NEW ZEALAND MEDICAL ASSOCIATION

Medical student selection in New Zealand: Looking to the future

Phillipa Poole
Head
Medical Education Division
School of Medicine
University of Auckland
Auckland

Helen Moriarty
Senior Lecturer
Department of Primary
Health Care and General
Practice
University of Otago
Wellington

Andy Wearn
Director
Clinical Skills Resource
Centre
University of Auckland
Auckland

Tim Wilkinson
Associate Dean
(Medical Education)
University of Otago
Christchurch

Jennifer Weller
Director
Centre for Medical and
Health Sciences Education
University of Auckland
Auckland

ABSTRACT

Aims To review whether current New Zealand (NZ) medical student selection policies are likely to result in specialists prepared to work in areas of greatest health need in the future.

Method This paper describes approaches used to select medical students, with some details about NZ medical student cohorts. It then discusses the evidence linking selection and career choice.

Results and Conclusions Selection processes have to serve multiple purposes and no tools are ideal. The NZ medical student population is more diverse than previously with more females than males, and higher proportions of students who are Māori, Pacific, rural, Asian or born overseas. Tracking projects are already underway to obtain data to better understand the effect of student factors on career choice. The Māori and Pacific Admission Scheme and Rural Origin Medical Preferential Entry affirmative action pathways have been successful, but to increase the number of doctors who identify as Māori or Pacific will require a larger pool of students with strong educational backgrounds from which to select. The strongest evidence between selection and future practice exists for students from rural backgrounds – they are more likely to practice in rural areas and to enter general practice. Therefore, increasing the numbers or rural students, or broadening the definition of 'rural', should be considered.

INTRODUCTION

New Zealand (NZ) medical students starting their programme in 2010 will enter the specialist workforce from 2022 onwards. Healthcare delivery will be very different then if NZ is to meet the challenge of providing quality healthcare to an aging population in the face of static financial and human resources.[1]

Having a strong primary care sector, and an increased proportion of 'generalist' specialists who work over traditional primary, secondary and tertiary boundaries may provide the best strategy to maintain quality and keep costs down.[2][3] For example, a recent Ministry of Health review of how best to configure agencies in the mental health and addictions sector concluded there is a need for more doctors working in both psychiatry and general practice.[4]

After years of piecemeal growth, medical student numbers in NZ are about to increase significantly.[5] A fundamental step in shaping the future workforce is the selection of medical students, making this an opportune time to review how future doctors are chosen.

This paper describes approaches used to select medical students, with some details about the current NZ medical student cohorts. It then outlines evidence between selection and career choice for the types of doctors NZ will need in the future.

SELECTION TOOLS AND THEIR RATIONALE

The ideal medical student selection tool would predict future performance in medical school and beyond, so that those selected progress through a rigorous programme and graduate as effective medical practitioners. Additionally, this tool would address issues of equity and diversity, 'screen in' those with desirable qualities that can't be taught, and 'screen out' those with unfavourable traits for medicine.

Finally, an ideal selection tool would select those attributes that are desirable in a doctor but which cannot be learnt in medical school. As there is no such tool, medical schools use a variety of approaches. These range from nihilism (relying on lottery alone), to measuring the easily measurable (such as grades or aptitude scores), to best guesses (where selection is based on what seems to have high face validity).

Evaluating the effect of these different approaches is problematic, due mainly to restriction of range where those with the lowest scores are not admitted and are thereby excluded from further analysis.

Although academic grades are the single best predictor of academic success in the early years of medical school,[6] the correlation is only moderate except in the case of very high grades and very low grades. Academic grades are less predictive of assessment measures after graduation.[7]

A reliance solely on grades for selection to medical school preferentially rewards those with prior educational advantage and ignores issues of social equity, fitness for the task, community expectations and the desirability of a diverse medical workforce.[8][9]

To address some of the aforementioned areas, tests of non-cognitive

attributes are used in medical student selection.10 However, personal references and statements have been shown to be of no predictive value.[11] [12] Traditional interviews have low reliability characterised by low agreement between raters, interview bias based on non-relevant candidate attributes and potential for candidates to adopt socially desirable stances in response to questions.

