Recommendation 7: Health professionals’ education and training institutions should consider using targeted admissions policies should be adopted to increase the socio-economic, ethnic and geographical diversity of students.

What is the link of admissions procedures and criteria to the quantity, quality and relevance of graduates produced by training programmes for health professionals?

A commentary based on a review of selected literature

By way of introduction, it should be stressed that this commentary does not claim to be based on a systematic review of the relevant literature. A systematic review entails the adoption of formal criteria for inclusion of sources, exhaustive search across a number of databases, including "grey literature" and literature written in a number of languages, and systematic assessment of the validity of the findings contained in each source. This commentary is based on literature obtained from non-exhaustive searches, largely of PubMed, supplemented by other ad hoc searches of selected journals and other sources, written in English since 1990, and without systematic assessment of the validity of findings. Although the intended application of the recommendations which may be based on this commentary is to low and middle income countries, it was found that the bulk of the citations identified referred to documents that were concerned with the situation in richer countries (OECD member states). The literature is also biased in coverage of the professions: references to doctors and medical education are far more frequent than to nurses and midwives, while references to any other category are rare.

The largest overlap of concerns between more and less developed countries concerns the difficulties of recruiting and retaining trained health workers for service in rural and remote areas, and this proved to be the most frequently encountered theme in the literature explored. There is an extensive literature, and indeed entire journals devoted to this topic, in (particularly) Australia, Canada and the less densely populated states of the USA. Although issues of recruiting and retaining doctors in rural and remote service numerically predominate among the literature found, this commentary has attempted to address the balance by giving particular attention to reports on other categories of health worker, and reports relating to low and middle income countries.

Few references were found to any linkage between admission procedures or criteria and the numbers of graduates produced. This is unsurprising, given that the main determinants of the
volume of outputs from training are the volumes of health workers needed/demanded and the
capacity of training institutions. Theoretically, an insufficiency of qualified candidates could be a
constraint on the numbers trained and graduated, so that modifying admission criteria could be
a means of increasing the numbers of graduates, though no reports of these actions were
found. One study of the feasibility of doubling the number of health graduates in Zambia (Tjoa
2010) found “a large enough pool of applicants to meet scale-up student intake targets without a
loss in the quality of trainees” quantified as “two or three times the number of qualified
applicants as there were available slots for training”.

There is a considerable literature, subject to the biases noted above, on admission criteria as a
predictor of performance within the training experience, which takes as the end point course
completion or attainment of a qualification (sometimes attainment before course completion).
There are strong indications that the predictive power of pre-admission academic performance
decreases as students progress through their basic training and postgraduate training.

Admission criteria and procedures

Taking as the default position, exclusive reliance on pre-admission academic attainment, this
literature explores the impacts of adding or substituting alternative criteria or admission
processes. There is a general, but not universal finding, that previous academic achievement
is a good predictor of success in medical school in the US (Mitchell 1990) UK (Brown and Lilford
(Reibnegger et al 2010) Holland (Urlings-Strop et al 2009, Cohen-Schotanus et al 2006) and
Croatia (Jankovic et al 2002)

The same broad conclusion is reached in some studies from developing countries, among them
Nigeria (Egbewale et al 2009), Bahrain (Al Nasir and Robertson 2001) and Sri Lanka (Hewage
et al 2011).

Some evidence disputing the predictive validity of previous academic attainment is offered for
the US (Basco et al 2000), New Zealand (Collins et al 1995 and Poole et al 2012) and for
Pakistan (Huda et al 2001) and Sri Lanka (De Silva et al 2004 and 2006).

For nurse education, a meta-analysis carried out in the US (Grossbach and Kuncel 2011) found
that standardized admission tests were effective predictors of performance in the National
Council Licensure Examination for Registered Nurses. Pre-nursing grade point average was
also effective, but to a lesser extent. In the UK, a study of an entering cohort of pre-registration
Diploma of Nursing students concluded that students with higher level entry qualifications performed consistently better than those with lower level qualifications (McCarey et al 2007). A Canadian study (Carpio et al 1996) found that school grades in English and chemistry were the best predictors at entry stage of success in licensure examinations. A New Zealand study which took as the outcome performance in the first year of an undergraduate nursing programme (Shulruf et al 2011) found that the best predictor of success was final year secondary school achievement as measured by the National Certificate of Educational Achievement Grade Point Average (NCEAGPA).

A dissenting voice from UK (Ofori 2000) argued that paper qualifications in psychology, sociology or biology should not be relied on as predictors of academic performance in their related nursing modules, and that age was a good predictor (mature students, defined as >34 years on entry, did better)---a finding which has been reported from other studies, and is advanced in the cause of a more diverse student body.

Among allied health professions it is also common practice to rely heavily on previous academic attainment in the selection of students. A US study of physical therapy students (Templeton et al 1994) found that cumulative grade point average scores in chemistry, physics and science were significant predictors of course success, as also were scores on the Allied Health Professions Aptitude Test. A study, also from the US, of dental hygienists (Downey et al 2002) found that incoming GPA was the best predictor of success in Dental Hygiene National Board qualifying examinations. A broader study of admissions criteria and procedures for allied health professions (Scott et al 1995), which however did not examine the predictive validity of those criteria and procedures, reported that the most frequently required admissions criteria were grade point average, references, interviews, science GPA, and writing sample, but that standardized tests were rarely utilized. A study of entry to physician assistant programmes (Hocking and Piepenbrock 2010) observes that the Graduate Record Examination was misused as 60% of programmes required or recommended precise minimum scores instead of using it in conjunction with other criteria as recommended by the Educational Testing Service.

