minimal laboratory space and personnel effort, make them a highly attractive platform for diagnostic use. As part of the arsenal of molecular cytogenetic techniques they are able to detect and define with great accuracy, and at a high-throughput, both microscopic and sub-microscopic deletions, duplications and rearrangements.

Over the next few years the targeted versus whole-genome debate will no longer be relevant as the two will be integrated, ensuring comprehensive coverage of all clinically relevant loci while excluding known areas of benign variation.

The interpretation of aCGH results, however, poses a significant challenge that should not be trivialised. As the degree of resolution used to analyse the genome increases, it becomes increasingly imperative to confidently filter the information to achieve outcomes that are understandable and clinically relevant.

It is important for diagnostic laboratories to be cautious in the adoption of novel technologies. This caution protects the welfare of patients by ensuring that a potential diagnostic test has well-established sensitivity, specificity and a suitable risk/benefit ratio.

Through research, array CGH has been shown to meet these criteria in a wide range of clinical settings. The time is ripe for the technique to take its rightful place as an integral part of diagnostic medicine.

Competing interests: None known.

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THE NEW ZEALAND MEDICAL JOURNAL
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A rare late complication of spilled gallstones

Dinuk L Gooneratne

Abstract

Laparoscopic cholecystectomy is the treatment of choice for symptomatic gallstones. A complication that is often overlooked is that related to lost intraabdominal gallstones as a consequence of intraoperative gallbladder perforation. This is a case report of a patient presenting with a colovesical fistula due to lost gallstones from laparoscopic cholecystectomy performed 14 years previously. A literature review follows that explains how lost gallstones have the potential to cause late complications and why it is should not be ignored.

The most common cause of colovesical fistula in Western countries is diverticular disease; other common causes include Crohn's disease and colonic malignancy.

The patient discussed is one of a handful of reported cases presenting with colovesical fistula secondary to lost gallstones during laparoscopic cholecystectomy, since the advent of the procedure in 1987.

Case report

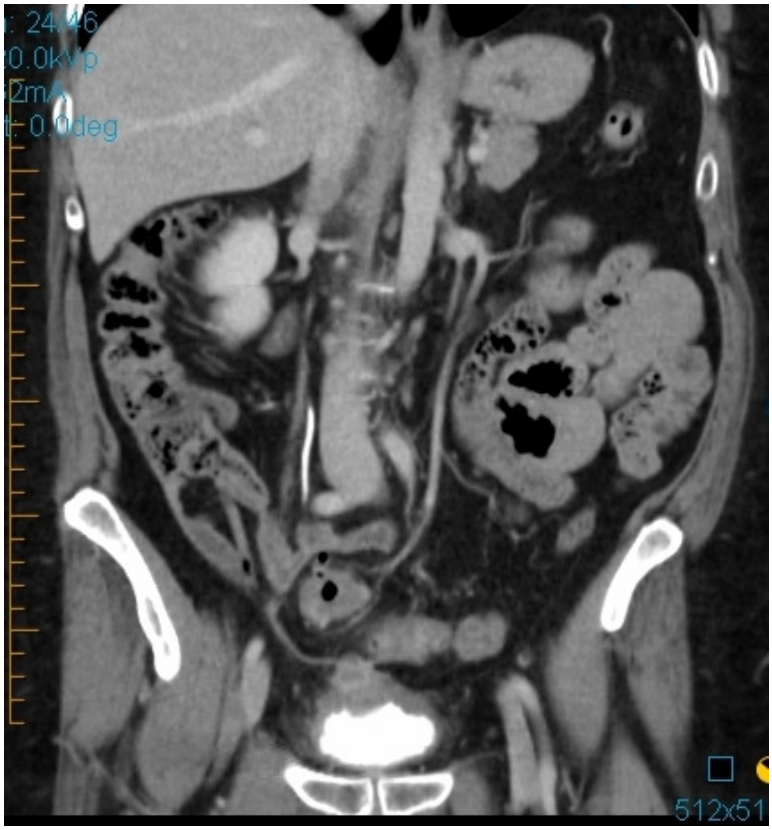
A 54-year-old lady presented to the General Surgical Outpatient Clinic at Greymouth Hospital in April 2009 for management of a documented colovesical fistula.

She was an otherwise well lady who had undergone a laparoscopic cholecystectomy (LC) for symptomatic gallstones in 1995. Postoperative course was unremarkable until June 2004 when she presented to her GP with recurrent urinary tract infections. She was investigated over the following 12 months with no cause found for symptoms.

She continued to be troubled by ongoing suprapubic pain and urinary symptoms over the next 3 years and was reinvestigated with a computed tomography (CT) scan of her abdomen in January 2009 which showed evidence of a colovesical fistula presumed to be secondary to diverticulitis (see Figure 1).

Subsequent colonoscopy in May 2009 demonstrated changes in the mucosa of the descending colon representing the colovesical communication.

Figure 1. CT scan showing fistulous communication between the colon and the bladder



An elective repair of the colovesical fistula was performed on 11 June 2009. When the fistula was divided, three small gallstones (see Figure 2) were identified within the fistula tract.

Figure 2. Gallstones removed from the fistula tract

A resection and anastomosis of the distal descending colon to rectosigmoid was carried out. She went on to have an uneventful recovery.

Review of the notes from her laparoscopic cholecystectomy performed in February 1995 state that a large gallbladder containing multiple stones was encountered. During the dissection one stone had fallen into the abdomen, and was unable to be retrieved.

Discussion

Since its introduction almost 25 years ago, laparoscopic cholecystectomy has become the main stay of treatment for symptomatic gallstones. However two complications are more common compared to the open procedure: (1) injury to the common bile duct and (2) complications due to lost gallstones.

As surgeons have become more experienced at laparoscopy, the risk of common bile duct injury has reduced. The incidence of spilled and lost gallstones as a result of intraoperative gallbladder perforation has remained unchanged however.[1]

There have been a number of hypotheses as to what effect leaked bile and lost gallstones have on intraperitoneal organs. Several studies over the past 15 years have looked at this subject, implanting bile and gallstones in animal models. These studies have shown that gallstones can remain inert in the abdominal cavity or can be partially reabsorbed causing only mild local effects.[2,3]

Gallstones also demonstrate the ability to cause postoperative adhesions and abscesses.[4,5] Risk factors for septic complications include the number, volume and composition of stones. Fragmented stones and stones from an acutely infected gallbladder also leave the patient at higher risk of complications.[3,6]

There are a wide variety of complications reported in the literature from lost gallstones. Intraabdominal abscess formation being the most common (60%), fistulisation to other intraabdominal organs being the next most likely (12%).[6]

Whilst the incidence of long-term complications from lost gallstones is low at approximately 1.7/1000 LCs,[1] the figures are more impressive in the subset of patients that have intraoperative gallbladder perforation. Woodfield et al analysed 18,280 LCs showing an incidence of gallbladder perforation in 18.3% of cases.[6] This was similar to the percentage of gallbladder perforations found by Brockman et al at 20% who analysed approximately 17,000 LCs.[7]

When the gallbladder was perforated, the incidence of spilled stones was approximately 40% or 7.3% of all LC's.[8,9] There have been two studies of 4813 LC's[9,10] and one review[7] looking at 16,869 LCs that have reported the incidence of spilled stones being unretrieved at 33%. The actual figure may well be higher given that approximately 20% of stones are lost without the surgeon realising it.[7]

The incidence of complications from a stone *knowingly left in the abdominal cavity* is approximately 7%-8.5%[1,6] but this figure may be higher given that late complications after end of follow up would not have been included in the above studies. Data suggests that there is a mean duration of 10.4 months until definitive intervention is carried out for complications from lost stones.[6]

Gallstones are most commonly spilled either during dissection of the gallbladder off the gallbladder fossa or during removal through a port site. The general consensus in the literature is that the surgeon should explore and remove as many of the spilled stones as possible. Conversion to an open procedure to retrieve lost gallstones is not recommended.[1]

As evidenced by the patient that is the subject of this case report, complications from lost gallstones can occur several years after the initial operation. The importance of clear documentation and informing the patient about the lost gallstones cannot be emphasised enough.

Documentation of lost gallstones should include relevant information on the status of the gallbladder, the number of stones lost and whether the stones were fragmented, as all these leave the patient at higher risk of developing late complications. Physicians need to have a high index of suspicion regarding symptoms that could be a complication from lost stones so that necessary investigations can be carried out early. Clear documentation and communication with the patient is important from a medicolegal standpoint if late diagnosis and/or unnecessary investigations do occur.

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Apical pulmonary lesions due to Marfan syndrome misdiagnosed as pulmonary tuberculosis

Prem P Gupta, Krishan B Gupta, Joginder S Gulia, Rohtas Yadav, Sanjeev Kumar, Dipti Agarwal

Abstract

A 55-year-male with chest symptoms and apical pulmonary lesions was diagnosed as a case of sputum smear-negative pulmonary tuberculosis at a peripheral health centre in India on the basis of Revised National Tuberculosis Control Programme Guidelines —he was put on antitubercular chemotherapy. He had no radiological or clinical improvement with antitubercular treatment, so the patient was referred to our institute.

On evaluation, we found that the patient had multisystem involvement with typical features of Marfan syndrome and a suggestive history in other blood-relatives. Upper lobe fibrosis, bronchiectasis, emphysematous changes, multiple blebs, small pneumothorax, pleural fibrosis and pleural thickening were seen which were due to Marfan syndrome rather than tuberculosis. The present case seems to signify the search for alternative aetiologies in similar clinico-radiological presentations if, after 3 months, cultures for *Mycobacterium* are still negative (despite sputum induction and/or bronchoscopy with biopsies) and the patient is having no radiological improvement.

Case report

A 55-year-man was diagnosed to have sputum smear-negative pulmonary tuberculosis at a peripheral health centre in India on the basis of clinical history of dyspnoea on exertion, cough with scanty expectoration and fever along with a chest radiograph suggestive of right upper zone lesions (Figure 1A). He was a non-smoker and never consumed alcohol. There was no exposure to agents leading to fibrosis at workplace or at home. He was categorised to WHO category III and antitubercular treatment was started. However, there was no clinical or radiological improvement and he was referred to our institute for further management.

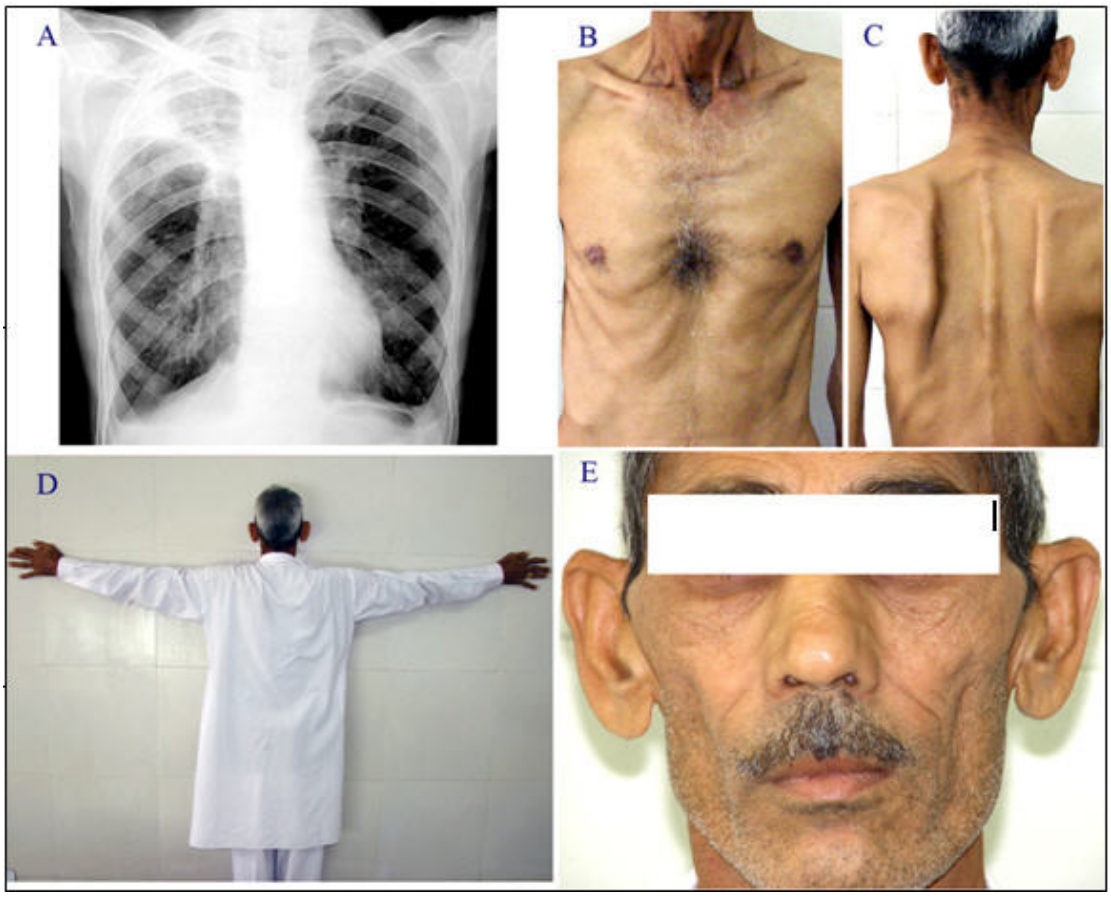
We observed that the patient fulfilled the diagnostic criteria described for the Marfan syndrome.[1] He provided a family history suggestive of similar disorder that he could recall over four generations involving male members—his grandfather, father, paternal uncles (all three affected), himself, along with two brothers and two sons.