More structured interviews show higher reliability,[13] and seeking examples of past behaviour ("tell me a time when...") may produce more honest responses than asking candidates what they would do if faced with a particular scenario.[14] A recent development is the Multiple Mini Interview (MMI)[15] during which candidates pass through a range of stations, each testing for specific attributes considered desirable in doctors. Stations may include interviews, standardised patient stations or video clips. The principal advantage of an MMI is the ability to sample across more areas of interest (increasing validity) and to aggregate the scores of a number of assessors (increasing reliability).

Other advantages include fewer problems with security violations,[16] being less expensive to run than traditional interviews,[17] and less subject to influence by coaching.[18] Disadvantages include the time and expense to develop the MMI process.

The attributes to be tested will depend on local circumstances and require stakeholder consultation. There is emerging evidence supporting reliability, validity and potential to predict future performance of the MMI process,[10, 19, 20] but as the MMI is a process and not a test in itself, the validity and reliability are dependent on how the MMI is constructed in each individual location.

Aptitude tests such as the Undergraduate Medical Admissions Test or UMAT (©ACER, Melbourne) are increasingly used in Australasia and beyond. The UMAT requires no previous scientific knowledge and is designed to measure logical reasoning and problem solving, interaction skills and non-verbal reasoning. There is some evidence supporting the ability of these tests to predict future performance in medical school, but as only those with high scores gain entry, it is difficult to investigate the predictive validity of these instruments.[18]

Commercial coaching courses for UMAT purport to influence scores but the only evidence is of a very small effect on non-verbal reasoning tasks.[18] The personal qualities assessment procedure (PQA) is a portfolio of psychometric tests that may offer an advance in predicting performance in medical school and professional progress.[21]

The use of the scores on these tests varies among schools. Some schools use all of them in ranking; others set thresholds for certain tests, with final selection decisions based on other data. Lotteries are appealing to some, and may be weighted towards region of origin or demographic characteristics. They may, however, perpetuate cognitive selection bias as the initial cut is still based on examination results.[22]

Another problem is that students selected using a lottery system are more likely to drop out of their medical programme than those selected using a combination of academic and non-cognitive tools.[22]

Faced with the paucity of robust data and the 'high stakes' consequences of declining a candidate a place in medical school, it is little wonder this area is controversial.

Selection tools are usually combined by schools based on their own assessments of the fairest way to select the most appropriate population of medical students.

STUDENT NUMBERS AND SELECTION PRACTICES

Medical students in NZ are selected after one year at university, or following completion of a degree. Those who are not graduates must undertake a health sciences first year at the same university to which they intend to apply for medicine; this is then credited to their six year programme. In recent years, there were 190 domestic medical student places available in Year 2 at the University of Otago and 135 at the University of Auckland, with another 20 domestic places allocated to each school for 2008.

There will be an additional 60 medical student places available nationally in 2010 with more likely over the next few years.[23]

At Auckland, all applicants are ranked using a combination of Grade Point Average (GPA), and scores from the UMAT. To be invited to the next stage which is a semistructured interview, the GPA across the eight courses undertaken must be a B+ or higher. With the exception of a small number of students included or excluded directly as a result of interview performance, the GPA, interview and UMAT are weighted 60:25:15 respectively towards the final ranking for selection.

For undergraduates applying to Otago, ranking decisions are based upon GPA and UMAT in a 66:34 weighting, provided the designated academic and UMAT thresholds are met. Graduates must meet the UMAT threshold and, thereafter, ranking is based on GPA alone. In contrast to Auckland, no interview is undertaken. In both NZ schools there are over three eligible applicants for every one place offered. As such, decisions may be based on very small differences in scores, and many who would otherwise be fine doctors are declined entry.

The attrition rates within both schools are low, suggesting that either method is satisfactory in screening out people with low potential for completion of the programme. However, the relative merits of the two methods in predicting students who may require additional assistance during the course is less clear.

