

Innovations in medical education to meet workforce challenges

AUSTRALIAN MEDICAL WORKFORCE ADVISORY COMMITTEE (AMWAC)

AMWAC is the national medical workforce planning and advisory agency for the Australian Health Ministers' Advisory Council. This paper was prepared for AMWAC by Dr Mary G Harris, Senior Policy Officer, Australian Medical Workforce Advisory Committee and Senior Lecturer, University of Sydney; Professor Nicholas A Saunders, Dean of the Faculty of Medicine, Monash University; Professor John Horvath, Chairman, Australian Medical Workforce Advisory Committee; Mr Paul Gavel, Executive Officer, Australian Medical Workforce Advisory Committee; and Mr Warwick Conn, Senior Project Officer, Labour Force Unit, Australian Institute of Health and Welfare.

Abstract

The winds of change world-wide have swept medical education in the last fifteen years. Today, Australia's medical students are older and drawn from more diverse socio-economic, ethnic and geographic backgrounds than twenty years ago, and there is now an equal mix of men and women in medical school. Admission policies have been rewritten to broaden access with a range of entry options now available including direct entry from high school and graduate entry following a first degree. Curricula have been revised and modes of learning transformed. This paper describes these changes and discusses the implications for medical schools and for planning the future workforce.

Introduction

"The system of medical education in Australia must be considered in relation to the health care system as a whole with which it is inextricably associated. It prepares practitioners to work in the health system, and must ensure not only that its graduates have the knowledge, skills and attitudes that are required, but also that they understand how the health care system functions and what responsibilities they have to it (Doherty, 1988, p 29)".

The focus of this paper is university medical schools and the changes being made to selection and education policies to assist Australia to meet the evolving medical workforce challenges. The paper also describes discernible changes in the characteristics of medical students undertaking the bachelor of medicine/bachelor of surgery (MBBS), importantly, those who are Australian citizens or permanent residents of Australia. The paper does not examine the characteristics of full-fee paying international medical students nor does it address the characteristics of students undertaking postgraduate studies.

The entering class for each medical school is determined by the choice of those who apply and by the selection process of the school. Following the recommendations of the Karmel Committee in 1973 and the Doherty Committee in 1988, medical schools in Australia have reviewed their curricula and their approaches to student selection. Driving the change in medical school selection criteria is a desire to improve the ability of graduate doctors to meet the expectations of their patients. For example, the ability to adopt an holistic approach to patient problems, to communicate in an appropriate and sensitive manner, to provide clear and accurate information and to work collaboratively with other members of the health team. There has been a growing awareness internationally of the limitations of selecting future doctors entirely on the basis of secondary school achievement combined with a medical school curriculum which emphasises performance in basic science subjects (Hamilton, 1995; Rolfe et al, 1995a; Allen et al, 1997).

The Doherty report emphasized that change is inevitable during the lifespan of all medical graduates. It proposed that graduates should, therefore, be provided with a broad understanding of basic and clinical sciences, and experiences to achieve a flexibility of mind and capacity for self-learning and problem solving to adapt and cope with change (Doherty, 1988). In recent years the body of medical knowledge has expanded exponentially and this required innovative approaches to curriculum design. Furthermore, changes in morbidity patterns and in the delivery of health care have challenged the range and depth of practical learning experiences available to students within teaching hospitals (Brooks and Goulston, 1998). As a result most medical schools have canvassed new educational methodologies such as problem-based learning and computer simulation (Hanlon et al 1995; Sefton et al, 1995).

The long lead-time between entrance into medical school and attainment of generalist or specialist qualification poses many challenges for workforce planners. Over a decade changes in medical knowledge and technology occur, government policies and funding arrangements may change, each of which has the potential to influence the demand for medical services by the community and the career pathways chosen by medical trainees. Further complexity is added by the number of different educational bodies involved in the training of doctors.

Method

This article first outlines the typical pathway to medical workforce participation, secondly examines government policies influencing medical education in Australia and then describes changes in student characteristics and medical school admission and curricula. Finally, we discuss the workforce planning implications of these trends. Data from various sources are used, including two reports published by the Australian Medical Workforce Advisory Committee (AMWAC) and the Australian Institute of Health and Welfare (AIHW) (AMWAC & AIHW, 1996a and 1997). The first of these reports established benchmarks (ie estimated optimal levels of supply) for the Australian medical workforce and the second described changes in medical school selection policies and processes and changes in the characteristics of students entering Australian medical schools. The latter report drew on data from medical schools, the AIHW and the Department of Education and Youth Affairs (DETYA). Several reports of the Commonwealth Department of Health and Aged Care are also used, namely, three annual reports of the Medical Training Review Panel (MTRP, 1997, 1998, 1999) and the 1998 report of the General Practice Rural Incentives Program. With the help of the AIHW, recent data from DETYA have been used to update trends in medical student numbers and characteristics. Other information has been gained from consultation with the Australian Medical Council, the Committee of Deans of Australian Medical Schools and the MTRP.