The known aetiopathological associations of upper lobe fibrosis including pneumoconiosis, sarcoidosis, ankylosing spondylitis, extrinsic alveolitis, and other conditions were considered but not found in present case. He had pectus excavatum (Figure 1B), mild scoliosis with winging of left scapula (Figure 1C), reduced extension at the elbows (<170°), pes planus, increased arm span to height ratio >1.05 (armspan was 188 cm and the height was 178 cm) (Figure 1D), reduced upper-

segment to lower-segment ratio, presence of wrist and thumb signs, and joints hypermobility.

He also had malar hypoplasia, enophthalmos, and retrognathia (Figure 1E). His ophthalmic examination revealed ectopia lentis and flat cornea. There was no skin involvement.

Figure 1. [Panel A] Digital chest radiograph showing non-homogenous opacities over right upper zone leading to misdiagnosis to smear-negative pulmonary tuberculosis; [Panel B] The patient had pectus excavatum chest deformity; [Panel C] Mild scoliosis with winging of scapula; [Panel D] An increased arm span/height ratio over 1.05 and; [Panel E] Marfan like facial expression: malar hypoplasia, enophthalmos, and retrognathia

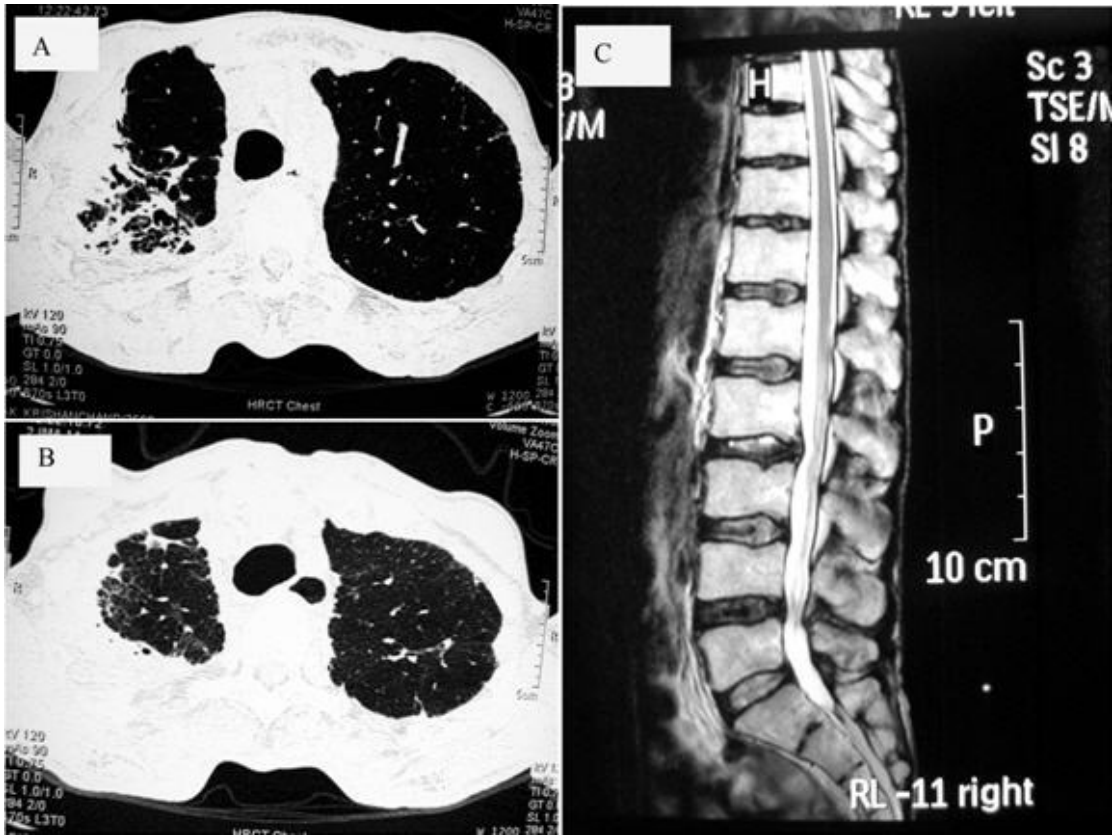


His complete blood count, routine biochemical tests including blood sugar and urinalysis were within normal limits. He had a negative tuberculin test both at 48 and 72 hours. He had no *Mycobacterium* in sputum when analysed through Ziehl Neelsen stained smear and also on radiometric rapid culture (BACTEC system). The spirometry was suggestive of restrictive pattern with decrease in FVC and FEV_1 but with a normal FEV_1/FVC ratio.

Computed tomography of thorax showed right apical pulmonary lesions suggestive of fibrosis and traction bronchiectasis along with volume-loss on right side. High-resolution CT thorax study was undertaken. It showed lung parenchymal fibrosis, traction bronchiectasis, areas of parenchymal destruction and honeycombing (Figure 2A), multiple subpleural blebs in apical segments of right upper lobe and paraseptal emphysema (Figure 2B), and a small right pneumothorax.

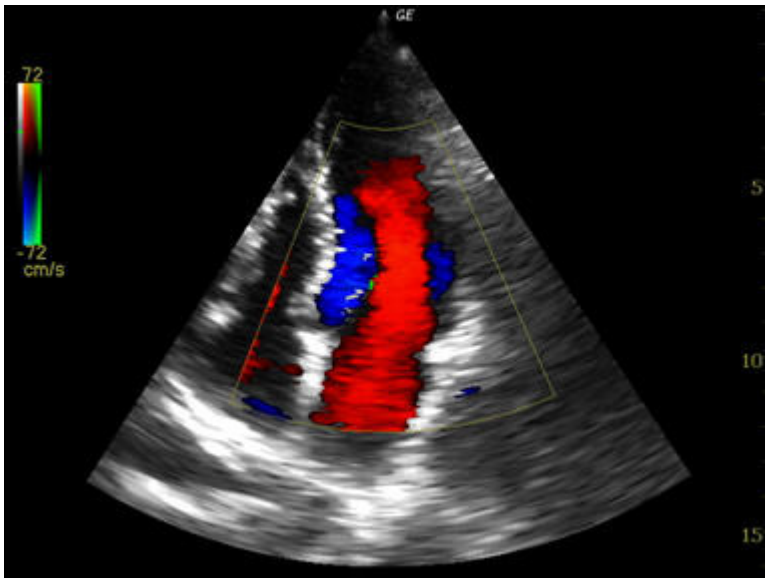
Bilateral pleural fibrosis and pleural thickening were also seen. Magnetic resonance imaging of lumbosacral spine revealed no dural ectasia (Figure 2C).

Figure 2. [Panel A] HRCT thorax axial scans revealing lung parenchymal fibrosis, traction bronchiectasis, areas of parenchymal destruction and honeycombing; [Panel B] HRCT thorax axial scan showed multiple subpleural blebs in apical segments of right upper lobe and paraseptal emphysema; [Panel C] Magnetic resonance imaging of lumbosacral spine showing no dural ectasia



He had no abnormality in cardiovascular system apart from mild mitral valve regurgitation (Figure 3).

Figure 3. Echocardiography of the patient showing mitral valve regurgitation



Final diagnosis: Marfan syndrome with pleuro-pulmonary manifestations

Discussion

Marfan syndrome is a systemic disorder of connective tissue caused by mutation in fibrillin-1 gene (FBN 1 gene) on chromosome 15 (15 q 21.1) that encodes for a glycoprotein called fibrillin-1.[2] Fibrillin-1 is a major building block for 10–12 nm microfibrils forming elastin fibres that are found throughout the body but are particularly abundant in suspensory ligaments of the lens, aorta, and ligaments—understandably the areas worst affected in Marfan syndrome.

Marfan syndrome is a hereditary disorder having an autosomal dominant inheritance. The case where neither of parents has been affected is described occurring due to *de novo* mutation in approximately one out of four of all cases with Marfan syndrome. It has a worldwide distribution with an estimated prevalence of about 1 in 10,000 individuals though some regional variations occur.

The mutation in fibrillin-1 gene (FBN 1 gene) has been suggested to exert a dominant negative effect whereby mutant fibrillin monomers impair the global function of the microfibrils.[1] Many aspects of the disease are caused by altered regulation of transforming growth factor β (TGFβ), a family of cytokines that affect cellular performance, highlighting the potential therapeutic use of TGFβ antagonists. However, it is not recommended to diagnose Marfan syndrome on the basis of

molecular findings as all fibrillin-1 gene mutations do not lead to Marfan syndrome and, moreover, molecular diagnosis is not ubiquitously available.

The diagnosis of this syndrome is made using *Marfan Syndrome Diagnostic Criteria* also described as '*Ghent Criteria'* named after the name of the city in Belgium.[1]

Marfan syndrome is a multisystem disorder with manifestations characteristically involving the cardiovascular, skeletal, and ocular systems. The pulmonary involvement is less common and seen in 10% of patients with Marfan syndrome. The incidence of spontaneous pneumothorax in these patients is almost 100 times higher than in normal populations. Widening of the distal airspaces with or without discrete bullae/blebs can predispose to spontaneous pneumothorax, which is found in 4–15% of patients with the disorder.[3]

Mechanical considerations suggest that, similar to a suspended coil spring, the largest alveoli and the greatest stress in the lung occur in the apex—a potential mechanism for localisation of interstitial alterations in Marfan syndrome, idiopathic apical fibrosis, centrilobular emphysema, and ankylosing spondylitis.[4] Moreover, as the pulmonary connective tissues are also weak in Marfan syndrome this could account for emphysema and apical bullae/blebs leading further to recurrent pneumothoraces.

Several reports suggest an increased susceptibility to pulmonary infection and bronchiectasis in patients with Marfan syndrome. Apical pulmonary fibrosis is speculated due to healing of pulmonary lesions in the apical parts of the lungs, the site where mechanical damage is expected to be maximal. Honeycombing in pulmonary parenchyma has also been described in Marfan syndrome.[5]

As the present patient was seen initially at a peripheral health centre in a region where the prevalence of tuberculosis is very high and even the Revised National Tuberculosis Control Programme (RNTCP) provide guidelines to treat smear-negative symptomatic patients with persisting radiological opacities, it was not difficult to see why this patient was prescribed antitubercular treatment.

In regions with high prevalence of tuberculosis, initial therapy with antitubercular drugs in patient with radiological and/or clinical features suggestive of tuberculosis seems to have a rationale as more harm could be caused by withholding treatment than the occasional inappropriate use of antitubercular treatment; however, it require a search for alternative diagnosis if after 3 months, cultures for *Mycobacterium* are still negative (despite sputum induction and/or bronchoscopy with biopsies) and the patient is having no radiological improvement.

The identification of non-tuberculosis aetiologies like pneumoconiosis, allergic bronchopulmonary aspergillosis, sarcoidosis, ankylosing spondylitis, extrinsic alveolitis, cystic fibrosis, cyanotic pseudo-fibrosis, bronchocentric granulomatosis and other conditions leading to upper lobe fibrosis is very important in later scenario. The present case appears to serve as a validation of this point.

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Nontraumatic hepatic hematoma caused by Wegener's granulomatosis: an unusual cause of abdominal pain

Selim Doganay, Ercan Kocakoc, Mehtap Balaban

Abstract

Wegener's granulomatosis (WG) is a vasculitis of unknown origin characterised by prominent involvement of upper and lower respiratory tract and kidney. There are only a handful of reported cases in the literature about hepatic involvement of WG. This report shows a patient with WG whose main complaint was severe abdominal pain due to nontraumatic subcapsular hepatic hematoma. To our knowledge, this is the first reported case of WG with hepatic hematoma depicted by US and CT in the English literature.