DIVERSIFICATION OF THE MEDICAL STUDENT POPULATION THROUGH AFFIRMATIVE ACTION

Māori and Pacific Admission Scheme (MAPAS)—Until about 20 years ago, the predominant medical student characteristics were being white, male, coming from a higher socio-economic group, and having university-educated parents, including one in eight with a parent in medicine.[24 25 26]

Until recently, medical schools have tended to focus on preparing students to function as PGY1 interns and for any branch of speciality training. Internationally there have been calls for medical schools to provide more evidence of their impact on the public good.[27] One aspect is the expectation that the population of doctors reflects the social and ethnic diversity of the community it serves.28 This expectation is underpinned by two main principles. The first is based on social justice and equity of access for minority groups; the second, because a diversified student population may be more disposed towards addressing priority areas of need.[29 30]

A study of the practice registers of black and Hispanic doctors in California, for example, found that doctors from these minority groups were more likely to take care of patients from their own ethnic groups as well as uninsured and Medicaid patients.[31]

For many years each school has had a MAPAS affirmative action pathway to provide equitable access for students who are Māori or Pacific with potential to undertake medical training. The majority of Māori and Pacific medical students enter via this pathway and to graduate, they must meet the same educational standards as other students.

It should be noted that a MAPAS pathway is far more than a selection process – there are specific recruiting and student support initiatives. The MMI is being piloted for MAPAS admissions at Auckland with one driver being to better understand individual academic and pastoral needs at entry.

Of the 155 domestic places available at Auckland, up to 30 may be offered to MAPAS students, however Otago does not have a fixed quota. Currently 3% of doctors identify as Māori, and 1.8% as Pacific32 compared with the population percentages of 15% and 7% respectively.[33] While there are encouraging increases in the numbers of Māori and Pacific medical students (see Table 1), the levels are nowhere near high enough to redress the shortages of Māori and Pacific doctors.

Table 1. Self-identified ethnicity MBChB domestic students, compared with NZ population at 2006 census

Ethnicity	Auckland 2008 All MBChB, n = 703	Otago 2009 All MBChB, n = 1391	New Zealand population overall	NZ ages 15-39 years
Māori	9.8%	5.0%	15%	17%
Pacific Islands	7.1%	2.7%	7%	13%
Asian (including Indian)	34.6%	33.3%	10%	8%
European and other	48.5%	59%	77%	71%

Rurality — Following a government initiative, the Rural Origin Medical Preferential Entry (ROMPE) pathway was established in 2004. Since then each school has admitted 20 students per year who meet the following criteria:

- Undertaken a significant proportion of their pre-secondary education while living in a New Zealand rural area; or
- Spent at least three years at a secondary school in a New Zealand rural area; or
- Have equivalent New Zealand rural experience

Note: a rural area includes those towns in New Zealand with a population or 20,000 or fewer.

It has been shown repeatedly that a rural background is associated with increased likelihood of practice in a rural setting, although most rural doctors have not grown up in rural areas.[34] [35] A systematic review based mainly on US data found that characteristics at admission were more likely than curriculum experiences to result in doctors working in rural settings. The number needed to 'teach' in a rural immersion curriculum to result in one extra rural practitioner was 17, compared with six as the number needed to be 'admitted' under revised admission criteria.[35]

A recent study of the intentions of 4112 Australian medical students at entry to medical school confirmed rural practice intentions were more likely in students from rural areas.[36] Other predictors were plans for a generalist career, and being bonded, or in receipt of a scholarship.

A census of all NZ medical students in 2001 found under-representation of those from smaller towns and rural settings compared with the general population.[37] Four years after the introduction the ROMPE pathway, a quarter of all students entering MBChB at Otago fulfilled ROMPE rural entry criteria, and 20% of Auckland Year 2 students reported coming from a provincial centre with 8% from smaller towns. Data from the 2006 and 2007 Auckland graduating classes showed 58% intended to work in a city and 15% in a regional/rural area, with the latter significantly more likely to be Māori and less likely to be Asian.[38]

Nothing is known about which students are more likely to work in outer metropolitan and regional centres, although based on hospital sizes and comparative populations, some regional centres in NZ would be regarded as 'rural' in Australian and US literature.