It has long been recognised that academic prowess alone is not sufficient to make a good professional. The BMJ editorial by Brown and Lilford cited above suggests “. . .we distil three broad attributes that doctors should have---cognitive ability (including linguistic and mathematical intelligence, problem solving capacity and memory) humanity (kindness, empathy, emotional intelligence, bedside manner and ability to work in a team) and diligence (care in
clinical practice, capacity to work hard, punctuality, honesty and conscientiousness). Since only cognitive ability is reflected in academic achievement, efforts have been made to assess the further desirable attributes by additional means, including interviews, letters of recommendation, personal statements of purpose in pursuing medical studies, and evidence of previous service. There is intuitive appeal in the attempt to assess non-cognitive attributes, but the literature is extremely cautious about the reliability and predictive validity of these endeavours, summarised by the conclusion reached by Brown and Lilford: “the evidence suggests that only cognitive ability can be assessed with reasonable accuracy by a mass selection process”. Even in relation to cognitive skills, the dissatisfaction with standard tests of school achievement has led to the development of a number of aptitude tests designed to more precisely measure the skills needed for medical training.

The US has developed and Canada has used MCAT, the Medical College Admission Test (McGaghie 2002, Julian 2005, Donnon et al 2007) Australia developed GAMSAT, the Graduate Medical School Admission Test (Coates 2008, Groves et al 2007) New Zealand has developed UMAT, the Undergraduate Medicine and Health Sciences Admission Test (Poole et al 2012), while the UK has UKCAT, the UK Clinical Aptitude Test and in some universities BMAT, the Biomedical Admissions Test (Emery et al 2011). The general conclusion of evaluations of these aptitude tests is that they have lower predictive power than measures of academic achievement if used independently, but they may enhance predictive power if used in conjunction with measures of academic achievement.

Two further aspects can be briefly touched on. The reliability of psychometric tests, and techniques such as interviews, personal statements and letters of recommendation that may be used to elicit non-cognitive skills, is yet to be established (Brown and Lilford 2008, Ferguson et al 2002). Similar findings linking previous academic attainment to examination success apply to postgraduate medical studies, with the significant exception that school achievement is a weak predictor of success; it is success in the undergraduate programme that correlates best, but even then, its predictive ability is not high.

Diversity in the student body and affirmative action

One consequence of heavy reliance on tests of prior academic attainment, which cuts across all professions, is that the students selected are not fully representative of the communities which they should subsequently serve. In short, the selection process produces a student body that reflects previous educational opportunity, rather than the potential to become effective health
professionals. In this student body, there is over-representation of candidates from more advantaged socio-economic backgrounds, and under-representation of minorities of all kinds.

In the US, the primary focus of concern is the under-representation of African Americans, Hispanics and Native Americans. The rationale for affirmative action to correct the imbalances is captured in this quotation from the abstract of an advocacy article (Deville 1999): “...the best and probably most viable justification for affirmative action policies is the one which recognizes that racial diversity in the medical profession is important because it provides the physicians with whom minority patients can feel safe and comfortable. Trust is a central component of the doctor-patient relationship and is the pre-requisite, in many cases, to the individual physician’s ability to practice good medicine. Unfortunately, minorities’ historical and current experience with the medical profession and health delivery system frequently breeds suspicion rather than faith. As a result, society and the medical profession have a compelling interest and duty to produce physicians who can inspire trust in patients. In the short-to-medium term, race-conscious admission policies may be necessary to fulfil this duty”.

While this might be regarded as a plea to relax admission criteria in favour of minority candidates, there is an argument that to do so has no impact on the ultimate product (Reede 1999). The abstract of this article states: “Admission to medical school should not be based solely on grade point average and Medical College Admission Test scores because these offer no measure of extremely important noncognitive attributes. Although performance in the preclinical years is predicted by the grade point average and Medical College Admission Test scores, no such correlation exists for achievements in the clinical years, for postgraduate training, or as physicians. Thus, even though under-represented minority applicants to medical school tend to have lower grade point averages and Medical College Admission Test scores than majority applicants, ultimate success in postgraduate training and as practicing physicians is equivalent to that attained by majority students.

A description of the Joint Admission Medical Program, a Texas experiment to address enrolment disparities embracing all medical colleges in the state (Dalley et al 2009) noted: “Cognizant of legal prohibitions against reliance solely on race or ethnicity in promoting diversity, JAMP is designed to enhance opportunities for economically disadvantaged students from across the state, including those from (1) rural and remote areas of the state (2) institutions that have historically sent few students to medical school”. These proxy criteria were evidently insufficient to overcome all historic imbalances, because increasing the participation of students
from under-represented minority groups was identified as one of the outstanding challenges of the program, years after its initiation.

The extent of the challenge in the US can be discerned from the following figures. Whereas African Americans, Hispanics and Native Americans collectively account for one fourth of the US population, they are only 12% of the student body in schools of dentistry and 5% of practicing dentists (Price and Grant-Mills 2010). They are only 9% of the medical student body (Grumbach 2011). Native Americans are nearly 2% of the US population, but they represent only 0.3% of entrants to medical school; in 2004, only 98 Native Americans graduated from the 125 accredited medical schools in the US (Sequist 2005). Sequist lays out some of the barriers to entry encountered by Native Americans, including upbringing or residence on reservations poorly provided with social services, economic barriers, lack of role models, lack of counselling, the desire to remain close to the community rather than move to a city, and cultural isolation if accepted by a medical college. He goes on to describe the Four Directions Summer Research Program run by Native American faculty and students at Harvard Medical School which is designed to address challenges faced by Native American undergraduates, and to convince them that they can thrive at a competitive academic medical centre. The program provides four key elements: individual mentoring related to students’ work in the laboratory of a senior faculty member; seminars about the admissions procedure for medical school and schools of public health; exposure to faculty members from minority groups; and mentorship and encouragement from Native American faculty, residents and students. Participants also “shadow” physicians at affiliated hospitals.