Pathways to workforce participation

Typically, from entry to medical school, it takes between five and seven years to become a hospital non-specialist and between 10 and 15 years to become fully qualified as a Fellow of the Royal Australian College of General Practitioners or one of the specialist medical colleges. For most medical students, the educational pathway involves four stages with different organisations associated with each stage (Appendix 1), namely:

- undergraduate education in medical school;
- prevocational training (including intern and other Hospital Medical Officer experience) which is predominantly undertaken in State and Territory teaching hospitals;
- vocational and specialist training which are largely the responsibility of medical colleges in cooperation with teaching hospitals and other health care facilities; and
- continuing medical education which is largely the domain of medical colleges (MTRP, 1997).

The MTRP (1997) report notes that "... undergraduate education at one of ten University based medical schools usually leads to a Bachelor of Medicine and a Bachelor of Surgery (MBBS). For seven of these medical schools, undergraduate students are mostly school leavers. The remaining three (The Flinders University of South Australia, The University of Sydney and The University of Queensland) have recently established a four

year undergraduate medical degree with postgraduate entry” (MTRP, 1997; p 11). It should also be noted that since early 2000 Australia has eleven medical schools, the most recent located at the James Cook University, Townsville (Hays, 2000).

Factors influencing medical education policy in Australia

International trends

The aim of national medical workforce policy in Australia (and in Canada and the United Kingdom) has been to train enough doctors locally to achieve self-sufficiency without reliance on net immigration, while at the same time ensuring that supply ‘best’ matches need (Sullivan et al., 1996; Goldacre, 1998). In other words, the traditional policy in Australia has been to avoid both undersupply and oversupply (Horvath et al., 1998). Mechanisms used to control doctor numbers in Australia include a limit on the number of government funded places available in medical schools; a prohibition in the Commonwealth legislation on fee paying places for Australian citizens and permanent residents (medicine is the only tertiary course that has such a prohibition); a limit on the number of positions available in vocational training courses; restrictions on new doctors providing services which attract Medicare benefits; and a points-penalty system to control the number of overseas trained doctors migrating to Australia.

During the early 1990s, Canadian policy makers accepted the notion that doctors are a national resource that requires careful management in order to avoid overproduction and to address distributional problems. In 1993, the Canadian Conference of Provincial/Territorial Ministers of Health recommended a reduction of 10% in the number of commencing medical students. Similar forces were at work in Australia during this time and since the mid-1990s, the Australian government has limited the number of funded places available in medical schools to approximately 1,250 per annum. Interestingly, in 1999, the UK decided to expand medical school intake by approximately 20% and this will occur gradually over the next five years. Factors influencing the decision to increase the supply of UK doctors include anticipated growth in population, ageing of the population, public pressure for improved access and quality, an increase in the number of women in the medical workforce, shorter working hours for junior doctors and growth in the use of overseas trained doctors (Medical Workforce Standing Advisory Committee, 1998; Goldacre, 1998). Some of these trends are also evident in Australia. For example, the population is ageing, there is an increase in the number of women in the workforce and the use of overseas trained doctors on a temporary basis is increasing (AMWAC, 1999).

The UK has also considered strategies for minimising wastage among medical students and recent graduates. It is estimated that during basic training 10% of medical students in the UK are lost from medicine and that a further 15-20% dropout within 10 years of gaining their basic medical degree (Goldacre, 1998). In Australia, no reliable data are yet available with respect to medical student and recent graduate attrition or retention rates.

National workforce policies

There is general agreement among Australian policy makers and planners that:

- the current medical workforce is characterised by comparative excess of general practitioners in urban areas, a shortage in some specialties and an undersupply of doctors in many rural and remote areas (AMWAC & AIHW, 1996a);
- in most specialist disciplines, there is a need for more specialists-in-training to meet projected increases in demand associated with growth in the population, ageing of the population and advances in medical technology and medical treatments (AMWAC specialist workforce reports 1996 to 1999);
- the predominantly male medical workforce is ageing, while among younger doctors the representation of women is increasing. These trends are impacting on workforce supply and patterns of practice (AMWAC & AIHW 1996a, 1996b; AMWAC 1997);

- the use of temporary resident overseas doctors is increasing and likely to continue and their contribution to the workforce is significant, particularly the public hospital workforce (urban and rural). Between 1992-93 and 1997-98, the number of temporary resident doctors entering Australia increased from 667 to 1,702, with an average annual increase of 25.9% (AMWAC, 1999); and
- Aboriginal and Torres Strait Islander people are significantly under-represented in the medical workforce (ie 2% of the Australian population in 1996 and 0.05% of the medical workforce) and there is a major need for more doctors to work in the field of Aboriginal health (ABS & AIHW, 1997).

The Australian 2005 ‘benchmark’ for supply of medical workforce (ie desirable number of doctors per head of population) is 220 full time equivalent (FTE) clinicians per 100,000 population increasing to 270 FTE clinicians per 100,000 in 2025 (AMWAC & AIHW, 1996a). This estimation assumed that the national health structure would not change significantly, that growth in demand for medical services due to population growth, ageing of the population and other factors would be 1.77% per year and that the number of graduates of Australian medical schools (Australian citizens or permanent residents) would fall from 1,200 per year in 1996 to 1,000 per year from the year 2002 and female participation would increase from 28% in 1997 to 34% in 2010 and 38.9% in 2025 (AMWAC & AIHW, 1996a).