OTHER TRENDS

Feminisation — For about 15 years the proportion of women in medical programmes in NZ, Australia and the UK has been between 50 and 65%.[39] A detailed review of the effect of gender on specialty choice in Britain found women graduates consistently more likely than men to choose general practice, obstetrics and gynaecology, paediatrics and pathology.[40]

Feminisation has implications for the medical workforce given that women work on average around seven fewer hours per week than men.32 Concerns have also been raised about the status of the profession once the majority of specialists are women.[41] On the other hand, women have already demonstrated a readiness to provide care to underserved populations and to work in teams with a focus on the broader aspects of health.[42]

Graduate students — Up to a quarter of the medical students in the two NZ undergraduate programmes have a prior tertiary degree. Older entrants including graduates are more certain of their career choice and use more desirable learning styles[43]; they also have more diverse backgrounds than school leavers. Most of the new programmes in Australia are four year graduate programmes and a separate graduate pathway within a medical programme in NZ has been considered.[44]

This would shorten the medical school portion of training for graduates to around four years, but does not take into account the time taken for the first degree, or that the medical academic year would need to be lengthened.

Despite the appeal of graduate programmes, increasing the proportion of medical students who are graduates may not result in higher numbers of doctors working in areas of need than the current system for the following reasons:

- Graduates perform at a similar level in medical school and internship to their school leaver colleagues;[45]
- Even though they are more professionally and altruistically motivated on entry to medical school, graduates as a group enter the same medical careers as other medical students;[46]
- Having to complete a degree prior to selection for medicine may create a significant barrier to Māori and Pacific students, and those from lower socioeconomic groups.

On the other hand:

- Graduates may be more likely to be in a permanent relationship and may therefore be more likely to be committed to work in New Zealand;
- Having undertaken a previous degree may 'even out' inequities related to secondary schooling, thereby advantaging students from less advantaged schools;
- Graduates may bring useful attributes resulting from skills acquired in obtaining their prior degree.

Migration — Around 40% of Auckland's current domestic medical students were born overseas, most commonly in South Africa or Asia (including India and Sri Lanka). While most have NZ citizenship, a significant proportion (11%) has permanent resident status.[39] This contrasts with the situation in Otago where only 9% of the domestic students were born outside NZ.

Why overseas-born students do so well in the multi-faceted selection process at Auckland has not been studied in depth. As the majority of Auckland students come from the greater Auckland area, reasons for the difference may include the rapidly changing demography of Auckland and the emphasis placed on educational achievement by the immigrant parents of these students.

Priority specialty areas — In 2009 the NZ government offered $30,000 scholarships for medical graduates prepared to work for 2 years in health board areas with shortages, then enter training in one of five discipline areas – general practice, general medicine, general surgery, pathology or psychiatry.[47]

Data from the Auckland 2008 graduating class showed varying levels of interest in these careers (see Table 2). Over 50% of the class had 'some' or 'strong' interest in general practice, general medicine and general surgery. While far fewer were interested in psychiatry and pathology, levels of interest still exceeded the proportion of these specialists in the workforce in that year.

Table 2. Level of Auckland graduate interest in the priority discipline areas compared with current proportions on MCNZ register

Variables	General Practice	General Medicine	General Surgery	Psychiatry	Pathology
Strong Interest	31.6%	27.5%	19.7%	10.7%	2.3%
Some Interest	45.1%	48.9%	34.1%	22.9%	7.6%
No Interest	23.3%	23.7%	46.2%	66.4%	90.1%
Current MCNZ proportion (house officers excluded)[32]	35%	14%	4%	8%	3%

*Whole of internal medicine, not just general medicine.

General practice — Student factors associated with an increased likelihood of entering general practice include a desire for varied scope of practice,[48] being female and older,[49] and having a rural home town address.[49,50] There is a strong association between wanting to work in general practice and to work in a regional-rural setting.[38] In NZ, the proportion of women entering general practice training (53%)[32] is about the same as the proportion of women medical students.

General medicine — In NZ, general physicians are consultants usually in secondary care. This is in contrast to the situation in the USA where general internists may be involved in primary or secondary care. Data from one USA study found that desiring an intellectual challenge and having an affinity for the continuity of patient care were determinants of a general medicine career choice.[51]

There was a slight preponderance of males in that study. In NZ, there is no gender difference in preference, and those interested in general medicine did not have any greater interest in general practice. Instead, they were more likely to express interest in a medical subspecialty.[52]

General surgery — Traditionally, surgery has been a male-dominated specialty although this is changing as more women move into surgical careers.[53] Those women who chose surgery, though, are less likely than other women to value flexibility in regard to training and work.[54] As a balanced lifestyle is increasingly important for most doctors regardless of background,[55] for more trainees to choose general surgery will likely require attention to surgical work patterns and incentives, rather than a change in medical student selection per se.