The device of pre-admission courses targeted at under-represented minorities as a means both to encourage applications and prepare candidates for admissions is quite widespread (Alexander et al 2009, Grumbach and Chen 2006, Gordon and Copes 2010, Andriole and Jeffe 2011, Grumbach 2011). According to Grumbach, there are around 20 postbaccalaureate premedical courses under the auspices of US medical schools, but there is a need for greater commitment both by the parent schools and by the Association of American Medical Colleges. These programmes “. . .focus on college graduates from underrepresented backgrounds, often those who have unsuccessfully applied previously for admission to medical school, and provide intensive academic and social support, MCAT preparation, coaching in the application process, and upper-level science course work to enhance the ability of these individuals to gain admission to medical school”. These programmes are effective in facilitating admission (Grumbach and Chen 2006) and medical school graduation is achieved nearly as frequently by
those participating in these programmes (95%) as non-participants (97%). A cohort study of students participating in postbaccalaureate premedical school programmes reported that they were more diverse than non-participants, and were more likely to express at graduation the intention to work in underserved areas (Andriole and Jeffe 2011). A very similar approach has been applied in nursing, this time targeting high school students contemplating a career in nursing (Gordon and Copes 2010). The Coppin Academy for Pre-Nursing Success is described as a “comprehensive year-round pre-entry baccalaureate preparation programme, targeting high school students from disadvantaged backgrounds . . . graduates have met or exceeded goals in retention, passing rate on the nursing licensure exam and service to the community”.

Pre-admission coaching is one element in the process described for increasing minority enrolment in dental schools (Price and Grant-Mills 2010). Starting with the need for a mission statement stressing a commitment to a diverse student body in the interests of ultimately better serving the oral health needs of the entire nation, including especially currently disadvantaged groups, the authors set out a menu of possible interventions before, during and after the admissions process designed to further that mission. They stress the key roles played by the dean of each school, the director of admissions and the members of the admissions committee, the importance of their commitment to the cause of diversity, and their appropriate induction in their roles. They advocate holding admissions workshops with the staff of the institutions from which applicants are drawn to provide information on admissions policies and practices.

One of the key interventions is to modify the admissions criteria. Whereas in the past, it was common practice to base admission decisions on academic attainment as represented by GPA or DAT (Dental Aptitude Test, the dental school equivalent of MCAT) and completion of recommended courses, the fifteen dental schools participating in the Pipeline, Profession and Practice: Community-Based Dental Education program starting in 2002 were encouraged to adopt holistic file review, also described as whole-file or full-file review. The file encompasses not only the academic record of the candidate, but also the assessments based on interviews, letters of recommendation, and candidates’ statements of career intentions. The essence of holistic file review is that it allows admission committees to take account of non-cognitive qualities and life experiences as well as prior academic performance. It also permits consideration of minority status as a relevant factor. “Even though the US Supreme Court has invalidated admission procedures based solely on race, it validated the use of race as a compelling interest in view of the educational benefits gained by diversity. Furthermore, the
court clarified that it is legally sound to consider race as part of the holistic and individualized admissions evaluation”.

Minority students face further hurdles once admitted, notably the expense of a dental education, the limited amounts of financial aid available, and the sense of isolation in schools which have not achieved a critical mass of minority students. Nevertheless, it is claimed that minority students admitted to Pipeline dental schools have performed well (no comparative statistics are offered) and contribute, or plan to contribute, to the oral health care of their originating communities.

Given the hurdles faced by minority students, including lower academic attainment on average, it might be supposed that academic support during the course would have a part to play in realising the intended outcome. One such intervention programme is reported for minority health care managers (Chatman and Sandler 1996).

Another advocacy article (Gabard 2007), also taking comfort from the US Supreme Court’s decision, proposes that health educators should be more aggressive in admitting students from minority communities through affirmative action. It proposes four actions to expand applications: outreach to schools; better informing school career counsellors; advertising possibilities; and community involvement through local school boards.

In the UK, concerns about the outcomes of conventional selection methods focus on two issues: race and socio-economic background. An early study of the 1991 cohort of applicants to five medical schools (McManus et al 1995) showed that Black British students were over-represented in medical school applications (3.0% compared with 1.7% in the general population), but were under-represented in acceptances (1%), and that they were less likely to be accepted than white British applicants with comparable academic records. British Asians were over-represented among medical school applicants (23.6% compared with 4.7% of the general population) and acceptances (18.2%) but nevertheless equivalently qualified candidates were less likely to be accepted than white candidates. The study concluded that discrimination against ethnic minority candidates occurred at the stage of issuing conditional offers, when admissions committees gave lower credence to referees’ reports on individuals with non-European names. Similar results were reported (Esmail et al 1995). A follow up study of the 1996 and 1997 cohorts (McManus 1998) basically confirmed the earlier findings, but noted that discrimination varied across medical schools, with some being completely blind to ethnicity. A study based on data released by the Nursing and Midwifery Admissions Service in 2005
(Grainger 2006) suggested that black students applying for training in nursing were less than half as likely to be selected as their white comparators. A more recent study (Gallagher et al 2009) showed that over half (50.5%) of all applications to dental schools were from ethnic minority students, compared with 29.5% of applications to medical school and 19% for all higher education, but confirmed the earlier finding by McManus that when other factors were controlled for, there was still a lower probability of acceptance in medical and dental schools for ethnic minority than white students.