Throughout Australia, there were 245 active medical practitioners per 100,000 population in 1997, which equates to approximately, 220 FTEs (Table 1). While this figure is consistent with the 2005 national benchmark, it is below the 1996 OECD average of 253 clinicians per 100,000 population but greater than countries with similar health systems such as Canada (211) and New Zealand (210) (AIHW, 1999). For every specialist, including trainee specialists, there were 1.2 primary care practitioners and hospital non-specialists (Table 1).

Table 1: Employed medical clinicians, by occupation and State/Territory, 1997

Occupation	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Total
Primary care practitioner	7,125	5,229	3,440	1,790	1,810	571	198	395	20,557
Hospital non-specialist	1,814	576	996	325	458	113	91	101	4,475
Specialist	5,534	4,296	2,573	1,487	1,386	328	106	280	15,992
Specialist in training	1,644	1,205	758	430	389	86	39	66	4,617
Total	16,117	11,306	7,767	4,033	4,044	1,098	433	842	45,641
Per 100,000 population	256.9	245.5	228.4	272.5	224.9	231.9	231.4	271.8	246.3

Source: AIHW

Since the publication of the AMWAC 1996 benchmark report, medical schools have graduated, on average, 1,243 students per year. At the same time, 1,238 students have, on average, per year commenced medical courses around Australia (Table 2). In 2000, the number of graduates are expected to number 1,216 (Lewenberg, 1999).

The appraisal of ratios of student places to State/Territory population may not be relevant as a guide to determining an appropriate number of medical students for each State/Territory because of the increasing movement of medical students across State/Territory boundaries. Of the commencing class of 1999, 20.1% of students chose to study medicine at a university other than one in their home State/Territory and among universities there was wide variation in the representation of interstate students. For example, in 1999, interstate students accounted for a relatively high proportion of students at four universities (viz the University of Newcastle, the Flinders University of South Australia, the University of Adelaide and the University of Tasmania) (Table 3). On the other hand, the representation of interstate students at three universities (viz the University of New South Wales, the University of Sydney and the University of Western Australia) was comparatively low (Table 4).

Table 2: Bachelor of medicine- number of Australian citizen or permanent resident students commencing^a and completing^b the course, 1988 to 1999

Year	1988	1989	1990	1991	1992	1993	1994 ^c	1995 ^c	1996 ^c	1997	1998	1999
Commencing students	-	1,379	1,417	1,392	1,330	1,304	1,217	860	928	1,233	1,221	1,334
Completing students	1,305	1,187	1,014	1,144	1,084	1,234	1,235	1,241	1,327	1,196	1,206	1,256 ^d

(a) Includes bachelor pass, bachelor honours and graduate entry bachelor courses.

(b) Before 1993, not all universities had citizenship information for all students completing courses, so these data include students for whom citizenship/residency status was unknown. Consequently, data before 1993 may slightly overstate the number of course completions by Australian citizen/resident students.

(c) The Flinders University of South Australia, The University of Queensland and The University of Sydney introduced a four-year postgraduate degree medical course in place of the previous six-year undergraduate course. Each university had a two-year transition period during which only a small number of students with the necessary qualifications were admitted. The first intake to the new course at The Flinders University of South Australia was in 1996 and the first intakes to the new courses at The University of Queensland and The University of Sydney were in 1997.

(d) Estimated number of graduates (Lewenberg, Monash University, 1999). Using population distribution by State/Territory as the benchmark, Table 2 and Appendix 2 indicate that the proportion of students graduating from the ten medical schools in 1998 was roughly in line with the distribution of the Australian population. In total, 32.6% of the graduating class of 1998 were from universities based in New South Wales, 23.9% from Victorian universities and the corresponding figures for Queensland, South Australia, Western Australia and Tasmania were 17.3%, 12.4%, 10.0%, and 3.9%, respectively.

Source: AIHW from Department of Education, Training and Youth Affairs data

Table 3: Percentage of bachelor of medicine course completions^a, by State/Territory, 1988, 1993 and 1998

State/Territory	1988	1993	1998	% Aust. population
New South Wales/Australian Capital Territory	34.3	33.0	32.6	35.5
Victoria	24.1	26.7	23.9	24.8
Queensland	13.9	16.5	17.3	18.4
South Australia/Northern Territory	12.6	11.7	12.4	9.0
Western Australia	8.9	8.4	10.0	9.7
Tasmania	6.2	3.7	3.9	2.6
Australia	100.0	100.0	100.0	100.0

(a) Australian citizen or permanent resident students.

Source: AIHW from Department of Education, Training and Youth Affairs data.