Wegener's granulomatosis (WG) is a multisystem disorder of unknown aetiology first described in the 1930s. Prevalence in the US is estimated at 3 per 100,000.[1] The common manifestations of the disease include the classic triad of upper airway, lung, and kidney, in 87%, 69%, and 48% of the patients. Gastrointestinal tract and spleen involvement are less common.[2]

There are only a handful of reported cases in the literature about hepatic involvement of WG.[3,4] Patients present with symptoms that are similar to common diseases. Many patients usually present with chronic fatigue, upper respiratory infection, sinusitis, hearing loss, otitis media, acute interstitial nephritis, or pulmonary haemorrhage.

Malaise, fever, weight loss, arthralgias, myalgias, and rashes are common but rarely dominate the clinical picture. The symptoms of WG may manifest individually and progress slowly.[1,5]

We describe a patient with WG whose main complaint was severe abdominal pain due to nontraumatic subcapsular hepatic haematoma. To our knowledge, this is the first reported case of WG with hepatic subcapsular hematoma depicted by US and CT in English literature.

Case report

A 27-year-old man presented to our hospital with abdominal pain, weight loss, and multiple purpuric lesions on the lower legs and feet bilaterally which had been gradually worsening over the previous 1 month.

Laboratory values were significant for elevated white blood cell count of 13,310 cells/mm³ with 78% neutrophils, mild anaemia with haematocrit 33%, an erythrocyte sedimentation rate of 72 mm/hr, cytoplasmic antineutrophil cytoplasmic antibody (c-ANCA) titre positive at 1:32. Urinalysis was normal.

Chest X-ray showed a cavitary lesion in the right lung. On the thoracic computed tomography (CT) there was a 2.5cm diameter thin-walled cavitary lesion (Fig. 1).

Fig. 1. Axial CT image shows a cavitary lesion in the right lung (arrow)

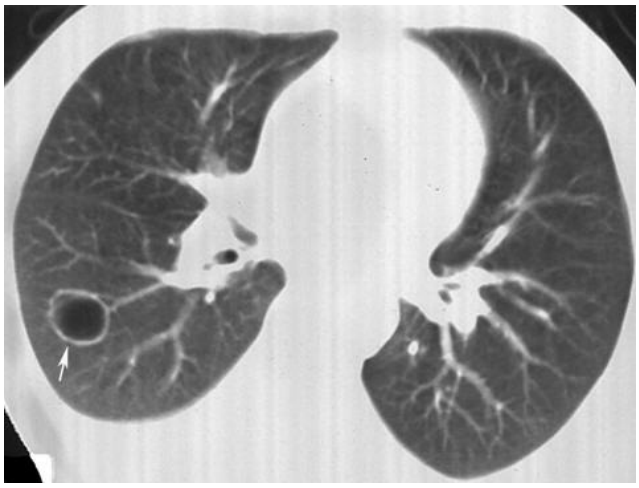


Fig. 2A. Ultrasonography images show multiple hypoechoic well defined lesions (arrows) in the liver and spleen

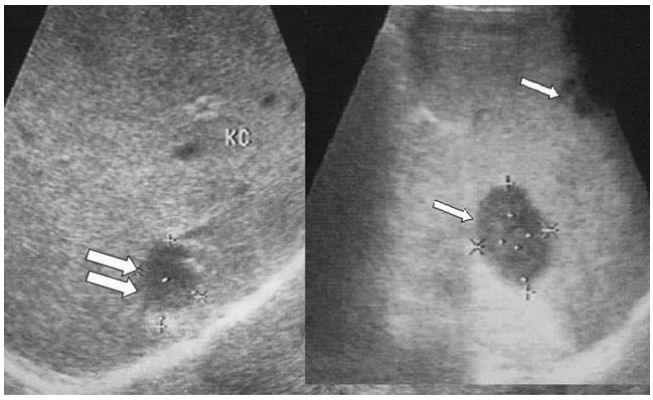
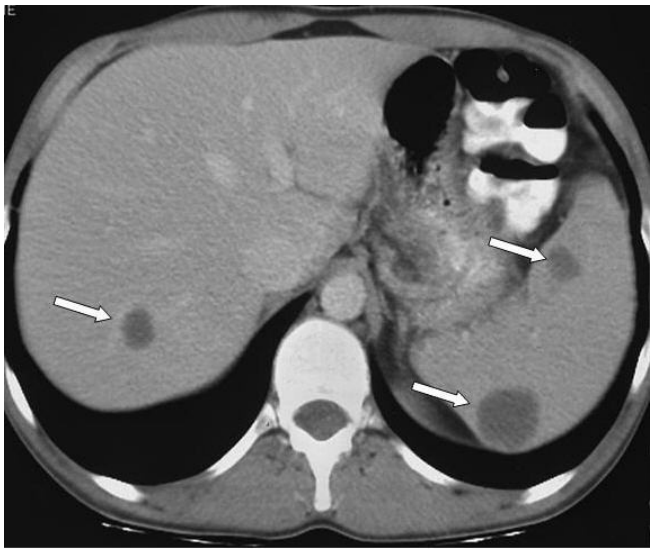


Fig. 2B. Axial CT scan shows multiple hypodense cystic lesions (arrows) in the liver and spleen



Abdominal ultrasonography showed multiple hypoechoic well-defined lesions in the liver and spleen (Fig. 2A).

A contrast-enhanced CT scan of the abdomen showed multiple non-enhancing cysts in the liver and spleen (Fig. 2B). A peripheral angiogram of the lower extremities revealed the decrease of calibrations in the peripheral arteries of the feet bilaterally.

Multiple liver and spleen biopsy specimens showed inflammatory granulomatous tissue which contains necrosis and suppuration. Based on the histopathologic results, clinical picture, radiological findings and laboratory results (c-ANCA titres) the probable diagnosis was WG with multiple organ involvement. The surgeons suggested splenectomy which the patient refused. So the patient was treated with prednisone, 1mg/kg/day, and cyclophosphamide, 2mg/kg/day.

Less than 2 years later, the patient returned to our hospital with a severe right upper abdominal pain. His blood pressure was 80/50mmHg. Laboratory examination showed elevated white blood cell count of 24,742 cells/mm³ with 68% neutrophils, severe anaemia with haematocrit 21%, an erythrocyte sedimentation rate of 76 mm/hr, c-ANCA titre positive at 1:32. His Hb was 6.9g/dl.

An urgent US revealed an enlarged liver with a giant subcapsular cystic mass consistent with hematoma (Fig. 3A). On Doppler ultrasonography, the mass was avascular (Fig. 3B). Abdominal CT scan confirmed a 15×12×7cm diameter subcapsular hepatic hematoma (Fig. 4A) and also showed small cystic lesions in the liver (Fig. 4B).

A blood transfusion was given and patient was treated and followed-up conservatively. Three weeks later the patient was discharged when he was asymptomatic and the size of hematoma had decreased.

Fig. 3A. Ultrasonography image shows a giant hepatic subcapsular cystic mass (arrows)

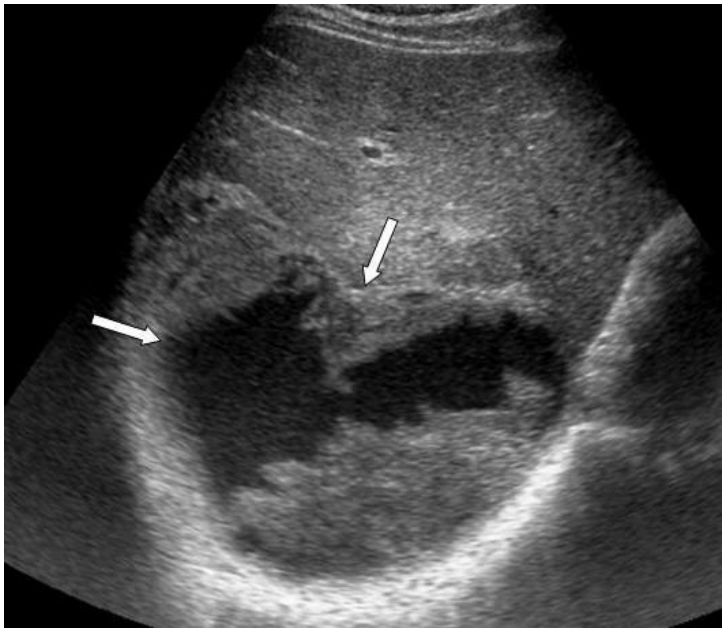


Fig. 3B. Doppler ultrasonography shows no arterial or venous flow in the cystic mass (arrows)

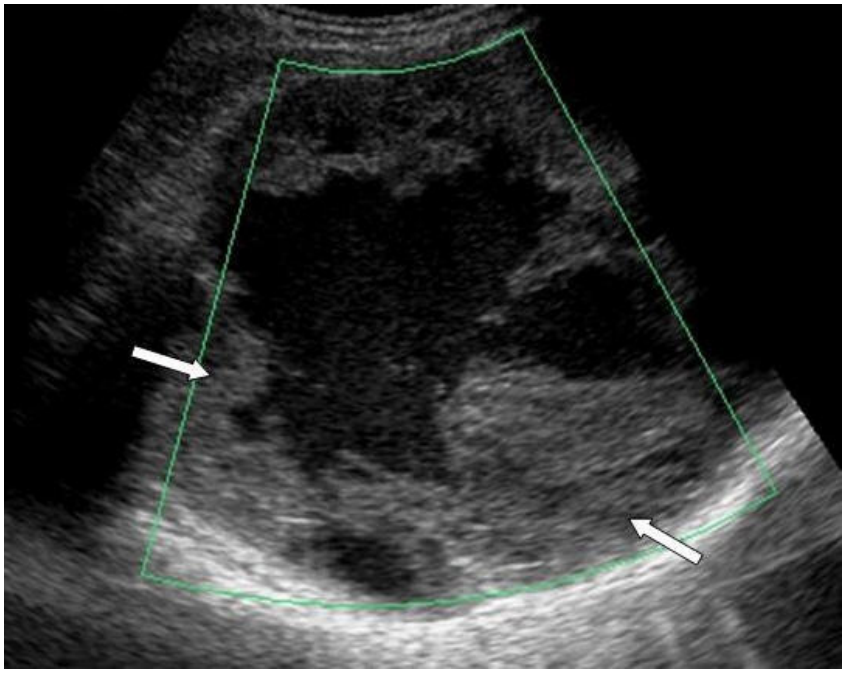


Fig. 4A. Axial CT scan shows a giant subacute subcapsular hepatic hematoma (arrows)