This apparent bias in admissions practice may be explained, at least partially, by two other factors. The first is that there are consistent reports that ethnic minority students do less well once admitted to medical schools (Woolf et al 2011). The second is that white students are under-represented in medical schools as measured by the standardised admission ratio (Seyan et al 2004), that is to say that they are a smaller proportion of students admitted than they are of the general population, in contrast to Asians who are hugely over-represented by a factor of more than six. It may be that when admissions committees favour white over equally academically qualified candidates from ethnic minorities, they are consciously or unconsciously seeking to compensate for these related observations.

The second major area of concern about the selection of medical students is that they are disproportionately from advantaged socioeconomic backgrounds. “A continuing concern of the UK government is that entry to medical schools is socially exclusive. The class distribution of entrants has been unchanged for over half a century, with a preponderance of applicants and entrants from social class I1. It is not clear whether the entrant profile reflects bias by selectors, an active choice not to apply for medicine by those from social classes IV and V, or an underlying distribution of ability by social class” (McManus et al 2009). There is a close link between socioeconomic status and type of schooling. The same authors go on to observe “Although most children in the UK attend state schools, the minority attending private (independent)2 schools are over-represented among university entrants, possibly because as a group they achieve higher A level scores”. The extent of the over-representation of social class I is revealed by the standardised admission ratios (Seyan et al 2004), which show that for both white and black students the probability of admission from class I is 100 times greater than from classes IV and V. The position is somewhat different among Asian students, since students

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1 The UK uses a fivefold classification of social classes, largely derived from the occupation of the head of the household, in which class I refers to professional and higher managerial occupations, and class V refers to unskilled manual workers. Students take the social class of the head of their households.

2 These schools are fee-paying. State schools are free.
from social class I are only 6-10 times more likely to be admitted than Asian students from classes IV and V. However, Asian students from social class I are 41 times more likely to be admitted than the average for all constituents of the UK population.

Gender has long ceased to be an issue in UK medical education. Females are 55% of all applicants (Gallagher et al 2009), they are over-represented in the student body (standardized admission ratio 115 in 2000) (Seyan K et al 2004) and they perform better once admitted (Ferguson et al 2002). Nursing has always had the image of a female dominated profession, which is not generally perceived as discriminatory. However, a study of completion of nursing education (McLaughlin et al 2009) noted that males were more likely to drop out in the first year of training, acknowledging “The female-dominated nature of nursing, prevalent stereotypes and gender bias inherent in nursing education seem to make this an uncomfortable place for males . . .the nursing profession need to take steps to address this bias to ensure their profession is open equally to both female and male recruits”.

Whereas historically UK medical education took the form of a five-year undergraduate programme recruited largely from school leavers, in recent years the majority of medical schools have also offered a graduate entry course, in part in response to the goal of widening diversity (Calvert et al 2009, Powis et al 2004). Parallel developments and motivation occurred in Australia. Some disappointment has been expressed about the failure of graduate entry to diversify the social class composition of the student body at the Universities of Newcastle and Sydney in Australia. A parallel finding for the UK (Mathers et al 2011) included the observation that students admitted to foundation courses were significantly different from both mainstream and graduate entry courses, with a higher proportion of ethnic minority and lower social class entrants; however, numbers were small.

Two observations may be made on the UK focused literature, in contrast to the US literature on these topics. The first is that the discussion is largely in terms of fair treatment of different students; the linkage to subsequent service in their communities of origin is not made. Second, there is little discussion of remedial measures; rather the discussion is largely confined to different selection instruments. The Powis article cited above is an exception to both these observations.

Australia and Canada have similar concerns with the poor health, lower life expectancy, and under-representation in the health professions of their aboriginal populations. For Canada, a description of policies related to aboriginal medical students (Spencer et al 2005) showed that
over half of programmes had recruitment initiatives and admission policies specific to aboriginal applicants; the majority reported curricula including learning objectives specific to aboriginal health and a few core curriculum activities focusing on aboriginal health. In Australia, the role of the medical school at James Cook University is explicitly stated to be to meet the health care needs of the population of tropical and rural North Queensland, including its aboriginal and Torres Strait Islander peoples (Hays 2002). There is indigenous representation in the management of the medical school, in staff selection, student selection, and curriculum content.

Nursing is similarly placed. “Canada does not have enough aboriginal nurses and aboriginal nursing faculty. Consequently, there is an inadequate number of nurses to meet both on- and off-reserve community health staffing needs” (Gregory et al 2008). In 2002, Health Canada set up a task force to examine aboriginal nursing in Canada, including recruitment and retention policies. An example of the types of support that may be necessary to attract and retain aboriginal nurses is given in an article describing a programme at the University of Saskatchewan (Arnault-Pelletier et al 2006). This programme promoted nursing as a career to aboriginal students, negotiated access seats for aboriginal students at all Canadian universities, and provided a nine week spring orientation programme to prepare students for the demands of campus life and nursing programmes. “Advisers strive for success and excellence for aboriginal nursing students through support and advocacy (personal issues, social services, individual funding, academic assistance, advocacy with faculty) summer employment assistance, recruitment efforts and community partnerships (including community-building efforts among the students and building partnerships with outside stakeholders, both First Nations and non First Nations)”.

In Australia, the Indigenous Nurse Education Working Group was established by government in the attempt to increase the number of indigenous registered nurses and to prepare nursing graduates with better understanding of, and skills to assist with indigenous health issues (Usher et al 2005a). The James Cook University established a satellite campus on Thursday Island in the Torres Strait to facilitate attendance by aboriginal nursing students (Usher et al 2005b).

In India, the big issue is caste. Historically, 22.5% of places in engineering, management and medical schools funded by the central government were reserved for members of the scheduled, that is lower-ranking, castes. Early in 2006, a government proposal to raise the proportion of reserved seats to 49.5% raised a storm of protest (Murdur 2006a). Those protesting claimed that the principle of entry on merit would be undermined. Those in favour
argued that it was a necessary offset to the proliferation of private medical colleges, which were in effect “reservations for the rich”. In response to the protests and an intervention by the Indian Supreme Court, the government planned to raise the total number of places in medical schools so that the number of non-reserved places would remain unchanged (Murdur 2006b).