Table 4: Commencing medical students^a, by university and State/Territory of home residence, 1999

University	Total number of students	% of students from interstate
University of Sydney	189	15.9
University of New South Wales	188	10.6
University of Newcastle	64	32.8
University of Melbourne	143	22.4
Monash University	145	18.6
University of Queensland	246	20.3
University of Adelaide	101	31.7
Flinders University	56	32.1
University of Western Australia	133	15.8
University of Tasmania	67	25.4
Total	1,334	20.1

a) Australian citizens or permanent residents of Australia

Source: AIHW from Department of Education, Training and Youth Affairs data.

Government funding initiatives to improve workforce distribution

Australian and overseas research supports the proposition that student background influences decisions about type and location of practice. For example, medical students who grow up in a rural area are considered more likely to return to rural areas post-graduation (Kamien, 1987; Rolfe et al, 1995b; Rabinowitz et al, 1999; Easterbrook et al, 1999). Since 1994, federal government funding under the Rural Undergraduate Steering Committee (RUSC) Program, has been made available to medical schools to encourage more students to take up careers in rural practice through changes to selection, curriculum and the support provided to rural students. In 2000, the Commonwealth government launched a new scholarship scheme (Rural Australia Medical Undergraduate Scholarship Scheme) to assist in meeting accommodation, living and travel expenses incurred while attending university (Commonwealth Department of Health and Aged Care, 2000).

Further rural initiatives have included Commonwealth government funding for a medical school at James Cook University in Townsville, a clinical school at the University of New South Wales in the Greater Murray Area and for nine more rural and regional clinical schools as of the May 2000 budget (Wooldridge, 2000). In addition, the Commonwealth government funds seven university departments of rural health and the John Flynn Scholarship Scheme. University departments are located at Alice Springs, Mt Isa, Broken Hill, Shepparton, Whyalla and Geraldton and provide students with a strong rural academic focus. Annually, the John Flynn Scholarship Scheme offers 150 new scholarships with a total of 450 scholarships awarded by the end of 1999 (Commonwealth Department of Health and Aged Care, 2000). As of May 2000, federal funds were made available for 100 new scholarship places of \$20,000 per annum to new medical students each year, in return for a commitment to work in rural Australia for at least six years after completing their vocational training. In addition, the federal budget provided funds so that graduating doctors who work in the country can forgo their Higher Education Contribution Scheme (HECS) debt for every year that they serve in an area of designated need over a period of five years (Wooldridge, 2000).

In most States, government scholarships and cadetships are available to medical students who demonstrate an interest in rural experience (GRIP, 1998) and most universities have affirmative action policies directed toward increasing the participation of Aboriginal and Torres Strait Islander students.

Changes in student characteristics

Age and gender are known to have an impact on workforce participation and on workforce distribution (AMWAC & AIHW, 1996b). For example, among the factors influenced by age and gender are average hours worked, level of part time work, age of retirement, location of practice, type of practice and type of problems managed (AMWAC & AIHW, 1997). Hence, change in the age and gender of students entering medical schools requires consideration by workforce planners. Less is known about the effects of doctor country of birth on workforce participation and distribution.

Students are older when they commence medical studies these days when compared with a decade ago. In 1999, 49.2% of commencing students were aged 20 years and over compared with 16.5% in 1993. Furthermore, 20.3% of commencing students in 1999 were aged 25 years and over compared with only 6.2% in 1993 (Table 5).

Table 5: Percentage of commencing bachelor of medicine students in each age group, 1989, 1993 and 1999

Age	1989	1993	1999
Less than 18 years	43.5	41.9	24.7
18 to 19 years	38.2	41.6	26.1
20 to 24 years	11.4	10.3	28.9
25 to 29 years	4.2	2.8	9.1
30 years and over	2.6	3.4	11.2
Total	100.0	100.0	100.0

Source: AIHW from Department of Education, Training and Youth Affairs data.

Nationally, the average age of entering medical students has increased from 18.8 years in 1988 to 21.5 years in 1999. These national figures mask variation in age by university. Commencing students of the graduate entry medical schools are approximately 4.5 years older, on average, than students entering the other medical schools (Table 6).

Table 6: Average age of commencing bachelor of medicine students, by State and university, 1989, 1993 and 1999

State and University	1989	1993	1999
New South Wales			
• University of Sydney	19.3	20.1	23.6
• University of NSW	19.0	18.2	19.0
• University of Newcastle	21.7	20.6	21.3
Victoria			
• University of Melbourne	18.3	18.4	19.5
• Monash University	18.1	18.0	19.3
University of Queensland	18.3	18.1	24.6
South Australia			
• University of Adelaide	18.7	18.7	20.1
• Flinders University	20.0	20.1	26.3
Uni. of Western Australia	18.1	18.3	19.5
University of Tasmania	17.9	17.5	23.0
Australia	18.8	18.7	21.5

Source: AIHW from Department of Education, Training and Youth Affairs data.

The representation of women among students commencing the bachelor of medicine has increased over the last decade from 43.4% in 1989 to 52.7% in 1999 with wide variation by age and university. For example, in 1999, 58.9% of students aged 18 to 19 years were women while only 37.7% of students aged 25 to 29 years were women (Table 7). In total 62.5% of commencing medical students at Flinders University were female compared with 43.5% at the University of Queensland (Table 8).