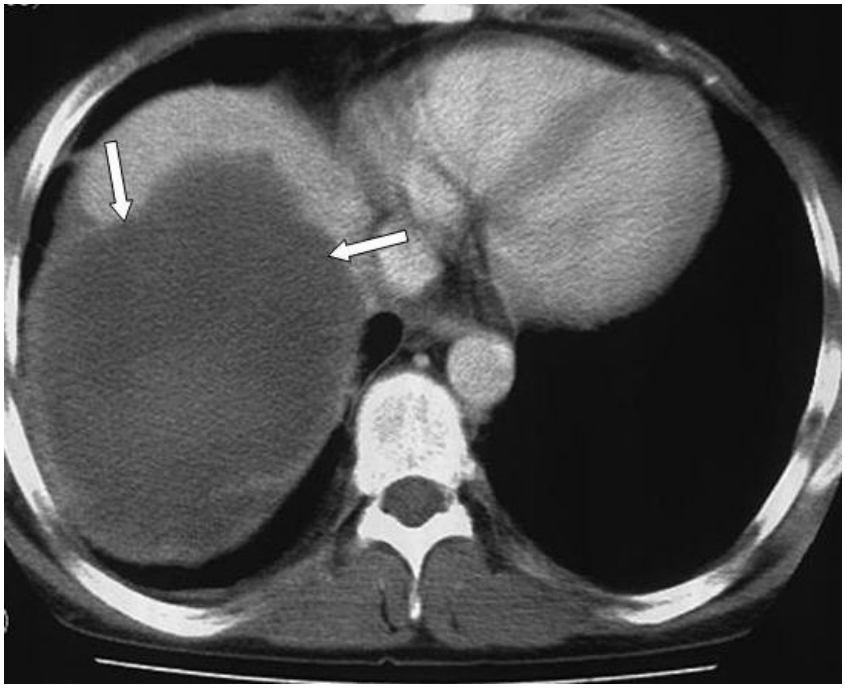
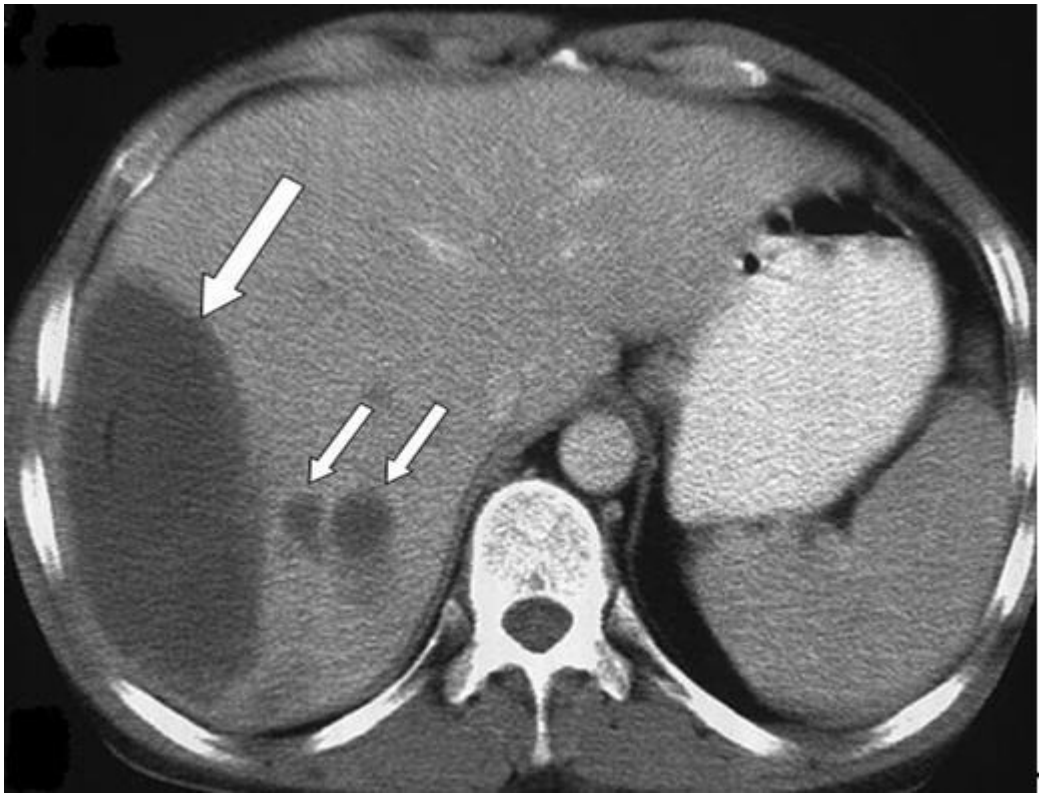


Fig. 4B. Axial CT image shows a giant subcapsular hematoma (big arrow) and cystic lesions (small arrows) due to WG



Discussion

Wegener's granulomatosis is a vasculitis of unknown origin characterised by prominent involvement of upper and lower respiratory tract and kidney. Histological pattern consists of the triad of giant cell granuloma, necrosis, vasculitis involving capillaries and small and middle-sized arteries.[6]

The case here described is characterised by hepatic nontraumatic hematoma with WG an unusual cause of severe abdominal pain. Spontaneous hepatic bleeding is a rare condition. The most common causes of nontraumatic hepatic hemorrhage are hepatocellular carcinoma and hepatocellular adenoma. Nontumoral causes of hepatic hematoma include HELLP syndrome, amyloidosis, miscellaneous, and intrahepatic aneurysm.[7,8]

Intrahepatic aneurysm is a very rare condition.[7] Chronic inflammation can lead to arterial aneurysm formation, a characteristic of medium-sized vessel vasculitis, but a very unusual feature of WG. Thirteen cases of WG complicated by arterial aneurysms are reported in the English literature.[9] Only four cases of aneurysmatic dilatation of the hepatic artery due to WG has been described in these literature.[9,10] In our case the probable cause of the nontraumatic hepatic subcapsular hematoma with WG could be the aneurysm of the hepatic artery. But we could not depict any aneurysms with Doppler US or abdominal CT.

On the other hand a review[11] described a case of splenic rupture in WG and reported that splenic vasculitis and vessel destruction with hemorrhage, infarct, and resultant necrosis may lead to rupture. In our case perhaps the same mechanism may lead to the hepatic subcapsular hematoma.

Hepatic hematoma can be easily diagnosed by US and CT. CT can be useful in defining the extent of the hematoma and showing density changes related to the age of the hematoma and can often indicate the underlying cause.[8,12]

During the acute stage (the first 24–72 hours), the hematoma is hyperattenuating, but it decreases in attenuation and develops a pseudocapsule by 10–30 days.[8] In our case the hematoma was at a subacute stage and we used these imaging methods to follow the diameter of the hepatic hematoma.

In conclusion, hepatic involvement and hepatic hematoma of WG in a patient whose main complaint is severe abdominal pain is very rare. CT and US can be useful to diagnose and follow-up.

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

Old blue eyes

Jens C Richter

An 81-year-old patient is hospitalised due to slow deterioration in general functioning, exertional dyspnea, inappetence, and chronic lumbar pain. The previous medical history includes ischemic heart disease with compensated cardiac failure, Type 2 diabetes mellitus, gout, hypothyroidism, and rosacea. His renal function is within the normal range. In addition to aspirin, cilazapril, digoxin, furosemide, oxybutynin, levothyroxin, and pantoprazole, the patient has been treated with oral minocycline 50mg bd for the past 16 years for his skin condition.

Despite good peripheral oxygenation (SO_2 96% on ambient air) and normal respiratory rate, he exhibits a generalised blue-grey skin colour, which is initially mistaken for cyanosis (see Figure 1). There is a peculiar accentuation of this pigmentation in the skin underneath the eyebrows, periorally, and symmetrically on the forehead with a finely granulated, partly confluent appearance. In addition, there is a marked blue discolouration of both sclerae, which decreases in the lateral interpalpebral fissures (see Figure 2). These slowly progressive changes have been noted by the patient for several years.

Figure 1. Blue-grey skin pigmentation, accentuated underneath the eyebrows, periorally, and on the forehead

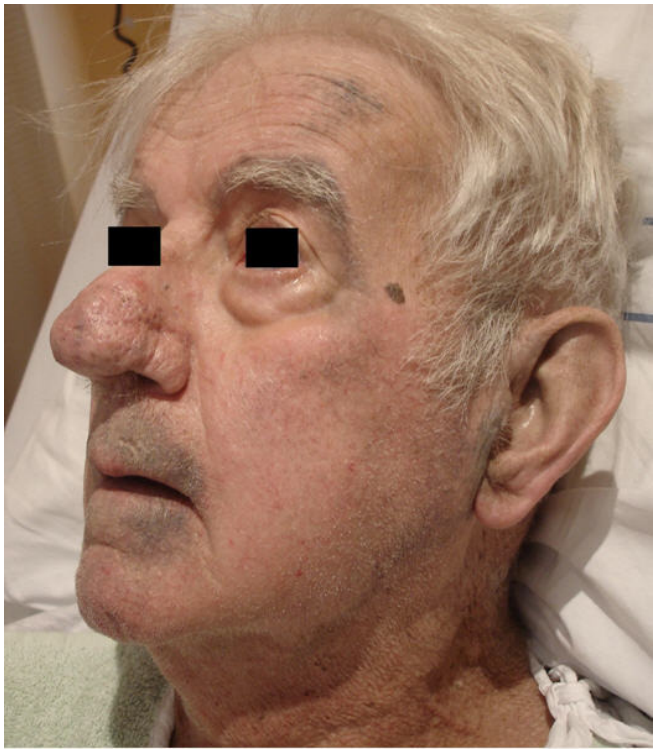
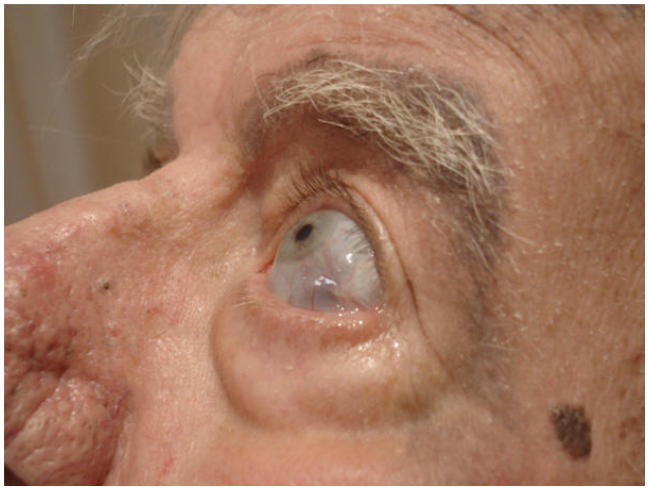


Figure 2. Blue discolouration of the sclera



What is the diagnosis?

Answer

The abnormal pigmentation of this patient's skin and sclerae is most likely caused by the *prolonged therapy with minocycline* (cumulative dose ca. 550g).

Discussion

This tetracycline antibiotic is the most lipophilic of its class and thus has excellent tissue penetration. It is frequently used for skin conditions such as acne or rosacea. There are multiple reports in the literature about cutaneous and scleral pigmentation.[1–4] The mechanism is not clear, but amongst the different pigmentation patterns, an occurence in sun-exposed areas has been noted. The pigment most likely consists of minocycline metabolites, possibly chelated to iron.[2] The incidence is presumed to range from 3 to 15%,[1] and rises with prolonged therapy.

Before initiating therapy, patients should be made aware of this rare but potentially disfiguring side effect. Once pigmentation is noted, the drug should be stopped; in some patients, a spontaneous resolution may occur.[3]

This case illustrates the importance of regular review of medications to ensure they are still indicated, effective, and not resulting in unwanted side effects.

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How the trainee intern (TI) year can ease the transition from undergraduate education to postgraduate practice

Mike J Tweed, Warwick Bagg, Stephen Child, Tim J Wilkinson, Jennifer M Weller

Abstract

The trainee intern (TI) year is unique to New Zealand medical education. The TI year occupies a complete calendar year in which the medical student is immersed in clinical care as part of healthcare teams. The TI year is an example of a 'capstone' course; integrating theory into practice, fine tuning workplace skills, and easing the transition from undergraduate medical student to practising clinician.

We discuss the TI year within the context of 'transition shock'. Transition shock, related to movement between contexts or levels of responsibility, is not unique to medicine or the healthcare professions. This shock is multifactorial but there are many ways that the structure and activities of the TI year may ease this transition. The TI year is valuable in terms of its potential to improve preparedness, both real and perceived, but further research and ongoing evaluation is still required.

"No greater challenge outside wartime"
(A junior doctor's opinion of the transition from medical student to junior doctor in the UK)[1]

From commencing undergraduate study to retiring from clinical practice, a doctor will experience many transitions. One of the most, if not the most, challenging of these is the transition from undergraduate medical student to post graduate year one (PGY1) doctor. This paper reviews general issues of work transition for healthcare professionals but places specific emphasis on the transition from student to doctor within the unique place of the Trainee Intern (TI) year.

The TI year, (the sixth and final year of the New Zealand medical degree) was established in the 1970s[2] and anecdotally appears to be a good bridge between student and practitioner. In the UK and USA, some medical schools offer students short house officers experiences while others suggest mandatory "student house officer" attachments in a medical student's final year.[3,4]

In contrast to these experiences, the NZ TI year occupies a complete calendar year in which the student is immersed in clinical care as part of several healthcare teams. It should be noted that this year remains primarily under the jurisdiction of the Universities rather than healthcare employers or the medical council.

Although there are minor differences between Auckland and Otago Universities, the principles of the year remain the same, and the experience is equivalent. Medical undergraduates have assessment of clinical competence and knowledge over the first five undergraduate years, whilst the TI focuses on workplace performance.

The main purpose of the TI year is to allow the transitioning student to function as a valued member of a health care team, applying their learning in everyday clinical practice whilst still receiving close supervision and ongoing education from the university. Thus this year provides 'hands-on' preparation for the following PGY1.

As for many professions and vocational training programmes, medical students learn within an environment of graded responsibility. Initial patient contact is tightly and directly supervised and all patients seen by the students must be reviewed (direct supervision).