The corrosive effects of commercial pressures on medical education are well captured in comments included in Murdur’s first report “It’s an open secret that management seats can be bought for 2 million rupees (£25 000; €36 400; $44 400) or more,” said Chittakkudam Soman, a former professor of nutrition at the Trivandrum Medical College.

Dr Soman said the purchase of medical school places is a starting point for unethical practices later in medicine. “Those who are willing to buy seats in medical colleges are likely to pose a greater threat to health care than socially deprived candidates who enter through reservations,” he said.

“An entire generation of doctors now believes that it’s perfectly legitimate to receive kickbacks for referring patients for diagnostic tests,” he said.

In South Africa, medical education has had to battle the legacy of apartheid (Colborn 1995). “As a result of the policy of apartheid, the University of Cape Town Medical School was prevented from admitting black African students by the South African Government until 1986. A further feature of this policy was to impose an inferior primary and secondary school education in African pupils, so that, in general, African school-leavers are underprepared for tertiary education. Admission to medical school is highly competitive and African school-leavers are unable to compete effectively with their counterparts from the other racial groups. Therefore, from 1986 to 1990 inclusive, an affirmative action admissions policy was followed that allowed the most successful African matriculants, whether competitive or not, to enter the Medical School and follow the regular course of study. This process failed in that an inadequate number of students gained admission to the MBChB programme and their academic progress was unsatisfactory. Since 1991, an affirmative action policy incorporating both academic support and mentor programmes has been followed by the Faculty of Medicine. This system has led to a substantial increase in the number of African students entering the first year of study and it is planned that up to 40% of all matriculants entering the MBChB programme in 1995 will be via this system. The academic load is reduced, and the results the students obtain at university have markedly improved, with 86% of students achieving the academic goals that they are set. The comparison between these two systems emphasizes the need to provide both academic
and social support as well as flexibility in the curriculum if and affirmative action policy is to succeed”.

A follow up study (Sikakana 2010) examined the effect of an academic development programme (ADP) integrated into an existing South African medical training programme. The results showed average student retention rates were 70% for those participating in the ADP, and 92% for the non-ADP group. Although there was a large difference in pre-admission matriculation scores, examination scores in the medical school converged with time; in the final year, the ADP group had an average score of 64.2% and the non-ADP group 68.3%. The study concluded that although the retention of ADP students was lower, the programme enabled those who graduated to overcome the effects of under-resourced schooling and to perform well in final examinations.

**Primary care and rural location**

Virtually all countries, rich and poor, and whatever their overall ratio of health workers to population, suffer from a geographic maldistribution with a concentration of the available professionals in large urban centres and prosperous regions, contrasted with scarcity in rural, remote and impoverished regions, which is more pronounced for the most skilled. Health service settings also differ between these geographic divisions: hospitals and specialised services are concentrated in the large urban centres and are easily accessed by the urban population, whereas in areas of low population density hospitals are on average distant, smaller and less specialised. For the majority of inhabitants of rural and remote regions, visits to hospital are rare and only undertaken for compelling necessity. Most of their needs for health care are met by visits to primary care providers, who are inevitably generalists. It is because of this association between the location and nature of health services that this section will treat the two as inextricably linked, as does much of the literature.

In the case of physicians, this association is eloquently expressed (Rourke 2010). “Rural general practice/family medicine requires the ability to care for a widely disbursed population with limited or distant access to specialist support and highly technical services. This can involve care of patients with complex and serious illnesses who, in large urban cities, would be managed by a team of specialists”.

The difficulties of staffing rural health services are compounded by the training experience of most health workers. They are recruited disproportionately from the urban elite, they learn their
profession largely in the context of specialist hospitals, they expect to practice their profession in
the context in which they learned it, and they become accustomed to and/or aspire to the social
amenities of urban life. It is small wonder that the majority of health workers display a
reluctance to take up rural posts. Against this back ground, there is one encouraging finding:
the literature is virtually unanimous that there is a positive association between rural origin and
rural employment subsequent to training.

It is reported for Australia: “A period of rural residence of unspecified length prior to entry into
medical school is the strongest predictor of a career in rural medicine after graduation” (Henry et
al 2009). Other Australian studies support this finding (Walker et al 2012, Orpin and Gabriel
Wilkinson et al 2000). Among nurses, a study of pre-registration students in Victoria (Birks et al
2010) found “Career projections reported by participants demonstrate the intention of those from
non-metropolitan areas to remain in this location on completion of their studies”. A study of
graduate nurses in northern New South Wales (Lea and Cruikshank 2005) reported: “Findings
indicate that previous connection with a rural area and positive experiences in a rural health
care facility during undergraduate preparation were significant factors influencing the graduate
nurses’ decision to pursue a rural graduate nurse position”. A study of nursing and allied health
students from Western Australia (Playford et al 2006) concluded: “This study augments previous
work showing that any prior rural background is a significant predictor of rural work. Rural
practitioners of both urban and rural origin who undertake voluntary rural placements are more
likely to enter rural practice”. A survey of allied health personnel in a rural area of northern New
South Wales (Smith et al 2008) reported that 65% of respondents were of rural origin. A study
of occupational therapists specifically (Lea and MacKenzie 2003) found: “Results indicated that
new graduates were attracted to their rural positions by multiple factors, especially their
previous rural experience”. Comparable findings were contained in a report (Schofield et al
2009) covering medical, nursing and allied health students.