Table 7: Percentage of commencing bachelor of medicine students who are women, by age, 1989, 1993 and 1999

Age	1989	1993	1999
Less than 18 years	43.7	47.0	55.5
18 to 19 years	43.9	46.1	58.9
20 to 24 years	39.1	50.4	53.2
25 to 29 years	50.0	55.6	37.7
30 years and over	38.9	47.7	43.0
Total	43.4	47.3	52.7

Source: AIHW from Department of Education, Training and Youth Affairs data.

Data from DETYA indicate that, nationally, there has been an increase of 1.5% in the number of rural students commencing the medical course during the past decade (Table 9). However, there is some evidence to suggest that the data about the number of commencing medical students from a rural area may understate the situation because rurality is based on the postcode of home address reported at time of initial enrolment. Students who do not enter higher education direct from school or transfer to medicine from another course may be expected to report a home address close to the institution of study. This may be particularly true for students in graduate entry courses.

Table 8: Percentage of commencing bachelor of medicine students who are women, by university and State, 1989, 1993 and 1999

State and University	1989	1993	1999
New South Wales			
* University of Sydney	36.5	43.8	57.7
* University of New South Wales	42.1	41.4	50.5
* University of Newcastle	67.2	57.6	59.4
Victoria			
* University of Melbourne	44.5	43.2	59.0
* Monash University	42.5	49.6	47.6
University of Queensland	42.2	55.5	43.5
South Australia			
* University of Adelaide	40.2	39.8	60.8
* Flinders University	41.4	51.6	62.5
Uni. of Western Australia	47.9	46.4	52.6
University of Tasmania	60.0	54.0	49.3
Australia	43.4	47.3	52.7

Source: AIHW from Department of Education, Training and Youth Affairs data.

In 1989, rural students accounted for 9.5% of students commencing the medical course, while in 1993 and 1999 the comparative figures were 11.5% and 11%, respectively (Table 9). These national figures mask wide variation by State/Territory of attended university. States with a higher than average proportion of rural background students in 1999 were Tasmania (28.8%), Victoria (16.3%) and Queensland (15.7%), while Western Australia (4.7%), South Australia (5.3%) and New South Wales (8%) were well below the national average (Table 9).

Table 9: Percentage of commencing bachelor of medicine students from a rural area^a, by State/Territory, 1989, 1993 and 1999

State	1989	1993	1999
New South Wales	8.2	7.5	8.0
Victoria	11.0	11.2	16.3
Queensland	10.8	18.4	15.7
South Australia	6.0	7.6	5.3
Western Australia	6.6	8.6	4.7
Tasmania	29.3	41.7	28.8
Northern Territory	33.3	-	44.4
Australia	9.5	11.5	11.0

a) As defined by region of home residence (postcode).

Source: AIHW from Department of Education, Training and Youth Affairs data.

The number of Aboriginal and Torres Strait Islander students entering a medical course increased from 6 in 1989 to 7 in 1993 and 21 in 1999, while the number completing the course increased from 6 in 1989 to 9 in 1998 (Table 10). Aboriginal and Torres Strait Islander students accounted for 0.4% of the commencing class of 1989 and 1.6% of the 1999 class, with variation in the representation of indigenous students by State and Territory (Table 11).

Table 10: Number of Aboriginal or Torres Strait Islanders students commencing and completing the bachelor of medicine, 1989, 1993, 1997 and 1999

	1989	1993	1997	1999
Commencing students	6	7	10	21
% Indigenous	0.4	0.5	0.7	1.6
Completing students	6	3	9	a

a) Data missing for this year.

Source: AIHW from Department of Education, Training and Youth Affairs data.

There is increasing diversity in the medical student body with regard to culture and country of birth. Between 1993 and 1998, the percentage of completing medical students who were born in Australia decreased from 66.6% of students to 58.7%. Decreases also occurred in the percentage of students who were born in the United Kingdom and/or Ireland. On the other hand, increases occurred in the percentage of students who were born in Malaysia, Vietnam, Hong Kong and other Northeast Asian countries (Table 12).

Table 11: Aboriginal or Torres Strait Islanders students as a percentage of all medical students commencing the bachelor of medicine, by State/Territory, 1999

NSW/ACT	Vic	Qld	SA/NT	WA	Tas	Total
2.0	0.3	0.8	3.2	2.3	1.5	1.6

Source: AIHW from Department of Education, Training and Youth Affairs data.

An examination of 1996 commencing medical student enrolments by socio-economic status (SES) based on postcode showed that, compared with all higher education enrolments, a high proportion of medical students came from high SES postcodes. In total, 57% of medical students were from high SES postcodes compared with 34% of all higher education students (Dobson, 1997). At the same time, 10% of medical students and 14% of all higher education students were from low SES postcodes (Dobson, 1997).