Psychiatry — When it was introduced, a secondary intention of the ROMPE pathway was to increase the numbers of psychiatrists in regional and rural NZ. Evidence is scarce, however, as to what selection methods are most useful in this regard. One older study found that doctors entering psychiatry were less likely to have studied science in their first degree, had wider intellectual interests and better developed social skills than their fellow students.[56]

Since 2004, several students with a background in mental health have been offered preferential entry to Otago, but it is too early to say whether or not they will enter a career in psychiatry. The reason for the relatively high number of Auckland students interested in psychiatry is unknown. Auckland has made no specific changes to select students for a career in psychiatry, however the interview process might allow evaluation of some relevant attributes.

Pathology — Medical students interested in pathology are reportedly not concerned they will have limited patient contact, and may view it as a scholarly and isolated specialty.[57] This specialty has the highest proportion of female trainees in NZ (63%).[32] As there are relatively small numbers of doctors in this specialty and career choices are often made in the early post graduate years, it is difficult to see how selection policy will solve workforce issues in this specialty.

CONCLUSIONS

Selecting medical students is a complex and 'high stakes' endeavour, yet the tools available are limited in number and predictive ability. The current selection tools, processes and pathways have been arrived over time through iterative review including input from a range of stakeholders. The only major change to the selection tools in recent years has been the introduction of UMAT which is not known to differentiate among students with different demographic characteristics or career intentions.

A collaborative predictive validity study is now being undertaken by the two schools to study its value. The current selection processes are generally accepted and feasible, although interviews will be more problematic with increasing numbers. On the other hand, having more places on offer will hopefully reduce competition and the need to use tools that are able to separate candidates with similar attributes.

Despite the shortcomings, the selection processes and pathways used in NZ to date have generated a more diverse and representative range of medical students than previously. Women now slightly outnumber men and there are increasing proportions of students who identify as Māori or Pacific, or come from rural backgrounds.

Predictions for the population profile of NZ in 2026 show that 17% of the population will be Māori, 10% Pacific and 16% of Asian descent.[33] As yet the numbers of Māori and Pacific students are insufficient to ensure the medical workforce mirrors current, let alone future population demographics. As there are relatively small numbers of Māori and Pacific peoples with sufficiently strong science education backgrounds for medicine, greater efforts must be directed towards increasing the level of educational attainment at high school and promoting health as a career.

An important area of future study is to look at career patterns and support needs of doctors who entered via MAPAS pathways[58] in order to maximise participation of these valuable practitioners in the health system. Specific pathways for students from lower socioeconomic groups have been introduced in Britain, however there is little evidence yet that this approach will provide better servicing of patients with the greatest health need.[59]

The current over-representation of students of who identify as Asian is multifactorial.

As this sector of the population is growing, this overrepresentation will not be as marked in the future and another research priority is to understand better career patterns of Asian students.

While there are slight differences in how data have been collected, it is notable that Otago admits a higher proportion of students from rural backgrounds (25%) while Auckland admits significant numbers of domestic students born overseas (40%). The only major difference in the selection process is that Otago does not have an interview, whereas Auckland does.

These findings support the notion of a contrast in the nature of the applicants between the two schools that may be due to catchment population differences, or differential student preferences for medical school location. In terms of developing a medical workforce that mirrors the community it serves, these differences are positive and offer opportunities for evaluation and research.

NZ data suggest that the correlations among a rural background, likelihood of practice in rural area and a career in general practice, apply in NZ. This would support the case to increase the numbers of ROMPE students significantly in order to increase the rural and regional workforce20,[21] and the number of NZ-educated GPs.[25] [26]

As there is not a large pool of applicants who meet the existing definition of 'rural', a review might consider whether rural criteria need to be broadened to include smaller regional centres where workforce shortages are also marked. It is encouraging that the majority of medical students at entry are interested in general practice.