For the US, a review article (Brooks et al 2002) found “These studies consistently found that
rural upbringing was positively associated with physicians’ practicing in rural areas”* A study
from Missouri (Longo et al 2005) came up with an unusual finding, that rural applicants were as
well qualified as urban, contributing to the conclusion: “The study demonstrates that a medical
school can maintain competitive admission criteria while at the same time accepting those
students [rural applicants] more likely to enter rural practice. This is valuable information that
medical schools with a similar mission to prepare physicians for rural practice might consider in
their admissions decision-making process”. A study of student nurse practice intentions in the US and Canada (Bushy and Liepert 2005) found “those who have life experiences and connections in small communities are more likely to choose this setting”.

For Canada, a study (Easterbrook et al 1999) found: “Physicians who were raised in rural communities were 2.3 times more likely than those from nonrural communities to choose to practise in a rural community immediately after graduation (95% confidence interval 1.43-3.69, p = 0.001). They were also 2.5 times more likely to still be in rural practice at the time of the survey (95% confidence interval 1.53-4.01, p = 0.001). Another Canadian study (Rourke et al 2005) concluded: “Practising rural physicians compared with urban physicians were significantly more likely to have come from a rural background, to have had an undergraduate rural medical education, to have had postgraduate rural training, to have graduated from a Canadian medical school outside Ontario, and to be male. Each of these had an independent effect on practice location”. A follow up study of a cohort of medical students from the University of Calgary (Woloschuk and Tarrant 2004) reached this conclusion “Rural background students who went on to complete family medicine residency training were approximately 2.5 times more likely to be engaged in rural practice than their urban-raised peers. Altering medical school admission policy to recruit more rural background applicants should be part of a multi-dimensional approach to increasing the number of rural practitioners

For the UK, a survey of the rural primary healthcare workforce in the Scottish highlands (Richards et al 2005) reported: “Our survey confirms, in the UK, the association between rural background and rural working”.

One citation was found for Japan (Matsumoto et al 2008). Jichi Medical University has a special mission to produce rural doctors. It has a unique contract system under which all the graduates have the obligation to work in rural areas in exchange for having their tuition fee waived during their 6 years undergraduate medical education. The findings, based on data collected at admission and graduation and from subsequent workplace addresses, were that subjects with rural origin were more likely to have parents with lower academic background, improve their standing throughout undergraduate medical education, and engage in rural practice than those from urban origins. The authors concluded that the selective admission policy was a reasonable way of increasing the number of rural physicians without placing an undue burden on medical schools.
One study was located for South Africa (de Vries and Reid 2003) with the following result: “The findings suggest that the South African situation is similar to that in other countries, with rural-origin medical students more likely to choose rural careers than urban-origin students. Rural-origin graduates are also more likely to choose general practice. It is recommended that the selection criteria of the medical faculties be reviewed with regard to rural origin, and that the career aspirations of applicants to medical school be taken into account in selection, particularly with regard to primary care or general practice.”

A study of medical and nursing students in Ethiopia and Rwanda (Serneels et al 2010) concluded: “Of the three factors that influence health workers’ willingness to work in a rural area, rural background is the most tangible” [the other factors being intrinsic motivation to help others and religious affiliation]. A study of nurses in Kenya, South Africa and Thailand (Blaauw et al 2010) reached a similar conclusion: “Of all the individual characteristics reported here, only rural origin was associated with a significant increase in the likelihood of choosing a rural job. This suggests, however, that preferential selection of rural students by training institutions can be an effective strategy, and it also lends supports to claims that student selection policies are a key component of human resource intervention packages”.

A Tanzanian study of a cohort of medical students (Leon and Kalstad 2010) produced one divergent finding: “we were not able to establish any significant relation between growing up in and accepting a job in a rural area” but still managed to arrive at the common conclusion: “Our results show that policies should be considered that aim at selecting the correct students (a fair representation of students with a rural upbringing and the “right” specialty preferences)”.

Given the shortage of health workers in rural and remote locations, and the universality of the finding that rural origin is associated with rural practice, across all types of countries and all types of health workers, it is a logical conclusion that admission procedures and criteria should be reflective of this association. This necessarily entails modifying historical reliance on previous academic attainment, the more so as there is considerable evidence that rural origin is also associated with diminished educational opportunity. However, it is widely recognised (and acted upon) that addressing admissions policy alone is insufficient to produce the volumes of rural practitioners desired. The proponents of increased recruitment into rural health use the metaphor of the pipeline from pre-admission to long term employment. This is characterised in an Australian review (Henry et al 2009) which nevertheless recognises the US antecedents of the term as follows: “The four stages of the rural pipeline begin with structured contact between
rural secondary schools and the medical profession, followed by rural student selection into medical programs, then rural exposure during medical training and, finally, on graduation, measures to address retention of the rural medical workforce. This study provides evidence-based commentary on all four stages with particular emphasis on the second and third stages of the pipeline.

They go on to say: “The impact of components of the rural pipeline on choice of a rural medical career is strongly supported by the literature. The first stage of the rural pipeline, structured contact between rural secondary schools and the medical profession or medical schools, has been implemented in a variety of ways. For example, American Health Education Centres have operated health career promotion activities through their ‘Pipeline to Practice’ program with years K-12 and college students for many years. These approaches vary in their intensity of contact and programmatic structure. All claim to influence rural school students’ career choices and pathways although only three of the four studies referenced here surveyed participants to support these claims.

There is an extensive literature on the second stage in the rural pipeline, selection of rural students into medical school programs. A period of rural residence of unspecified length prior to entry into medical school is the strongest predictor of a career in rural medicine after graduation. Acting on this finding, a number of medical schools have developed selection procedures with positive discrimination towards rural applicants, including quotas for rural applicants, adjusting selection scores according to rurality and separate selection scores for rural and remote applicants. There is evidence that positive discrimination can be undertaken in ways that maintain adequate academic entry standards and that the academic and clinical performance of these students during their medical training is satisfactory.