Table 12: Country of birth of students^a as a percentage of all medical students completing the bachelor of medicine, 1993 and 1998

Country of birth	1993	1998
Australia	66.6	58.7
Malaysia	5.3	7.5
Vietnam	4.3	5.5
Hong Kong	3.2	5.4
United Kingdom/ Ireland	5.6	3.8
Other Northeast Asia	1.1	3.8
Other Europe/ Russia	1.7	2.3
Singapore	1.2	2.2
Sri Lanka	1.6	1.7
Middle East/North Africa	2.3	1.5
India	1.6	1.2
Other Southeast Asia	0.8	1.2
North America	1.4	1.2
New Zealand	0.3	1.1
South Africa	0.8	1.0
Other	2.1	2.1
Total	100.0	100.0

a) Australian citizens or permanent residents of Australia

Source: AIHW from Department of Education, Training and Youth Affairs data.

Changes in medical school selection processes

At both graduate and post high school entry level, universities are changing their medical school admission policies with the aim of achieving a mix of students more representative of the Australian community, and selecting students with the capacity for sustained tertiary studies who possess additional skills and personal qualities appropriate to the study and practice of medicine.

At high school matriculation entry level, capacity for tertiary studies is assessed on achievement in Higher School Certificate (HSC) or State equivalents like the South Australian Certificate of Education (SACE), while at graduate entry level achievement in prior university studies is used. Personal qualities are tested in interview and include characteristics directly relevant to quality of care, namely, ability to communicate orally and in

writing, tolerance of and insight as to other peoples' point of view, ability to analyse and solve problems and a priority commitment to patients and their interests. The interview used across Australia is based on the University of Newcastle's experience and is structured. Interview panels are trained and normally include academics and community representatives.

Ten years ago, only one medical school in Australia (Newcastle) used an aptitude test and interview in addition to scholastic achievement to make decisions about admission to medical school. Nowadays, only one medical school (University of New South Wales) relies solely on scholastic achievement. All other medical schools use scholastic achievement in combination with either an aptitude test or interview or both. Specifically, the Universities of Tasmania and Melbourne use an aptitude test to assess high school applicants, James Cook University uses an interview, while the University of Newcastle, Adelaide University, University of Western Australia and Monash University use both aptitude test (Undergraduate Medical Admissions Test-UMAT) and interview to assess the suitability of their predominantly high-school-leaver applicants. The UMAT was developed by the Australian Council for Educational Research (ACER) in collaboration with the University of Newcastle. It comprises a series of tests designed to measure personal qualities, including logical reasoning and problem solving, personal interaction skills and non-verbal reasoning (UMAT, 2000).

The graduate entry medical schools (Flinders University, University of Queensland, University of Sydney and the Melbourne University for one-third of its entrants) use the Graduate Australian Medical School Admissions Test (GAMSAT) and interview. The purpose of the GAMSAT is to assess the candidate's ability to understand and analyse material, to think critically about issues and, to organise and express their thoughts in written communications in a logical and effective way. A major focus of the GAMSAT is assessment of problem solving abilities and it is composed of three main subject areas, namely, reasoning in humanities and social sciences, written communication, and reasoning in biological and physical sciences (Australian Council for Educational Research, 1997).

Changes to medical courses to address workforce challenges

Changes that have occurred in the medical curriculum and the forces that have influenced these changes can be considered from two viewpoints, namely from the students' perspective and from the teacher's perspective.

From the students' perspective, all medical schools are seeking to increase community placements (including but not exclusively general practice) and rural placements (both general practice and hospital experience). Some very innovative programs are in place. These include the previously mentioned departments of rural health and the development of rural clinical schools. Flinders Medical School has established a clinical school in Darwin, and the University of New South Wales is developing one in Wagga Wagga. Commonwealth government funds also support other innovative programs, such as payments to GPs who provide placement to medical trainees. This initiative will undoubtedly increase participation and opportunity in general practice teaching. Federal funding through the RUSC program to medical schools requires agreed targets to be met in terms of proportions of rural students to be admitted to medical school and minimum period of placements in rural environment etc.

Most medical schools have affirmative action programs for rural students and Aboriginal and Torres Strait Islander students. Some schools have subquotas. For example, James Cook University has a subquota for rural and indigenous students and the Flinders University of South Australia has subquotas for Northern Territory students and for Aboriginal and Torres Strait Islander students. The University of Newcastle has the most comprehensive approach to recruiting, selecting, training and graduating Aboriginal and Torres Strait Islander students (Garvey et al., 1997). This program includes course promotion activities, culturally appropriate admission procedures and a supportive learning environment. Other medical schools, such as the University of Sydney, reserve a number of places annually for Aboriginal and Torres Strait Islander applicants with the required qualifications (AMWAC & AIHW, 1997).

Further medical school initiatives to improve the quality of the services provided by future doctors to the community include the trend toward problem-based learning (PBL), an increased emphasis on skill acquisition and a broadening of the medical curriculum to include topics such as health informatics and medical ethics.

Recent evidence indicates that students and faculty find PBL a more challenging and motivating learning approach than conventional methods, but as yet there is little evidence to support the claim of benefit in knowledge acquisition and clinical performance (Albanese and Mitchell, 1993; Colliver, 2000).