Later, following medical school graduation, these new doctors are granted the responsibility to see patients on their own, but these patients still 'belong' to a wider medical team and the majority of patients' overall care is regularly reviewed (indirect supervision). Following registration (granted after 12 months approved practice in New Zealand), new doctors are granted permission to see patients on their own but are still under indirect collegial supervision.

In addition to these transition points of graded responsibility, students also have transitions in roles and environments, locations and disciplines, from student to employee and from university to employer.

Transitions into employment in other professions

Managing transitions is not unique to medicine or healthcare. A large body of literature exists on different aspects of the stress of education-to-employment transitions.[5-9] In the preparation for employment, prior expectations are important. No matter what the level of stress, when the actual work experienced is equivalent to or less stressful than what was expected, commitment is enhanced. Conversely, when the experience is more stressful than expected, new employees may feel demoralised.[10,11]

While vocationally orientated degree courses aim to prepare graduates for employment, graduate surveys frequently highlight a perceived lack of preparation.[7] A possible contributor to this may be the emphasis on self-reliance, i.e. students should take responsibility for their own development, and preparation for practice. While self-reliance is a valuable attribute for many professions, and therefore to be encouraged, students may not be in a position to predict the types of problems they will face and therefore, without appropriate mentoring, cannot take steps to prepare for them.[7]

Employers' criticisms of ill-prepared graduates across many professions have led to the development of "capstone" courses in business degrees, a capstone being "a top or crowning stone of a wall" or "crowning touch".[6] The aim of the course is to integrate theory and practice and to fine-tune workplace skills.[12] These courses follow completion of the core curriculum and are an important part of many professional curricula.[6]

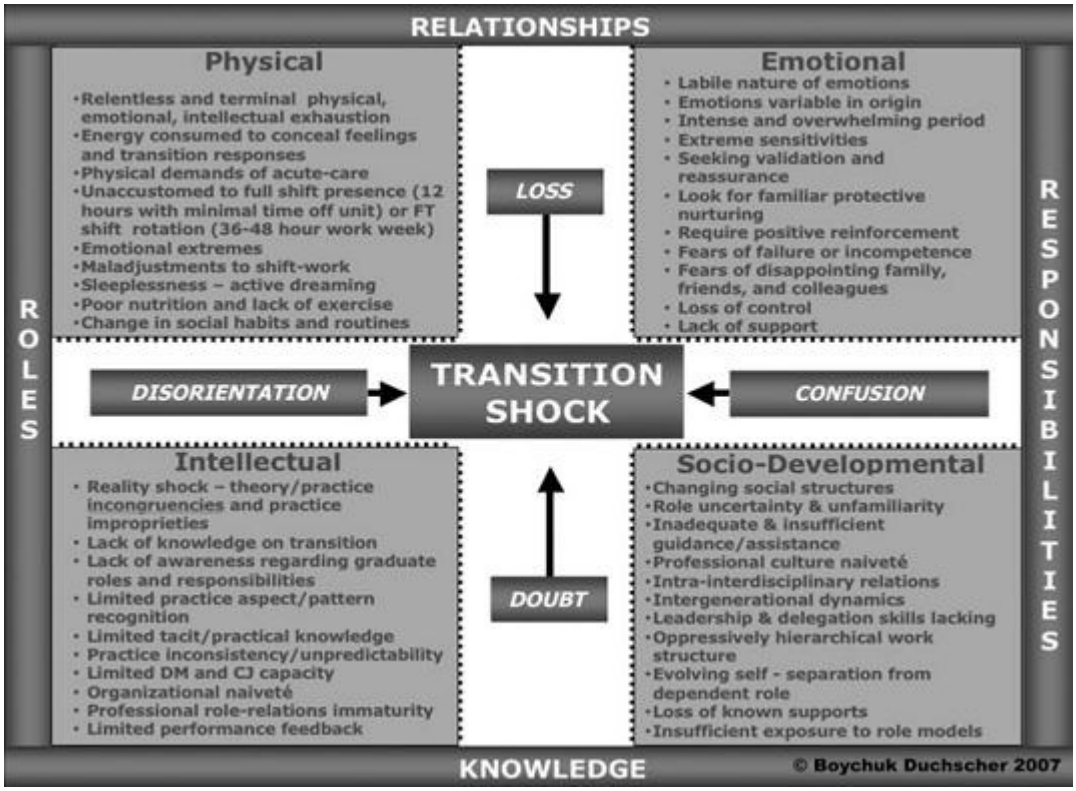
The TI year is an example of a capstone course. Proposals to develop and improve capstone courses include, with specific relevance to the TI year: increasing dialogue between university and employers (with increased feedback from employers); improved assessment including the use of portfolios and individualised assessments;[6,12] and the use of key mentors.[13]

The transition to working life as a doctor and healthcare professional

The particular journey of transition from undergraduate student to independent practitioner across healthcare professionals is especially challenging[14] and has even been termed "transition shock".[15]

Within the nursing literature, a framework (Figure 1) has been developed to describe the issues affecting healthcare professionals as they graduate, with notable emphasis on some of the stresses faced by a graduating medical student. Root causes of transition shock include expectation differences, change of support infrastructure, geographic relocation, reduced clinical support and social withdrawal. A similar pattern of problems is seen for junior doctors.[16]

Figure 1. Transition shock conceptual framework (reproduced with permission) developed for the nursing profession in United States[15]



Undergraduate education is constructed as preparation for professional practice, but the reality of a working environment includes issues of productivity, efficiency and achievement.

Conflicts between 'service' and 'education' are well documented[17] and can lead to dissatisfaction and disillusionment. At graduation there is a change from the known role of the 'student' to the less familiar role of practitioner with the accompanying increase in professional responsibilities. In addition, the student's undergraduate support network may be simultaneously removed with geographic relocation.[18]

Words used by healthcare professionals to describe these transition experiences often include confusion, being in-between, groundlessness, role ambiguity, and ill-preparedness.[15] The most intense shock is experienced in the first few months and can potentially be followed by social withdrawal.[15]

Although each progress step through healthcare education is a transition, that from graduation into practice is likely to be the greatest leap. For new doctors, the reality of being personally responsible for patients can induce fear, doubt and stress.[16] The emphasis to pass assessments is replaced by an emphasis to care for patients. This is both the reward and the responsibility of becoming a doctor.

The level of emotional trauma is also potentially heightened by a real or perceived lack of support. Colleagues and other healthcare professionals can support the new graduate through this emotional stress or add to it and undermine confidence to practice.[15] To alleviate this, it is not surprising that support through formal and informal teaching with feedback from senior colleagues and peer learning is valued by junior doctors.[18]

This emotional stress can compound physical stress and illness. Shift work for nurses has been found to disrupt sleep patterns.[15] Sleep is filled with dreams (nightmares) about work. Waking hours become filled with reviewing past shifts and anticipating upcoming shifts: this leads to perpetual work and further exhaustion.[15]

Graduates also want to develop a sense of their own professional self. Often they strive to find their place within their new "community of practice".[19] Therefore it is surprising that when Brennan,[1] interviewing junior doctors during their first postgraduate year, found that "working within a multidisciplinary team" was highlighted as a key component adding to their work related stress.

The potential gaps in transition to working life

Despite decades of research and multiple reviews of medical school curricula, many junior doctors still perceive gaps in their preparation for working life. For example, a number of researchers in the UK, Europe and Australia have surveyed or interviewed junior doctors on their perceived ability to cope with the job and found perceptions of deficiencies and inability to cope.[16,18,20–22] Self reported experience of procedures and skills from the Medical Council of New Zealand (MCNZ) list[23] highlighted variability in both exposure and perceived level of experience.

Gome[18] suggests , that junior doctors may be better prepared than they perceive themselves to be and this under-confidence may be unwarranted. However, in contrast stress is augmented by a disparity between what is expected of graduates and what they can reasonably achieve, with over-expectation of junior staff abilities by others being apparent.[24]

Farnan[25] explored residents' (junior doctors in training programs) uncertainty when dealing with problems they had recently faced on the ward. The residents described the following dilemmas in decision making: knowing when to escalate care; deciding between therapeutic options; uncertainty about ability to carry out a procedure; uncertainty regarding patients' wishes and goals due to perceived inadequate communication with the patient or fear of breach of trust in that relationship.

Ten of the 18 problems reported by residents were felt by the residents to have resulted in patient harm. Barriers to seeking advice from a more senior doctor included a perceived hierarchy for seeking assistance (i.e. ask a peer first), fears of losing autonomy, revealing gaps in knowledge, and being a "bother".

The New Zealand experience of preparation

In New Zealand there is evidence that, in general, TIs feel prepared for practice.[23,26,27] In a national study in 2007, compared to Year 5 students, TIs reported significantly greater perceived competence and performance levels across clinical, procedural and professional domains. The greatest improvement appeared to be in the independent performance of procedural skills and clinical tasks as well as in the level of clinical responsibility taken.

At the end of the trainee intern year, 92% of students felt prepared to be a junior doctor, versus only 53% at the end of Year 5. This is a substantially higher proportion of final year medical students who feel ready to work as junior doctors than those in the UK (58% in 2002), and Australia (64% in 2006).[28–31] While it is acknowledged that these data compare differing lengths and types of medical programmes, nevertheless they are the final year of the respective programmes.

Interestingly there also appears to be a shift in learning that occurs in this transition with TIs focussing their learning on preparation for the junior doctor role, rather than just academic and clinical abilities.[26] While the NZ data are about perceived competence and performance, rather than measured competence and performance, they provide some reassurance that the TI year may ease the transition to the junior doctor role.

The TI Year easing the transition

The transition from medical student to junior doctor is a major event and a degree of transition stress is inevitable. As well as attempting to align expectations and current experiences to future expectations, interventions to ease this transition include; providing an educational framework to support and supplement clinical attachments; socialising students into the healthcare team;[32] specific courses; exposing students to critical incident discussion groups; providing targeted simulation-based clinical skills training; and ensuring assessments are well designed and support learning.

The TI year easing the transition: educational framework—Although experiential workplace-based learning in clinical practice improves preparedness of medical students[33] and reduces transition stress,[1] reliance on clinical attachments as the sole learning approach in the TI year has some limitations. Learning may be opportunistic with no assurance that students will have the breadth of clinical experiences to reach the required standards across the curricular goals. Therefore a framework designed to support learning in clinical attachments is required.[34]

Evidence suggests that the transition attachments should be structured around a set of clear objectives.[3,35] While lists of expected competencies have been produced by national bodies such as the MCNZ[36] and the Australian Curriculum Framework for Junior Doctors,[37] currently these are only indicative and not mandated.

The TI year easing the transition: socialisation—Building collegial relationships is critical and contact with a variety of professional staff and role models will reduce the shock of working practice[15], but brief attachments and frequent rotations might work against building these relationships. Rather than attempting to "cover" the entire range of clinical practice, longer attachments and becoming part of the team may have some advantages. Indeed, this may enable students to become more engaged and take on

more responsibility for some aspects of patient care, both shown to promote better preparation for practice.[3,4,22,32,34,38–40]

While concerns over patient safety and optimising efficiency have tended to limit student involvement, well supervised students should be viewed as positive contributors to patient care and not as risks.[1] Furthermore, working with the same people in the same environment may be helpful, and it may be advantageous for TI attachments to be aligned with PGY1 posts. However, ensuring the TI year complements, rather than replicates PGY1 is also advantageous.

The TI year easing the transition: critical incident discussion—Junior house officers often provide much of the 'supervision' and teaching for TIs, but their high service load may limit the amount of time for reflection to optimise learning from the case. Opportunities to discuss experiences, including critical incidents, provide a way for students to make sense of cases and situations they have seen on the ward, by reflecting on diagnostic processes and decisions, thereby honing their clinical reasoning skills.[39,41]

Critical incident discussion could also be a venue to discuss ethical and professional issues; for example, when to call for help.[25] The importance of effective and supportive supervision cannot be overemphasised.[13]

The TI year easing the transition: specific courses—Other positive interventions described in the literature include "Patient Safety and Crisis Management" courses,[42] disease prevention and health promotion,[43] professionalism,[44] and learning about the theory and practice of teaching.[45–49]

The relevance of learning must be clear to the students. Students may not recognise the importance of some of these educational interventions as they will not have had experience of the workplace and the responsibilities they will have as doctors. Learning occurring when TIs are actually caring for patients will often maximise relevance and learning.

The TI year easing the transition: simulation-based clinical skills training—A number of targeted initiatives have been described to support transitioning doctors. Stolarek[50] reported that a clinical skills programme in a NZ hospital improved student self reported competence across a range of skills and that this complemented the experiential learning on wards. Experience during the intern year, especially recent experience of procedures and attending skills programme all increase self-reported confidence.