A range of other measures designed to increase the likelihood of selecting students who will choose a rural career have been reported, including weekends in rural locations prior to selection, interview questions assessing understanding of rural issues, additional autobiographical statements and referees’ reports. Broadening the interview panel with rural community representatives and/or rural GPs has also been described.

A number of reports support the efficacy of the third stage of the rural pipeline, rural experience during medical training, to promote choice of a career in rural practice. There is some evidence
that exposure to rural practice may also influence urban students towards a rural career. The effect of rural exposure is claimed to be strongest for clinical placements in the later years of medical training and for prolonged rural placements that are thought to increase opportunities for rural connectedness.

Obligatory bonding on completion of specialist or general practice training has recently been introduced as a strategy to increase the Australian rural medical workforce. There are scant research studies supporting this approach and its long-term effectiveness has been questioned.

Several authors have addressed the final stage of the rural pipeline, measures to improve retention of the rural medical workforce. Retention of rural medical practitioners is improved by professional support at national, state and local levels, and availability of career pathway opportunities. The practitioner’s spouse’s contentedness in rural communities, preparedness to adopt a rural lifestyle and success in connecting with the local community are key factors affecting retention, as are concerns about educational opportunities for children and proximity to extended family and social circle. Medical schools have limited capacity to address many of these external issues”.

It was suggested above that the decision to practice in a rural location was intimately connected with a decision to engage in primary care. This is not wholly true, in that there are hospitals located at smaller towns and administrative centres within predominantly rural areas, and in some countries at least these hospitals may be served by specialists. But even here, it is a distinctive type of specialist that is required: the general surgeon, as opposed to the sub-specialists, the internal medicine specialist, rather than the cardiologist or rheumatologist. In a recent Australian study (McGrail et al 2011) the categories of rural specialist used were: “specialties that are not limited by location to practising in large metropolitan centres, specifically anaesthesia (non-ICU), diagnostic radiology, emergency medicine, general medicine, general surgery, obstetrics and gynaecology, orthopaedics, paediatrics and psychiatry”.

It is clearly not true in the reverse direction, that a decision to be a primary care health worker necessarily implies a rural location, because there are primary care facilities in urban locations. Indeed, in industrialised countries, the majority of general practitioners/family physicians will be found in urban locations, for the simple reason that the majority of the population is urban. What does seem to be true, for both general practitioners and the “general specialists” who choose rural locations, is that they are attracted by the breadth and variety of work they
inevitably encounter, including the opportunity to conduct procedures which in bigger centres would be reserved for specialists or super specialists, autonomy and flexibility

The excellent review article previously cited (Brooks et al 2002) commented on a methodologically strong study (Rabinowitz et al 1999) which makes the observation: “Rural background was overwhelmingly the most important independent predictor of rural practice, and freshman plans to enter family practice was the only other independent predictor”. Brooks and colleagues conclude that “the training environments in medical school and residency are important in the students’ eventual decision about specialty and practice community. To support this fact, we think it is important to note that, although students who initially express a desire to go into family practice have a much higher likelihood of doing so, more than half of all students who end up in family practice residencies did not list family practice as their specialty choice when admitted to medical school”. Other studies support the finding that specialty choice at entry to medical school is predictive (Senf et al 2003, Wright et al 2004, Scott et al 2011). A study of the admission practices of medical schools in the US (Basco et al 1998) found that 64% of schools gave preference to students likely to become generalists. Among students “multivariate analysis [showed] premedical recruitment efforts and public school ownership were associated with greater interest of matriculants in both generalism and rural practice”. In short, the image of the school has an impact on applicants’ selection of their school of choice.

An Australian article on the choice of general practice as a career (Bunker and Shadbolt 2009) examined the influences via selection of medical students in these terms: “Selection processes and criteria for entry into medical school have changed considerably over the past 2 decades, moving away from selection based exclusively academic performance to a broader assessment of attributes and competencies for medical practice. A second change is the growth in graduate entry courses which will provide 45% of Australian medical graduates in 2012 (from a base of zero in 1996). There is also an increase in the proportion of female entrants; while women have been in the past more likely to choose general practice than their male peers, this appears to be changing. The change to graduate entry may have transiently increased the number of students interested in a general practice career but overall the changes are not significant. Graduate entry has been associated with an increased average age of entry, but age at entry into medical school was not a significant predictor of career choice. Recent articles in the Australian medical press point to differences in the proportions of alumni choosing general practice as a career, and relate this to the selection criteria, location and philosophy of the
medical school of graduation. A survey of medical school websites does suggest that medical schools vary in the extent to which they perceive and project themselves as having a focus on producing doctors working in primary care. A broader consideration of the influence of entry criteria on eventual career choice would also look at the increasingly complex mixture of financial variables on entry. Entry requirements may be modified according to the financial contribution the student is prepared to make. Bonding or other long term commitments may also impact on the attributes and qualities of students on entry, and the financial and other commitments on exit. The effect of these changes on the proportion of graduates choosing general practice as a career remains unclear”.