Other important initiatives include those designed to smooth the transition from medical student to doctor. Medical schools are restructuring final year medicine to make it more of a student internship and State based Postgraduate Medical Councils, with the support of the MTRP, have been established to facilitate the development of structures and processes to support and improve the training received by doctors in their first two postgraduate years and to assist them to make wise career choices (MTRP, 1999). For most graduates, these years are predominantly spent in the public hospital system. At the same time the Australian Medical Council has written guidelines for teachers and has expressed interest in the development of a national assessment system for interns.

Anecdotal evidence suggests that medical students, like students in other disciplines are acquiring increasing levels of debt as the cost of the Higher Education Contribution Scheme (HECS) increases and as a more diverse socio-economic group is accessed for admission. The cost of HECS is now nearly \$6,000 per year and many students are taking out loans to complete medical school. Furthermore, as this paper has shown there is greater movement of students interstate and from rural homes and many graduate entry students have family responsibilities. As a result a large number of students have significant debt at graduation. To what extent financial debt influences the career decisions of Australian junior doctors is unknown. However, there is evidence from the United States to indicate that debt influences the specialty choice decisions of junior doctors in complex ways, with its significance varying by level of expected income, gender, type of loan, and geographic location of anticipated practice (Colquitt et al., 1996).

From the clinical teachers' perspective (ie the medical staff who teach the students, often in an honorary capacity), the pressure to deliver quality care in an increasingly 'resource-scarce' health service environment means that there is growing tension between service delivery and academic activities (both teaching and research). At all levels of government (State, Territory and Commonwealth) there have been recent attempts to 'unbundle' the costs of teaching and research from delivery of care. It is hardly surprising that these have been unsuccessful given the complex interdependency that exists between these three important spheres of activity. Indeed, it is now accepted that attempts to unbundle costs of processes that produce multiple 'products' (or outcomes) is not desirable or feasible and if attempted is likely to produce perverse outcomes. The New Zealand experience has not been a success.

Implications for workforce planning

The age at which students commence medical studies is increasing and this trend is associated with changes in admission policies, most notably the move to graduate entry programs. This trend will influence the age at which completing students commence vocational training and therefore the lifetime contribution they make to the workforce.

There is increased movement of commencing medical students between States with 20% of students choosing to study medicine at an interstate university. This phenomenon adds complexity to workforce planning based on the allocation of university medical school places according to population size.

The representation of women among medical students is increasing and the trend is towards a gender mix close to that of the Australian community. This demographic trend has important implications for vocational training programs and for workforce planners and the community. Vocational training programs need to adapt to better accommodate the needs of young women who may have other important social responsibilities besides their medical studies (AMWAC & MTRP, 2000). For the community, the increased participation of women in the medical workforce means that patients who prefer to consult a female practitioner are more likely to have that option.

Medical schools have responded creatively to the problem of undersupply of doctors in Australia's rural and remote regions. With the assistance of targeted funding from Federal and State governments, there has been a concerted effort to recruit more students from rural backgrounds into medical school and to provide all medical students with increased opportunities for community and rural experience. To date, these changes have resulted

in substantial increases in the representation of rural students in commencing medical classes in Queensland and Victoria. However, at the national level, the increase has been small. Because these data are based on postcode of residence at the time of enrolment it is likely to be an underestimate of the situation, particularly for graduate entry programs.

Among medical schools, there is a major effort to recruit more indigenous students into medicine. These efforts are being greatly assisted by Federal government funding to establish academic centres for rural health across Australia. The representation of Aboriginal and Torres Strait Islander students has increased substantially in the last two years to the point where they now account for 1.6% of all commencing bachelor of medicine students.

There is increasing diversity in the medical student body with regard to culture, country of birth and life experience. This is both a challenge and an opportunity to medical educators to provide an appropriate cultural and practical education, which respects the diverse needs of students and prepares graduates to serve an increasingly diverse Australian population.

Conclusions

At both graduate and undergraduate entry levels, universities have changed their admissions procedures in order to select students who are academically able and who possess other skills and personal qualities appropriate to the study and practice of medicine. These changes, combined with innovations in the medical curriculum, such as increased community and rural experience and an increased emphasis on clinical skill acquisition and problem solving, are consistent with the recommendations of the Karmel report and the Doherty report. Furthermore, they are likely to alter the mix of students studying medicine to a group more representative of the wider community.

Changes occurring in the characteristics of Australian medical students have important implications for the structure of the future medical workforce. Medical workforce supply will be affected by changes in the age and gender profile of completing medical students since both are known to impact on levels of workforce participation. Less well understood are the effects of student background (rural, country of birth, Aboriginal and Torres Strait Islander, socio-economic status) on choice of specialty, location of practice and workforce participation. Further research is required in Australia to improve understanding of the impact of these issues.