Simulation provides the opportunity for students to learn how to manage realistic clinical scenarios within a safe setting. They take responsibility for "the case" and have to make real-time decisions in a safe environment where there is an opportunity for reflection and feedback and repeated practice.

Learning can be structured and many of the potential gaps arising from the ad hoc nature of clinical exposure can be addressed. Simulation provides, among other things, a suitable teaching modality for learning diagnostic decision making, patient management, care of the acutely unwell patient, crisis management, teamwork, patient safety and procedural skills.

There is evidence showing the benefit of programmes that include simulations to support and supplement learning in the clinical environment.[51–56] Simulated experience and intervention courses however, should complement and not replace involvement with real patients which encompasses the complexity and uncertainty of the clinical environment.

The TI year easing the transition: authentic assessment—Finally, the range of assessments must also match the range of curriculum goals.[43] Benbassat[43] argues that if students are assessed in a minimum set of core skills against the standard of performance expected of a practitioner, this will raise the standard from familiarity to performance.

If the goal is to learn workplace-based patient management skills, then the assessments should be workplace-based, and could include direct observation tools such as mini-CEX (mini clinical evaluation exercise), DOPS (direct observation of procedural skills), case note review, case-based discussion or multisource feedback.[57]

Other approaches could include assessment of clinical skills using simulation or standardised patients, group assignments, supervisor reports or peer assessment.

Conclusions

In summary, transitioning from medical student to practising doctor is a time of major stress for most, if not all medical graduates. Many factors add to the transition shock, including new levels of responsibility, change of support, relocation, emotional stress, physical stress and service-education tensions. While clinical attachments in the final year of medical school are crucial, as at other stages in medical training, and require appropriate supervision and a supporting framework to achieve the desired goal of easing this stress.

Several means are available to ease this transition shock and include supportive colleagues and peers, educational infrastructure, clearly delineating expectations versus reality, better descriptions of objectives/curriculum, lengthening time with teams, offering modular courses in some gap areas, offering simulation to augment workplace-based learning, and aligning assessments to attributes that are required in the workplace.

Above all, these measures require a partnership between universities and employers because any transition requires an understanding of where the trainee is coming from and where they are going to.

The available evidence suggests that including the Trainee Intern year is a sound educational strategy for preparing our medical students for practice, and should be retained as the capstone course in our programmes. Nevertheless, there is a need for a more complete understanding of how this year influences the transition so that the good aspects can be enhanced and any negative aspects can be diminished. This is where research efforts could be employed.

We have identified a number of approaches to supporting TIs through this year to better achieve the outcomes expected of a graduating doctor. Whatever we do, however, there will still be a transition period when students are faced with taking on the responsibilities of a medical practitioner. An understanding and acknowledgement

of the influences on this transition may go some way to creating a more compassionate and supportive environment for our junior doctors.

Take home messages:

- As a capstone course, the TI year is valuable in terms of its potential to improve undergraduate preparedness for practice, both real and perceived, and hence reduce transition shock.
- Evidence from the international literature suggests that the transition to practice can be eased with a supportive educational framework, immersion in the healthcare team in a supportive clinical environment and high quality supervision.
- Although it is likely that the TI year does ease the transition, further research is warranted to identify the optimal structure.

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

Friendly Society Appointments in NSW

Excerpt from NZMJ 1910 November;9(36):49—in the British Medical Association (N.Z. Branch) Council and Division Meetings section.

The following letter, from the Hon. Secretary of the New South Wales Branch of the B.M.A., has been received by the Hon. Secretary of the New Zealand Branch :—

Dear Sir,—I am requested by the Council of the New South Wales Branch to invite you to take such steps as you may be able to take to let the New Zealand members know that all applicants from New Zealand for Friendly Society appointments in New South Wales should, in the first instance, communicate with the Hon. Secretary of the New South Wales Branch.

Although a "Warning Notice" to this effect has appeared for some 10 months in the B.M. Journal, Dr. J. F. Robertson, recently a member of the Nelson Division, and now by virtue of his change of residence a member of this Branch, applied, in response to an advertisement in the New Zealand papers, and was appointed M.O. of the North Sydney United F.S. Society, a prohibited institution, and has created a very difficult position for himself.

I am, dear Sir,

Faithfully yours,

ROBT. H. TODD,

Hon. Secretary.

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

Suppression of cough in young children—what about honey?

The Medicines and Healthcare products Regulatory Agency (MHRA) in the United Kingdom have recently banned use of the most commonly used over-the-counter (OTC) cough remedies in children under 6 years of age. The reason for this is their lack of efficacy and possible adverse effects. So far so good. But their alternative—'a warm drink of lemon and honey' has roused the ire of some.

The authors of this report point out that there is negligible evidence for the benefit of honey. A Cochrane review found only one relevant randomised trial—this compared honey, dextromethorphan and an empty syringe as a control. This trial, sponsored by the US National Honey Board, has been widely criticised as its results are inconclusive. Although the reviewers are highly critical of the MHRA suggestions I note that they recommend that honey's role as a cough suppressant in children should be tested in a well designed trial.

J R Soc Med 2010;103:164–5.

Growth hormone, testosterone and athletics

Both of these substances are known to be used by cheating athletes—do they have any effect? This trial involved 96 athletes (63 men and 33 women) with a mean age of 27.9 yrs. The men were randomly assigned to receive placebo, growth hormone (2mg/d subcutaneously), testosterone (250 mg/wk intramuscularly), or combined treatments over an 8-week period. The women had only growth hormone or placebo. Various body measurements were made and it was shown that growth hormone significantly reduced fat mass, increased lean body mass through an increase in extracellular water, and increased body cell mass in men when coadministered with testosterone.

In terms of performance, growth hormone significantly increased sprint capacity and the effect was nearly doubled when combined with testosterone. However, aerobic capacity and other measures of power were not affected. The "benefit" disappeared after 6 weeks. It is uncertain whether the effects would really help performance. Funding for the study came from the World Anti-Doping Agency.

Ann Intern Med 2010;152:568–77.

Can one annual treatment with high-dose vitamin D supplementation prevent falls and fractures in older women?

It is alleged by some that 700–800 IU of vitamin D daily reduced fracture risk by 13% to 26%, whereas others conclude that vitamin D is ineffective. This discrepancy might be explained by non-compliance with daily dosage in the elderly female who is at the greatest risk of falls and fractures.

In this trial, over 2000 women aged 70 years or older were randomised to receive either a placebo or a single annual dose of 500,000 IU of cholecalciferol administered orally in autumn or winter. The timing was intended to prevent the presumed lowering of vitamin D levels in wintertime.

Somewhat unexpectedly participants receiving annual high-dose oral cholecalciferol experienced 15% more falls and 26% more fractures than the placebo group. The authors speculate that the adverse outcome may be dose related. A reviewer speculates that the high dose may have improved mood and mobility thus increasing the risk of falls and fractures.

JAMA 2010;303(18):1815-22 & 1861-2.

Orthopaedic surgery skin closure—sutures versus staples

Skin closure with stapling is quicker than suturing but is it better? That is the question asked in this meta-analysis which focuses on wound infection rates. Six papers were included, detailing 683 wounds. In total, 332 patients underwent suture closure and 351 staple closure. The overall risk of developing a superficial wound infection was more than three times greater after staple closure compared with suture closure, after orthopaedic procedures. A sub-group analysis of hip surgery alone showed wound infection to be four times more likely after stapling.

The authors recommend that orthopaedic surgeons should close wounds with sutures. However, it may not be as simple as that. Hip surgery, particularly after fracture, skewed the results. These patients presumably were older and frailer which may be relevant. I note that in three of the studies there was no difference in the rate of infection in either type of skin closure

BMJ 2010;340:c1199 & c403.

Symptomatic carotid stenosis—stenting compared with endarterectomy

It has been established that endarterectomy is better at preventing strokes than medical treatments alone in those with severe carotid stenosis. Stenting is an alternative and this international randomised trial reports on a comparison of these two techniques in a cohort of over 1700 patients. The incidence of stroke or procedural death at 120 days significantly favoured the endarterectomy treatment arm. However, there were more treatment related cranial nerve palsies and significant haematomas noted in the endarterectomy group.

The conclusion of the triallists was that endarterectomy should remain the treatment of choice. They indicate that longer follow-up will provide more information on the relative merits of these treatments.

Lancet 2010;375:985–97.

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

Increased use of nicotine replacement therapy at Christchurch Hospital

The article by Stephen Vega and Iwona Stolarek[1] reporting increased usage of nicotine replacement therapy (NRT) at Hutt Hospital referred to an earlier editorial published in the *New Zealand Medical Journal*[2] which reported low use of NRT in Christchurch Hospital during the 2005–6 financial year.

NRT use in Christchurch Hospital has increased since 2005 and in the year July 2009 to June 2010 $16,685 was spent on NRT—more than triple that spent in 2005. Across all Canterbury District Health Board (CDHB) services, $34,966 was spent on NRT in the 2009–10 year. Provision of NRT to inpatients forms part of the ABC Strategy for Smoking Cessation and is one intervention that can be provided to meet Health Target 5: Better Help for Smokers to Quit.[3]

On this target, Christchurch Hospital has improved from 15% of hospitalised smokers in September 2009 provided with advice and help to quit to 67% in June 2010. Elsewhere in the CDHB, the Specialist Mental Health Services are now fully smokefree, and the Burwood Spinal Unit is working towards being smokefree by January next year.

Tobacco control in the wider CDHB region continues, and there are now 10 smokefree marae in the CDHB region. Smoking cessation has been promoted assiduously by CDHB Community and Public Health Division staff in education, workplace, and community settings and the first ABC Kohanga Reo smoking cessation group was held in Christchurch in May 2010. The CDHB is also working with Smokefree Canterbury on the adoption and evaluation of the Christchurch City Council Smokefree Public Places Policy.

Community and Public Health staff prepared a submission from the CDHB to the Māori Affairs Select Committee, and a group led by Hector Matthews (CDHB Executive Director, Māori and Pacific Health) presented to the Select Committee. The focus of the presentation was on the challenges of enforcing current legislation and the challenges of cessation. CPH staff also coordinated a CDHB submission on Tobacco Displays.

CPH smokefree officers have worked proactively with tobacco retailers, and achieved 94% compliance with selling tobacco only to those over the age of 18. Accessibility of tobacco products is a risk factor for smoking initiation, and there is evidence that restricting sales to minors through enforcement of legislation can reduce youth tobacco use.[4]

Based on evidence about the effectiveness of tobacco control interventions[4–6] these initiatives are very likely to have contributed to the continued reduction in the prevalence of smoking in the CDHB region, with CDHB having the fourth lowest prevalence of regular smokers of all DHB regions in the 2006 Census.[7]

The latest ASH Year 10 Survey[8] found that the CDHB region also has one of the lowest percentages of regular 14–15 year old smokers. Parental smoking and exposure to smoking in the home as reported by students have also decreased significantly in the CDHB ($p<0.05$).[8]

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

A response to the letter "Backlash follows chiropractors' attempts to suppress scientific debate"

The New Zealand Chiropractors' Association (NZCA) would like to address a number of inaccuracies in the letter "Backlash follows chiropractors' attempts to suppress scientific debate".[1]

The authors infer that the NZCA complaint made to the "Broadcasting Standards Association" (sic) about comments made on television regarding chiropractic[2] by Shaun Holt was somehow an attempt to stifle academic free speech and suppress scientific debate. This is incorrect. The complaint was primarily directed at a number of statements Holt presented as facts, but which were inaccurate. The complaint focused on the following statements, with relevant extracts of the Broadcasting Standards Authority's ruling provided:

> *Statement that chiropractic treatment "can cause stroke" and has resulted in "at least 700 cases" of severe injury*
>
> [52] In the Authority's view, the information supplied to it by Dr Holt (see paragraphs [29] and [30]) does not provide sufficient basis for his statement that chiropractic treatment "can cause stroke".
>
> [56] ….It therefore finds that it was also inaccurate to state that there are over 700 cases of such injuries, and that viewers would have been misled by the statement.

At the time of broadcast the Bone and Joint Decade had already published the most comprehensive research into vertebrobasilar artery (VBA) stroke, looking at over 100 million person years worth of data.[3] They uncovered only 818 cases of all aetiologies and "no evidence of excess risk of VBA stroke associated chiropractic care compared to primary care". The incidence of VBA stroke was higher in both chiropractic and primary healthcare provider groups compared to age and sex matched controls, and this was considered likely due to patients with headache and neck pain from a VBA dissection in progress seeking care before their stroke. Regardless, this is an extremely rare condition with risk factors that may include yoga, painting ceilings and nose blowing.[4]

The reference to 'at least 700 cases" is not based on research published in any peer reviewed literature.