As with the issue of rural origin, there is a clear case for modifying admission criteria in favour of applicants with a propensity to undertake a career in family practice (Rabinowitz 1988, Rabinowitz 1999). He reports: “Jefferson Medical College initiated the Physician Shortage Area Program (PSAP) in 1974; this program preferentially admits medical school applicants from rural backgrounds who intend to practice family medicine in rural and underserved areas. Evaluation of the program has shown that PSAP graduates from the classes of 1978 to 1985 have performed slightly less well than their peers (non-PSAP) during medical school, although there was no difference in attrition between the two groups. Nor did the performance of PSAP and non-PSAP graduates differ during their postgraduate training. PSAP graduates from the classes of 1978 to 1981 were almost five times as likely as non-PSAP graduates to practice family medicine (59.6 vs. 12.6 percent, P less than 0.001), three times as likely to practice in rural areas (37.8 to 42.2 percent vs. 10.0 to 11.8 percent, P less than 0.001), and two four times as likely to practice in areas where there is a physician shortage (26.7 to 40.0 percent vs. 9.2 to 11.2 percent, P less than 0.01). They were 7 to 10 times as likely as their peers to combine a career in family medicine with practice in a rural or underserved area (24.4 to 31.1 percent vs. 3.1 to 3.9 percent, P less than 0.001), thereby fulfilling the goals of the PSAP. This study concludes that the medical school admissions process can have a major influence on the specialty choice and geographic practice location of physicians, and suggests one mechanism for increasing the number of family physicians in rural and underserved areas”.
Strength of the evidence

There is almost unanimous agreement in the literature quoted above about the association between rural background before admission to health professional training and rural employment subsequent to that training, although many other factors influence the choice of location and career. This evidence is summarised and characterised as strong (in the case of rural origin) or weak (in the case of ethnic diversity) in the review article previously cited (Walker et al 2009). An extensive quotation from this review follows:

“Selection

There is strong evidence from various countries that ‘rural origin’ (or rural background) is associated with rural practice. Most studies defined rural origin as completing primary and/or secondary school education in a rural setting. In this respect, rural origin is especially linked to the decision to choose a rural community as one’s first practice location. The potential impact of selecting medical students of rural origin was quantified by Rabinowitz in a longitudinal study that evaluated the impact of the Physician Shortage Area Program (PSAP) in the USA. The PSAP combined selective admission criteria with a rurally orientated educational program. On multivariate analysis, rural origin was the single variable most strongly associated with rural practice (OR 4.2, 95% confidence interval [CI] 2.8–6.3). Another strong influence that was rarely considered is the origin of the spouse. Rabinowitz found that 64% of rural physicians had spouses of rural origin; in Australia, doctors whose spouses had a rural background were significantly more likely to practice in a rural setting (OR 3.14; 95% CI 1.96–5.1). A home prefecture recruiting scheme in Japan was successful in recruiting medical professionals from rural areas and retaining them as qualified professionals in medically underserved prefectures. Table 4 reflects the evidence that selection according to geographic origin increases the number of graduates who practise in rural settings.

Table 4: Evidence that selection according to geographic origin may reduce the rural-urban mismatch
There is limited evidence that being from a minority ethnic group or an underserved population increases the likelihood of practising in a rural or underserved area. A single study that investigated underserved, inner-city populations in the USA reported that Hispanic generalists established practices in areas in which the percentages of the population that were (i) below poverty level; (ii) Hispanic; (iii) Hispanic and below poverty level; and (iv) white, non-Hispanic, and below poverty level, were greater than in areas in which white, non-Hispanic primary care physicians practiced. However, ethnicity has not been associated with rural practice in any of the other studies evaluated. Men were previously reported to be more likely than women to enter rural practice, although the strength of the association was highly variable. In contrast, Laven and Wilkinson concluded that gender was not found to be significant in 3 of the 9 studies. Five studies found that rural GPs were more likely to be male. There is thus a great need to understand gender-related differences and how this influences geographic and specialty distribution; as more women enter medicine it may have the effect of further reducing the supply of medical doctors to rural areas.

The PSAP experience demonstrated an association between initial career intent (freshmen’s interest in family practice, which was one of the selection criteria) and ultimate rural practice (OR 1.8; 95% CI 1.2–2.6); however, 60% of practising rural doctors in the US reported no intent to become a generalist at the onset of their medical studies. Service orientation, as demonstrated by involvement in volunteer activities reported at the time of medical school application, has been associated with a generalist career in a single report. The significance of this observation and its association with eventual practice in rural and/or underserved areas has not been evaluated.
The Rural Physician Associate Program (RPAP), also in the USA, has demonstrated success in providing rural primary care physicians to the State of Minnesota. While selection is important as a success factor in the success of RPAP, many of these students had already expressed an interest in primary care. Students were also encouraged to spend 9 months in a primary-care setting to increase their interest and relevant experience. Flinders University established the Northern Territory Clinical School in Australia and employed a local quota program. This quota program has been an effective method of enlisting local students who express an interest in living and studying in the sparsely populated Northern Territory. Quota students (Northern Territory resident, Aboriginal and Torres Strait Islander) undertook longer rural placements than their non-quota peers and were 10 times more likely to spend their intern year in the Northern Territory. Both these programs thus support the concept of combining selection with local training.

The available evidence suggests that student selection, favouring rural applicants with a stated interest (or ‘career intention’) in general practice and a service orientation, is the strategy with the greatest likelihood of reducing the rural–urban gap”.

**Outstanding research needs**

It has been apparent throughout this commentary that the literature on admissions criteria and practices is hugely biased in favour of rich countries. It is also biased in favour of medical education, to the relative neglect of nursing and allied health professions. This suggest a need to make research funding available in low and middle income countries to enable academics to replicate the types of studies that have been undertaken in industrialised countries, and to extend their scope particularly to types of health worker specific to those locations, for example medical assistants/clinical officers and pharmacy technicians.

Even in the rich countries, most of the studies encountered suffer from severe limitations of scope (restriction to one cadre or one training school), sample size (often below 100 and sometimes below 10 subjects) and weak methodology (low response rates, biased selection of subjects, failure to control for confounding variables, use of proxy outcome measures such as career intentions instead of observed career paths). It would be helpful if cohort studies with large national samples following the entire pipeline from pre-admission characteristics through to long term employment could be undertaken.
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