As with other medical careers, translating this interest into practice likely requires conducive learning experiences and a relative valuing of general practice compared with other specialties; a discussion that is outside the scope of this paper. It highlights the more general research need to understand better the multiple and interacting factors that affect career choice.

Both schools are mindful of the dilemma created by the long lead time in medical training: there is a need for careful evaluation of any changes in selection policy, yet prompt implementation of changes in response to anticipated workforce needs. Further efforts to quantify the complex interplay among the effects of student characteristics, undergraduate curriculum and early post graduate experience on career choice are already underway.

Since 2006, entering and graduating University of Auckland medical students have been enrolled in a longitudinal investigation of the characteristics, study and career patterns of undergraduate medical, nursing, pharmacy and health science students.

Over the past two years, both medical schools have joined the Australasia-wide Medical Student Outcome Database project that has similar aims.[60] Already the project has been valuable in providing data about students and their intentions, however, the most useful data will come from 2011 onwards once entry and exit data from the same cohort can be analysed, and the original exit cohorts are differentiating by speciality and location of practice.

The main conclusion that may be drawn about medical student selection and the future workforce in NZ is that an immediate increase in the numbers of medical students entering through the ROMPE and MAPAS pathways would have a positive effect on the future workforce. Other links between student characteristics at entry and career remain speculative, and not robust enough to justify major changes in selection approaches. As new evidence comes to light through the tracking projects, medical schools might be joined by the broader health community in the debate as to how the future medical workforce should be chosen.

Practice points

- Health care delivery in 2020 and beyond will be very different owing to health needs of the ageing population and constrained financial and human resources.

- Medical student selection practice has to predict future performance, rank among many with the capability to succeed, and address issues of equity and diversity. It should select those attributes that are desirable in a doctor but which cannot be learnt in medical school. There is a very long lag time to evaluate the effects of any change in selection policy on workforce.

- The NZ medical student population now has more females than males, and higher proportions of students who are Māori, Pacific, rural, Asian or born overseas.

- The MAPAS and ROMPE affirmative action pathways have been successful, but to increase the doctors who identify as Māori or Pacific will require a larger pool of students with strong educational backgrounds from which to select.

- The strongest evidence between selection and future practice exists for students from rural backgrounds – they are more likely to practice in rural areas and to enter general practice. Thus, increasing the ROMPE numbers or broadening the definition of 'rural' should be considered.

CORRESPONDENCE:
Assoc Prof Phillippa Poole, Head, Medical Education Division,
Faculty of Medical and Health Sciences, University of Auckland,
Private Bag 92019,
Auckland 1142, New Zealand.
Fax: +64 (0)9 3737555; email: p.poole@auckland.ac.nz

REFERENCES:

1. NZIER.
Ageing New Zealand and health and disability services demand projections and workforce implications, 2001–2021: discussion document.
Wellington: Ministry of Health; 2004.

2. Baicker K, Chandra A.
Medicare spending, the physician workforce, and beneficiaries quality of care. Health Affair 2004;07 April W4:184-97.

3. Ferrer R, Hambridge S, Maly R.
The essential role of generalists in health care systems.
Ann Intern Med 2005;142:691-700.

4. Accountability and funding: nationwide service framework library website.
Ministry of Health, 2009.
http://www.moh.govt.nz/moh.nsf/indexmh/dhbfundingperformance-nsfl

5. Workforce Taskforce. Reshaping medical education and training to meet the challenges of the 21st century: a report to the Ministers of Health and for Tertiary Education from the Workforce Taskforce.
Wellington Ministry of Health; 2007.

6. Lumsden M, Bore M, Millar K, et al.
Assessment of personal qualities in relation to admission to medical school.
Med Educ 2005;39:258-65.

7. Ferguson E, James D, Madley L.
Factors associated with success in medical school: systematic review of the literature.
BMJ 2002;324:952-7.

8. Powis D, Hamilton J, McManus I.
Widening access by changing the criteria for selecting medical students.
Teach Teach Educ 2007;23:1235-45.

9. Reiter H, Eva K.
Reflecting the relative values of community, faculty, and students in the admissions tools of medical school.
Teach Learn Med 2004;17:4-8.