> *Statement that Dr Holt had surveyed "chiropractors in this country" and two-thirds said they would treat asthma and ear infections*
>
> [58] NZCA argued that this was inaccurate because Dr Holt had only surveyed 13 people. The information provided by Dr Holt (see paragraph [33]) confirms this.

The NZCA and the Authority consider that to present the statements of 13 people as being the opinion of an entire profession is highly misleading.

The letter attempts to position the chiropractic profession as "anti-science" and then presents the results of an "informal analysis of current material". The 'overwhelming consensus' Gilbey and Holt refer to is indeed present on skeptic blogsites. However, the portrayal of chiropractic as cultist, unscientific, and having a philosophy incompatible with modern medicine selectively ignores the findings of many independent government enquiries[5–8] and the World Health Organization[9] which have recommended the use of chiropractic care in selected circumstances. It also contradicts the opinions of many independent agencies, including the American College of Surgeons[10] along with findings published in the journal of the American Academy of Family Physicians that encouraged family physicians to positively "re-evaluate their relationship with chiropractors".[11] In light of this the NZCA would ask readers that they question these aspects of Gilbey and Holt's letter on chiropractic published in the *New Zealand Medical Journal*.

The NZCA defends the right to free speech but does not consider the spread of inaccuracies, innuendo or the selective presentation of research under the guise of academic debate to be valid.

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David Owen
Chiropractor
Whakatane

On behalf of the New Zealand Chiropractors' Association

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

The recognition and treatment of pigmented lesions: a survey of New Zealand beauty therapists

Intense pulsed light (IPL) and laser devices are readily accessible to beauty therapists in New Zealand for the treatment of pigmented skin lesions. However their usage is unregulated as these instruments do not fulfil the local legislative definition of a medical device.[1] The concern is that these devices may be used inadvertently for the treatment of malignant skin lesions such as melanoma by personnel who do not have formal training in the recognition of skin cancers. This survey questioned New Zealand beauty therapists about training in skin cancer and management of pigmented lesions.

A standardised questionnaire was formulated by the New Zealand Beauty Therapy Association (NZBTA) and the Dermatology Department of Middlemore Hospital. These were distributed to all 700 members of the NZBTA as an insert in the "Beautynz" magazine. The anonymous questionnaire contained 16 questions including four unlabelled photographs of pigmented lesions.

The four photographs were of a "classic" superficial spreading malignant melanoma, a subtle melanoma *in situ*, a lentigo and a naevus. The superficial spreading melanoma and the melanoma in situ were histologically confirmed. Ethics Committee approval was obtained for this study.

79 questionnaires (11% of questionnaires sent out) were returned. 39% (n=31) of respondents did not receive any formal training in the identification of skin cancer. 51% (n=24) of those who had formal instruction spent less than a day on this aspect of training. Most respondents were taught about skin cancer identification by other beauty therapists (53%, n=38) while 28% (n=20) received teaching from doctors or nurses. 12.5% (n=9) were self-taught from sources ranging from magazines to the internet.

When asked what they would do if a client was concerned about a skin pigmentation from ultraviolet exposure on the skin, the majority (90%, n=70) would refer to a doctor. Most therapists also reported that they would not treat a blemish if they themselves had concerns about it (87%, n=67).

The questionnaire asked the therapists if they would treat the "classic" superficial spreading malignant melanoma and the more subtle melanoma *in situ*. For the "classic" melanoma, 97% (n=76) would not and 3% (n=2) were unsure. By comparison, when shown the "subtle" melanoma, 29% (n=22) would have treated the lesion, 49% (n=38) would not and 22% (n=17) were unsure.

The therapists were asked if they knew the meaning of the ABCD guide to melanoma and 60% (n=46) replied "no". The majority of them (94%, n=74) were keen to receive formal training in the identification of skin cancer. More than half the respondents (64%, n=50) did not have access to a registered medical practitioner or registered nurse in their practice.

Beauty therapists are commonly requested by the public to treat pigmented lesions and they may be the first treatment providers that patients seek. Professionally-trained beauty therapists have formal instruction in the recognition of skin cancers and understand the importance of communicating with medical professionals when faced with pigmented lesions about which they have concerns. There is no regulatory body overseeing the usage of IPL and lasers; the potential exists for unqualified personnel to use these devices unintentionally on malignant melanoma.

The diagnosis of malignant melanoma relies on an accurate history and careful examination. Dermatoscopy and comparison of serial images adds to diagnostic accuracy. Nonetheless the diagnosis can, at times, be challenging even for the experienced practitioner. This survey demonstrated that a large number of the respondents received no training in skin cancer recognition. The majority was not aware of the ABCD guide to melanoma. Reassuringly, most respondents managed to accurately identify the "classic" melanoma. However, some beauty therapists would have treated the subtle melanoma *in situ*.

Where practical, surgical excision remains the standard treatment for primary melanoma.[2] The use of a Nd:YAG and Alexandrite lasers is reported in the treatment of melanoma in situ however long term clearance was achieved in only 12 out of 22 patients. Laser treatment is associated with a high recurrence rate perhaps related to protection of atypical melanocytes within appendageal structures and the presence of amelanotic cells beyond the visible pigmented margin.[3]

Almost all the beauty therapists participating in the survey realise the need for formal training in skin cancer identification. With the high incidence of melanoma in New Zealand this aspect of training is essential for anyone involved in treating skin lesions. This study was limited by the low response rate and that the management response was based on image recognition alone. A larger survey, particularly examining those who chose not to return the survey would be preferable.

We propose that all users of IPL and lasers undergo appropriate standardised and mandatory training in the recognition of skin cancer to limit the potential risk of an adverse outcome to patients.

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Middlemore Hospital, Auckland.

References:

1. Section 2, Medicines Act. Ministry Of Health, Government of New Zealand, 1981.

2. Australian Cancer Network Melanoma Guidelines Revision Working Party. Clinical Practice Guidelines for the Management of Melanoma in Australia and New Zealand. The Cancer Council Australia and Australian Cancer Network, Sydney and New Zealand Guidelines Group, Wellington 2008.
3. Madan V, August PJ. Lentigo maligna--outcomes of treatment with Q-switched Nd:YAG and alexandrite lasers. Dermatol Surg. 2009;35:607-11; discussion 11-2.

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

PHARMAC and New Zealand pharmacy

Scahill et al[1] describe the landscape for New Zealand pharmacy and touch on the role of Pharmaceutical Management Agency (PHARMAC) and its impact on pharmacy.

We accept that PHARMAC's work has an impact on what pharmacists do, but we are committed to minimising that impact as much as possible. In recent years we have been working to remove 'niggles' from the work of pharmacists, and this has included reviewing and, where appropriate, removing Special Authority requirements for medicines and looking closely at dispensing rules.

Part of this involves listening to the feedback we receive, both informally and through formal consultation processes. Scahill et al refer to a "*recent example is the need for community pharmacists to check the scope of practice of the prescriber for every prescription received*". This was proposed by PHARMAC, but as a result of the feedback we have received, we changed our approach and no longer propose to include such references.

Rather than an example of PHARMAC's hand hindering pharmacy, this is a good illustration of PHARMAC's determination to work cooperatively with pharmacy, listen to feedback and remove unnecessary obstacles where we can.

Rachel Mackay
Manager, Schedule and Contracts
PHARMAC, Wellington

Reference:

1. Scahill S, Harrison J, Carswell P, Shaw J. Health care policy and community pharmacy: implications for the New Zealand primary health care sector. N Z Med J 25 June 2010;123(1317). http://www.nzma.org.nz/journal/123-1317/4189

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

Clarification of MCNZ's role

Recertification—I enjoyed reading the previous Health and Disability Commissioner, Ron Paterson's article *Lessons from complaints: implications for medical education* (NZMJ 14 May 2010, Vol 123 No 1314; http://www.nzmj.com/journal/123-1314/4110/content.pdf)

Ron writes,

> …Patients assume that doctors have to maintain their professional skills and that this is checked, much as a car must have a valid "warrant of fitness" to stay on the road. In fact the current Medical Council requirements for recertification are light, based on a fairly soft CME model. There is too much mileage given to attending update conferences and not enough focus on participation in audit, peer review, and quality improvement activities.

The Council's focus is right touch regulation, not light touch as suggested by Ron. We try to be proportionate and outcome focused. The Council feels that the answer is in supporting and promoting excellence and professionalism. More regulation is not necessarily better regulation.

The Council currently requires most doctors to do 50 hours of continuing professional development every year. This must include:

- At least one **clinical audit** to assess, evaluate and improve the care of patients
- A minimum of 10 hours per year **peer review**
- A minimum of 20 hours per year **continuing medical education**.

The Council has required doctors to recertify since 2001. Over the last 3 years we have consulted on these requirements and are now introducing regular practise reviews, which are formative in nature and outcome focused.

Discipline: clarification of the Council's role—In their paper, *Opportunities to learn from medical incidents: a review of published reports from the Health and Disability Commissioner,* Sara Temelkovski and Kathleen Callaghan (NZMJ 14 May-2010, Vol 123 No 1314; http://www.nzmj.com/journal/123-1314/4114/content.pdf) note,

> …These recommendations can range from a formal written apology by the medical practitioner to the patient or family, or a direction that the medical practitioner undertakes a review of practice, to a copy of the report being sent to the NZMC for consideration of initiating remediation processes and/or discipline related actions.

To clarify the Medical Council has not undertaken '...any discipline related actions' since the inception of the Medical Practitioners Disciplinary Tribunal on 1 July 1996. Any 'discipline related actions' are the role and function of the Tribunal.

The Council's philosophy is one of dealing with concerns about a doctor's fitness to practice in a collaborative and non-adversarial way with the objective of protecting public health and safety. More often than not this is achieved by requiring a doctor to undertake an educational programme to upskill their clinical competence.

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

Professional Misconduct – Not Guilty (Med07/65D)

Charge

The Doctor was charged with professional misconduct by the Director of Proceedings. The charge alleged that:

1. Between 29 May 1987 and 31 December 1988 the Doctor had a sexual relationship with Ms N while she and/or her husband and/or her children were his patient or patients;
2. Between 6 June 2006 and 8 June 2006, once a complaint had been made to the Health and Disability Commissioner by Ms N's husband about a sexual relationship between him and Ms N, he contacted Ms N and encouraged her not to respond to the Commissioner's letter that had been sent to her and/or not to supply any medical records if she had them.

Finding

The Tribunal found the Doctor not guilty of professional misconduct.

Background

In July 1983 the Doctor moved to the area where Ms N and her then husband (Mr R) lived, which was a small country town.

Ms N and the Doctor shared an interest in music. In April 1987, they were invited to perform musical items together. Thereafter, a close, and then sexual, relationship developed. The Tribunal concluded that the sexual relationship occurred from December 1987 to December 1988.

During the sexual relationship there were the following medical consultations:

- The contraceptive pill was provided to Ms N.
- The Doctor attended Mr R for an eye injury on an emergency basis.
- From early October 1987 to October 1988, the Doctor provided GP services in respect of one of the children, who had a urinary tract condition; treatment was given, however, at Hospital.

The consultation on Mr R, during the period of the relationship, was on an emergency basis. The Tribunal was satisfied it was not appropriate to consider it in this particular disciplinary case. It was put to one side.

After December 1988 the parties, had little to do with each other until 2005, when the Doctor telephoned Ms N to advise he was applying for a senior office within his profession. He asked her to be discreet about their affair if questioned by the media about it. In the course of the conversation Ms N suggested the Doctor contact her former husband Mr R, since he was more likely to have concerns about this situation.

Ms N then contacted Mr R and told him to expect a call from the Doctor.

Mr R wrote to the organisation where the Doctor was applying for the senior position. Mr R raised his concerns as to the possibility that the Doctor would be appointed to a senior position within the organisation, given what he considered to be previous conduct by the Doctor, which lacked integrity. The organisation responded stating that the allegations should be referred to the Medical Council.

On 24 January 2006, Mr R wrote to the Medical Council laying a complaint alleging professional misconduct. On 2 February 2006, the Medical Council forwarded the complaint to HDC.

On 26 May 2006, the HDC wrote to the Doctor, informing him of the complaint and stating that the Commissioner intended to investigate the issues raised. At the same time, the Commissioner wrote to Ms N and it appeared a request for medical records was made about this time. Ms N sought the assistance of her then GP to obtain previous notes. The Tribunal found that she had already commenced these inquiries by the time of a phone call which then occurred between the Doctor and Ms N.