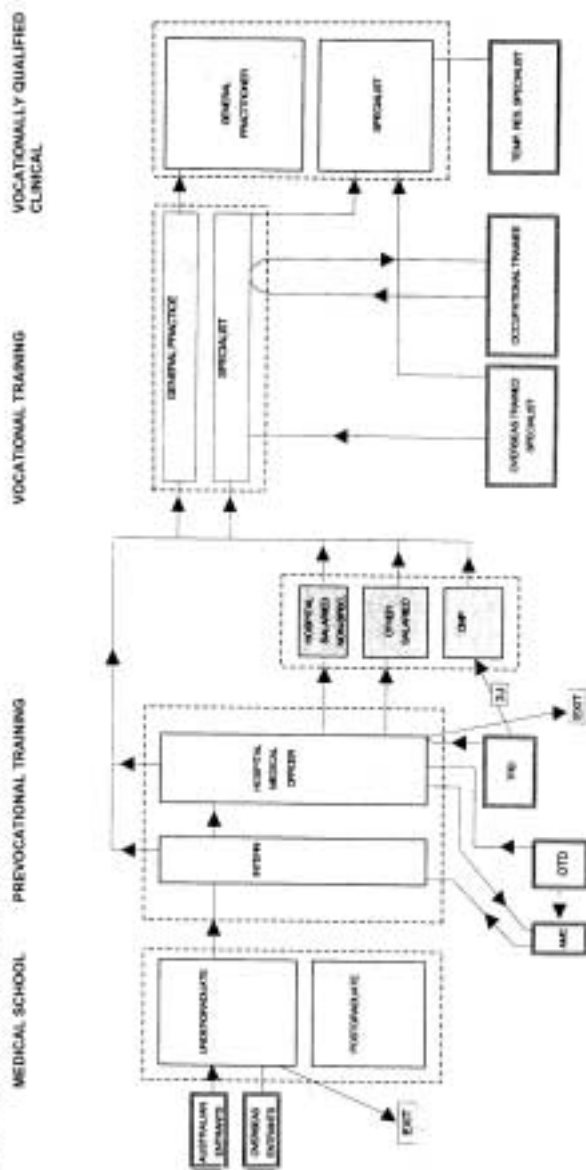
Further research is also required to determine the level of attrition among medical students and among junior doctors undertaking vocational training.

While there have been significant increases in the number of rural students commencing medical studies in two States, at the national level progress appears to have been slow. On the other hand, in the last twelve months considerable advances have been made with respect to increasing the participation of Aboriginal and Torres Strait Islander students.

Achieving balance in the supply of, and requirement for, doctors represents a major challenge for workforce planners because both sides of the equation keep changing. Furthermore, among stakeholders and jurisdictions, opinions vary as to what constitutes an optimal level of supply and the strategies that should be employed to arrive at this determination. While there is general agreement that the current workforce is characterised by an oversupply of general practitioners in urban areas, a relative shortage of specialists and an undersupply of doctors in many rural and remote areas, there is on-going debate as to whether the nation is 'over-doctored'. Intermittent pressure is placed on medical schools by the Federal government to reduce student intakes below the current target of 1,200 per annum. At the same time the use of temporary resident overseas trained doctors increases and a new medical school opens this year at James Cook University in far northern Queensland.

Changes in the demographics of the medical student population (equal numbers of men and women, older at commencement, broader ethnic and socio-economic background and increased debt), and changing expectations about work and lifestyle may ultimately necessitate an increase in medical student intakes. Planned periodic updates by AMWAC of the national workforce 'benchmark' (ie estimated optimal number of doctors required to meet current and future population needs) will incorporate the above supply-side changes and if necessary, appropriate action will be recommended to government. Given the limited number of points of entry into the medical workforce one of the key focuses will obviously be medical student numbers.

Appendix 1: Current Australian medical training pathways



Source: Medical Training Review Panel 1997, First Report, Commonwealth Department of Health and Family Services, Australian Government Publishing Service, Canberra.

Appendix 2: Bachelor of medicine course completions^a by Australian citizen or permanent resident students, by State and university, 1988-98

State and University	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
New South Wales	448	433	264	379	263	407	427	429	459	406	393
* University of Sydney	249	235	43	154	203	214	224	232	238	204	206
* University of NSW	144	150	175	172	8	139	132	136	146	147	125
* University of Newcastle	55	48	46	53	52	54	71	61	75	55	62
Victoria	314	309	280	285	290	330	294	308	345	300	288
* University of Melbourne	179	167	155	168	155	197	171	171	192	173	167
* Monash University	135	142	125	117	135	133	123	137	153	127	121
University of Queensland	181	166	191	183	196	203	197	216	215	201	209
South Australia	165	143	137	162	185	144	159	148	150	166	149
* University of Adelaide	103	86	82	92	116	88	93	94	97	93	93
* Flinders University	62	57	55	70	69	56	66	54	53	73	56
University of Western Australia	116	86	103	102	109	104	109	97	114	103	120
University of Tasmania	81	50	39	33	41	46	49	43	44	20	47
Australia	1,305	1,187	1,014	1,144	1,084	1,234	1,235	1,241	1,327	1,196	1,206

(a) Before 1993, not all universities had citizenship information for all students completing courses, so these data include students for whom citizenship/residency status was unknown. Consequently, data before 1993 may slightly overstate the number of course completions by Australian citizen/resident students.

Source: AIHW from Department of Education, Training and Youth Affairs data.

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