10. Lemay J, Lockyer J, Collin V, Brownell A.
Assessment of non-cognitive traits through the admissions multiple mini-interview.
Med Educ 2007;41:573-9.

11. Wagoner N.
Admission to medical school: selecting applicants with the potential for professionalism.
In: Stern D, ed. Measuring Medical Professionalism. Oxford: Oxford University Press; 2006

12. Powis D.
How to do it: select medical students.
BMJ 1998;317:1149-50

13. Lievens F, Buyse T, Sackett P.
The operational validity of a video-based situational judgement test for medical college admissions: illustrating the importance of matching predictor and criterion construct domains.
J Appl Psych 2005;90:442-52.

14. Taylor P, Small B.
Asking applicants what they would do versus what they did do: a metaanalytic comparison of situational and past behavioral employment interview questions.
JOOP 2002;75:277-94.

15. Eva K, Rosenfeld J, Reiter H, Norman G.
An admissions OSCE - the multiple mini-interview.
Med Educ 2004;38:314-26.

16. Reiter H, Salvatori P, Rosenfeld J, et al.
The effect of defined violations of test security on admissions outcomes using multiple mini-interviews.
Med Educ 2006;40:36-42.

17. Rosenfeld J, Reiter H, Trinh K, Eva K.
A cost efficiency comparison between the multiple mini-interview and traditional admissions interviews.
Adv Health Sci Educ 2008;13:43-58.

18. Griffin B, Harding D, Wilson I, Yeomans N.
Does practice make perfect? The effect of coaching and retesting on selection tests used for admission to an Australian medical school.
MJA 2008;189:270-3.

19. Harris S, Owen C.
Discerning quality: using the multiple mini-interview in student selection for the Australian National University medical school.
Med Educ 2007;41:234-41.

20. Roberts C, Walton M, Rothnie I, et al.
Factors affecting the utility of the multiple miniinterview in selecting candidates for graduate-entry medical school.
Med Educ 2008;42:396-404.

21. Powis D, Bore M, Munro D.
Selecting medical students: Evidence based admissions procedures for medical students are being tested.
BMJ 2006;332:1156.

22. Urlings-Strop L, Stijnen T, Themmen A, Splinter T.
Selection of medical students: a controlled experiment.
Med Educ 2009;43:175-83.

23. Budget 2009: education initiatives.
Ministry of Education 2009. http://www.minedu.govt.nz/theMinistry/Budget/Budget2009/EducationInitiatives.aspx#TertiaryEducation

24. Heath C, Stoddart C, Green H.
Parental backgrounds of Otago medical students.
NZ Med J 2002;115:U237.

25. Collins J, Jones J, White G.
Demographic variables in Auckland medical students.
NZ Med J 1993;106:306-8.

26. McManus I.
The social class of medical students.
Med Educ 1982;16:72-5.

27. Boelen C, Woolard B.
Social accountability and accreditation: a new frontier for educational institutions.
Med Educ 2009;43:887-94.

28. Garlick P, Brown G.
Widening participation in medicine.
BMJ 2008;336:1111-3.

29. Lakhan S.
Diversification of U.S. medical schools via affirmative action implementation.
BMC Med Educ 2003;3:1-6.

30. Angel C, Johnson A.
Broadening access to undergraduate medical education.
BMJ 2000;321:1136-8.

31. Komaromy M, Grumbach K, Drake M, et al.
The role of black and Hispanic physicians inproviding healthcare for underserved populations.
N Engl J Med 1996;334:1305-10.

32. The New Zealand Medical Workforce in 2008.
Medical Council of New Zealand, 2009
.http://www.mcnz.org.nz/portals/0/publications/workforce_2008.pdf

33. National ethnic population projections: 2006 (base) – 2026 Statistics New Zealand, 2006.
http://www.stats.govt.nz/~/media/Statistics/Browse%20for%20stats/NationalEthnicPopulationProjections/HOTP0626/nationalethnicpopulationprojections2006basehotp.ashx

34. Rabinowitz H, Diamond J, Markham F, Paynter N.
Critical factors for designing programs to increase the supply and retention of rural primary care physicians.
JAMA 2001;286:1041-8.