On 7 June 2006, the Doctor telephoned Ms N. She told him she had received a letter from HDC. Later that day she made a note of the conversation in which she recorded the Doctor as saying it would "… all go away if the records got lost".

Reason for Finding

The Tribunal found that medical services were given to both Ms N and to one of her children during the relevant period. They were therefore patients during December 1987 to December 1988, the period of the sexual relationship.

The Tribunal was satisfied that the established facts in this particular amounted to malpractice, and to the bringing of discredit to the profession.

The Tribunal was then required to consider the question of whether discipline was warranted.

In considering the issue of threshold the Tribunal took into account the following factors:

- The parties lived in a small community where there was social contact particularly with regard to shared musical interests. This contact was clearly outside of any professional relationship and it was the genesis of the sexual relationship.
- The only established consultations for Ms N, whether before or during their sexual relationship, were for relatively minor matters. The nature of those matters did not place her in a position of being unduly vulnerable.
- There was serious delay in bringing the matter to the point of consideration for professional disciplinary purposes.
- The Doctor, in response to the complaint laid, stood down from obtaining a senior office within his profession, which was a matter of importance to the complainant.

- As to whether there are any ongoing practice issues which might be relevant to the question of whether discipline is warranted so as to protect the public, the Tribunal received evidence of a Performance Assessment Committee report which had carefully assessed the Doctor's attitude to boundary issues (amongst others). The writers of that report verified a high awareness as to the maintenance of boundaries and potential risks.

This was a very unusual case. But having regard to the totality of all the factors it had identified, the Tribunal was not satisfied that discipline was warranted in this particular instance. Therefore Particular 1 was not established.

In relation to Particular 2 the Tribunal found the Doctor understood that the notes had already been sent and he made a flippant remark in frustration. The Tribunal accepted it was a throw away remark, which could not have been intended to have any effect.

The Tribunal understood the charge to allege that there was a deliberate attempt to subvert the HDC process. The Tribunal was not satisfied that this assertion was established.

Since neither Particular was established, the charge was dismissed.

The full decisions relating to the case can be found on the Tribunal web site at www.hpdt.org.nz
Reference No: Med07/65D.

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

James (Jim) Francis Gwynne

Jim Gwynne (MBChB, MD, FRCPA, FRCPath) was born in Sydney on 3 January 1925. When he was 18 months old the family moved to Auckland NZ when his father was appointed as the radiologist to the Auckland Hospital Board.

Jim practised as an anatomical and forensic pathologist for 40 years—mainly in New Zealand where he worked in Auckland, Dunedin and Christchurch. In 1985 he moved to Brisbane where he worked at the John Tonge Forensic Institute from 1985 until 1993.

He finally retired from teaching medical students in 1997 but retained his interest in and support of the UQ Pathology Museum until 2007.

Jim was devoted to the public sector and was never attracted to private practice which would have deprived him of his special enthusiasm for teaching and the study of major surgical pathology and autopsy examinations.

Jim was educated at King's Primary school and Auckland Grammar and graduated from the Otago Medical School in 1950. He was a mediocre medical student but won Blues in rugby and athletics. After 2 years as an intern in Dunedin Hospital, Jim entered pathology as a registrar without commitment but he soon became a staunch advocate as he recognised its importance along with anatomy and physiology as the basis of sound medical practice. After 4 years in the Otago Department of Pathology he obtained an MD in Pathology.

In 1957 he became a Fellow of the Royal College of Pathologists of Australasia and in 1960 he was elected a founding Fellow of the Royal College of Pathologists (UK). In 1956 he moved to Auckland being employed as pathologist in charge successively at National Women's, Middlemore and Green Lane Hospitals. He took a special interest in neuropathology. In 1964 he returned to Dunedin and the Otago University as a Senior Lecturer and then Associate Professor until 1979 when he was appointed Pathologist in Charge at the Princess Margaret Hospital in Christchurch. He stayed there until he moved to Brisbane in 1985.

In 1970 Dr Gwynne was awarded the Wolfson Travelling Fellowship studying major side effects of therapeutic drugs in the United Kingdom and the United States of America. On return to New Zealand he undertook a national speaking tour where he reported his findings to clinical and pathology colleagues.

Dr Gwynne was the chairman of the NZ National Road Safety Research Council. He was also a member of the NZ working party to review relationships between the

police and the forensic services. He was on the Otago University Executive at the time of their centenary and he was a member of the Executive of the NZ Society of Pathology which preceded the establishment of the Royal College of Pathologists of Australasia. In Brisbane, Dr Gwynne performed forensic autopsies for the health department and was a part time teacher in the University of Queensland Medical School in both pathology and anatomy, until his retirement in 1997.

Dr Gwynne never undertook basic research but published about 40 papers mainly concerned with morbidity and mortality topics based on his personal experience and observations. He was especially interested in death certification and its contribution to mortality statistics, the road toll, alcohol and unexpected sudden death.

There were many outside interests throughout his life, He was an active and vigorous administrator in the Otago University Rugby Club having been a player, and also functioning as club captain, selector, and coach of the senior team. He was also chairman of the committee that raised the funds to refurbish the Otago University Oval Grandstand "scrum room" for social events which was named the *Arnold Perry Room*. He was awarded a life membership of the OURFC in 1984. His children were active competitive swimmers and this led Jim to become daily swimmer himself, a habit which continued for the next 40 years.

Dr Gwynne was staunchly opposed to abortion and was a co-founder of the NZ Society for the Protection of the Unborn Child (SPUC). He gave many talks on the subject. He was also involved with the Medico-Legal Society and the Sports Medicine Federation in New Zealand. As an amateur actor he played the role of the Bureaucrat in the James K Baxter play of that title at the Globe Theatre in the 1960s. Twenty years earlier he was tine the cast of the *Wind and the Rain* by Merlon Hodge at Auckland University.

On retirement Dr Gwynne became a volunteer and community speaker for the Heart Foundation, Cancer Council and Drug Arm in Brisbane. He had also been a member of the National Heart Foundation Executive in New Zealand. He was a strong and supportive antismoking campaigner having battled for years with cigarette addiction himself. His Drug Arm association involved talking to prisoners in various Brisbane correctional centres about the side effects of drugs and alcohol.

He had a great empathy with working people since a wide experience as a labourer while he was a student. Jim had friends from many walks of life and habitually spoke to strangers which helped him develop his wide interests. In January 2003 he commenced hosting a monthly "chat group" for an eclectic group of around 12 retirees for 2 hours of unrehearsed conversation. This ceased in January 2008 after 5 years due to his failing health but many of his friends still called around individually to enjoy his ongoing stories and to share their jokes and enthusiasms.

Dr Gwynne was grateful to the physicians, surgeons and general practitioners who cared for him through various illnesses in his later years. Dr Gwynne is survived by his second wife Joan Faoagali, 8 children, 15 grandchildren one great grandchild and his younger brother Peter.

This self-written obituary was completed by Dr Gwynne on 31 May 2008. He died at his home in Brisbane on 12 July 2010.

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

Richard Campbell Begg

Dr Richard Campbell Begg MBBCH, DOBST, RCOG, DPH, DIH passed away in Nelson Hospice on 24 July 2009 after a short illness.

Dr Begg (the son of Dr Robert Campbell Begg, the first urologist in New Zealand) was born in Wellington, New Zealand, in 1924. In 1937, he immigrated with his four siblings and parents to Johannesburg, South Africa. After matriculating in 1939, Richard worked as a junior clerk at the Chamber of Mines in Johannesburg. Two years later he sailed to England to train (for 6 months) at the British Royal Naval College in Dartmouth. He served on various ships in World War II including the HMS Norfolk, HMS Kent and HMS Orwell in the home fleet based at Scapa Flow.

Operations included escorting merchant ships across the Arctic Circle to Russia, escorting American and merchant ships to northern Africa and escorting the Renown, which was bringing the then British Prime Minister, Winston Churchill, home after meeting allied leaders in Canada.

By the time the war finished, Richard was a lieutenant serving on the destroyer HMS Paladin (East Indies Fleet, based at Trincomalee in Ceylon). Although the Paladin returned to the United Kingdom in October 1945, Richard remained in Ceylon as a watch-keeping officer in the destroyer depot ship HMS Woolwich. He returned to South Africa in May 1946. His application to resign his commission was finally accepted in October that year.

Richard studied medicine in Johannesburg but upon qualifying in 1952, returned to New Zealand. His medical career was varied, beginning with a stint as a house surgeon in Dunedin and Balclutha hospitals and several years as a general practitioner (in New Zealand and overseas) before moving into the area of public health.

After obtaining a Diploma of Public Health at Otago University in 1962, Richard took on the first of several posts as Medical Officer of Health (MOH)—in Gisborne. In association with local iwi and other colleagues, he instigated a series of medicosocial surveys into Maori health and environment. As a result, committees aimed at improving Maori health were set up.

Over the next 14 years, Richard worked as MOH in the Hutt district and Dunedin (where he also lectured in social medicine at the University of Otago), as medical officer for the New Zealand Forest Products plant Kinleith (near Tokoroa), superintendent of Dunstan Hospital, Clyde and medical officer at Cherry Farm Hospital (psychiatric).

In 1976, he joined the then Department of Health as Deputy Director of Public Health. Two years later he was appointed head of the Department's new Division of Health Promotion. He retired in 1984.

Richard's priorities in public health were the promotion of good health and prevention of illness and disability. One of his biggest contributions was in the area of deafness. As well as raising public and professional awareness about deaf prevention and hearing conservation, Richard helped establish services, which would identify and advise on children with hearing problems.

Retirement enabled Richard to indulge in other interests, in particular history and travel, with his wife Margaret.

In the mid-1990s, Richard began recording the stories of World War II veterans—including cartoonist the late Sydney Scales and Professor John Mackie (surveying), both of Dunedin—at the request of Peter Liddle, the then Director of the Second World War Centre in Leeds, England.

The recordings led to the creation of *For Five Shillings a Day,* collection of eyewitness accounts by 54 veterans of the British and Commonwealth armed forces. Harper Collins first published the book—edited by Richard and Peter Liddle—in Great Britain in 2000. The original tapes are with the Second World War Experience Centre in Leeds and copies have been lodged with the relevant service museums in New Zealand.

Richard's is survived by his wife Margaret, five children and nine grandchildren.

John Begg (Richard Campbell Begg's son) wrote this obituary which previously appeared on the Otago Medical School Alumnus Association website (http://medicalalumni.otago.ac.nz/obituaries/Begg_Richard_Campbell.html).

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

Exercise and Cancer Survivorship: impact on health outcomes and quality of life

John Saxton and Amanda Daley (editors). Published by Springer, 2010.
ISBN 9781441911728. Contains 238 pages. Price 129.95 Euros

Due to continuing improvements in cancer detection and treatment methods, more individuals with cancer are living longer post-diagnosis. As many of these individuals are over 65 years of age, the possible interaction of the cancer itself, their advancing age and treatment side-effects may pose many challenges to their health and well-being. Specifically, many cancer survivors experience reduced quality of life and physical functioning as well as increased levels of fatigue and susceptibility to other chronic conditions.

This book brings together leading researchers from North America and Europe with experience in the cancer exercise field. The initial two chapters of this book describe the cancer "experience" and how exercise may be of general benefit to cancer survivors. The following 11 chapters then focus on presenting stand-alone reviews of the literature on the benefits of exercise for some of the most prevalent cancers, these being breast, prostate, colorectal and lung. Considerable sections of these final 11 chapters also review the evidence for the likely mechanisms underlying the known exercise benefits and the barriers and motives to exercise in cancer survivors. The barriers and motives sections are particularly important as such information is needed for the results of these intervention studies to improve usual care practice.

Each of the 13 chapters concludes with recommendations for usual care and future research as well as a comprehensive reference list that will provide the interested reader with much additional information. While the recommendations of this book regarding the benefits of exercise may be applied with the greatest certainty to breast, prostate, colorectal and lung cancer groups, the emerging evidence for other cancer groups would suggest that these recommendations may be quite applicable to most other cancer types as well.

Overall, I would recommend this book for all health professionals who work with cancer patients and survivors. Exercise instructors and health promotion specialists who may wish to work with cancer survivors would also find this book of great benefit. I hope that this book acts as a stimulus for health professionals, health promotion specialists, exercise instructors and researchers within New Zealand to work together in improving the health and well-being of our cancer survivors. This could be achieved by making exercise a part of usual care for many cancer patients/survivors and to conduct further research in this quickly-developing area.

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