35. Hseuh W, Wilkinson T, Bills J.
What evidence-based undergraduate interventions promote rural health?
NZ Med J 2004;117:U1117.

36. Jones M, Humphreys J, Prideaux D.
Predicting medical students' intentions to take up rural practice after graduation. Med Educ 2009;43:1001-9.

37. Fitzjohn J, Wilkinson T, Gill D, Mulder R.
The demographic characteristics of New Zealand medical students: the New Zealand wellbeing, intentions, debt and experiences (WIDE) survey of medical students 2001 study.
NZ Med J 2003;113:U626.

38. Pasley T, Poole P.
Characteristics of University of Auckland medical students intending to work in the regional/rural setting.
NZ Med J 2009;122:50-60

39. Fitzjohn J, Wilkinson T, Gill D, Mulder R.
The demographic characteristics of New Zealand medical students: the New Zealand wellbeing, intentions, debt and experiences (WIDE) survey of medical students 2001 study.
NZ Med J 2003;116(1183).

40. Elston M.
Women and medicine: the future.
In. London: Royal College of Physicians; 2009.

41. Laurance J.
The medical timebomb: "too many women doctors"
In: The Independent. London; 2004.

42. Levinson W, Lurie N.
When most doctors are women: what lies ahead?
Ann Int Med 2004;141:471-4.

43. Wilkinson T, Wells J, Bushnell J.
Are differences between graduates and undergraduates in a medical course due to age or prior degree?
Med Educ 2004;38:1141-6.

44. Campbell A.
Selecting medical students for the New Zealand medical workforce.
NZ Med J 2002;115:U233.

45. Elliott S, Epstein J.
Selecting the future doctors: the role of graduate medical programmes.
Int Med J 2005;35:174–7.

46. Rolfe I, Ringland C, Pearson S-A.
Graduate entry to medical school? Testing some assumptions.
Med Educ 2004;38:778-86.

47. **Voluntary Bonding Scheme**.
Ministry of Health, 2009. http://www.moh.govt.nz/moh.nsf/indexmh/bonding-terms

48. Wright B, Scott I, Woloschuk W, Brenneis F, Bradley J.
Career choice of new medical students at three Canadian universities: family medicine versus speciality medicine.
CMAJ 2004;170:1920-4.

49. Kassebaum D, Szenas P, Schuchert M.
Determinants of generalist career intentions of 1995 graduating medical students.
Acad Med 1996;71:198-209.

50. Ward A, Kamien M, Lopez D.
Medical career choice and practice location: early factors predicting course completion, career choice and practice location.
Med Educ 2004;38:239-48.

60. Hauer K, Durning S, Kernan W, et al.
Factors associated with medical students' career choices regarding internal medicine.
JAMA 2008;300:1154-64.

61. Poole P, McHardy K, Janssen A.
General physicians- born or made? Use of a tracking database to answer workforce questions.
Int Med J 2009;39:447-52.

62. Lawrence J, Poole P.
Career and life experiences of New Zealand women medical graduates.
NZ Med J 2001;114:537-40.

63. Lawrence J, Poole P, Diener S.
Critical factors in career decision making for women medical graduates.
Med Educ 2003;36:1-9.

64. Dorsey E, Jarjoura D, Rutecki G.
Influence of controllable lifestyle on recent trends in specialty choice by US medical students.
JAMA 2003;290:1173-8.

65. Jurvetson K.
Characteristics of medical students and residents who select psychiatry: implications for recruitment.
Acad Psychiatr 1995;19:125-31.

66. Holland L, Bosch B.
Medical students' perceptions of pathology and the effect of the second year pathology course.
Hum Pathol 2006;37:1-8.

67. Collins J, White G, Mantell C.
Selection of medical students: an affirmative action programme.
Med Educ 1997;31:77-80.

68. Ip H, McManus I.
Increasing diversity among clinicians: is politically correct but is costly and lacks evidence to support it.
BMJ 2008;336:1082-3.

69. **MSOD project: a national database for medical education research and workforce planning.**
Medical Deans Australia and New Zealand, 2009. http://www.medicaldeans. org.au/msod.html